



NS TOOL  
ENDMILL CATALOG  
Vol.19 2022.03—

# Particular about quality in Monozukuri

## For Crafting Tomorrow



In any time of period, we have always been proud to support Japan's *monozukuri* (manufacturing) and the commitment has been our basis since foundation.

As a leading company specialized in small-diameter cemented carbide end mills, NS TOOL manufactures high value-added products by responding to needs and expectations of customers and society.

NS TOOL strives constantly to enhance its own technological standards and create cutting-edge solutions.

Wishing for delivering unseen innovation in technology, quality and service for the future and the world, we, NS TOOL, will open up the infinite dreams and possibilities of *monozukuri*.

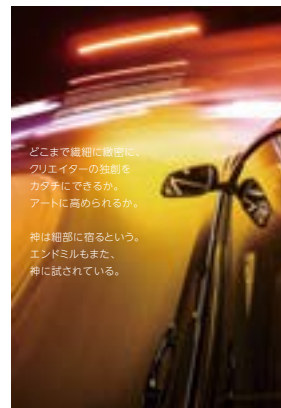
## NS TOOL embody innovation

Shape the exciting dreams and inspirations of companies and engineers.

NS TOOL creat end mills that produce unprecedented "molds" and "parts", and will support the next innovation.



For Crafting Creation



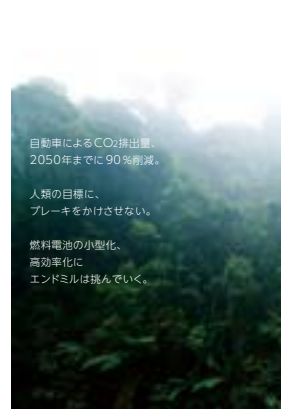
NS TOOL  
OUR COMMITMENT

The future is ...

For Crafting Medical



For Crafting Environment



For Crafting Memory



For Crafting Victory



Be a TOOL for our future

How to use NS catalog

Main Series Classification

There are four major categories, end mill, drill, thread mill, and chamfering

Furthermore, end mill from many models, are classified as "CBN and PCD end mill"

"Ultra-micro size end mill"

"Regular line with wide variation"

and "end mill designed according to work material"



| Identified color | Name of Series                | Features of Series                                                                                                      |
|------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|                  | CBN Core Line                 | Various lineup optimize a long time machining on hardened steel                                                         |
|                  | PCD Core Line                 | Achieves nano-level surface roughness like a mirror surface by milling                                                  |
|                  | Micro Edge                    | Various lineup for micro manufacturing                                                                                  |
|                  | Regular Line                  | MUGEN COATING PREMIUM Plus<br>Optimized for machining hardened steel up to 55 to 70HRC                                  |
|                  |                               | MUGEN COATING PREMIUM<br>Suitable for machining on 50~65HRC hardened steels, stainless steels and heat resistant alloys |
|                  |                               | MUGEN COATING<br>Abundant variations support machining on different work materials                                      |
|                  | Tapered                       | End mills enables tapered machining                                                                                     |
|                  | High Efficient Milling        | End mills lineup to realize high efficient machining                                                                    |
|                  | Aluminium Milling             | Sharp cutting to realize high speed machining without chattering                                                        |
|                  | Copper Electrode Milling      | Realized overwhelming long tool life and high quality burrless cutting performance                                      |
|                  | Resin Milling                 | High machinability sharp cutting edge suppresses burrs and enables good finished surface                                |
|                  | Hard Brittle Material Milling | Diamond coating realizes direct milling even on hard brittle materials                                                  |
|                  | Graphite Milling              | Long time machining and high durability are achieved on graphite machining                                              |



Drill

Standard lineup from  $\phi 0.01$



Thread mill

Fine thread milling is realized on different kind of work materials



Chamfering

Chamfering cutter enables R chamfering and C chamfering

How to use NS catalog

Listed by every Main Series

Spread page

Feature of Series

Name of Series

Micro Edge

Various lineup for micro manufacturing

Machinable indication by ◎, ○

◎ Strongly recommended

○ Recommended

New products released after Catalog Vol.18

Model

Size

Number of Teeth

Helix Angle

Supplement

Slot Milling

Face Milling

Plunging Milling

3D Milling

Work Material

Number of Sizes

Page

Shape of cutting edge

Model

Tool image

Feature of tool

CBN Micro Edge Square

SMEZ120

$\phi 0.03 \sim \phi 0.1$

Slot

Side milling...Side

Slotting...Slot

Face milling...Face

Plunging...Plunge

3D milling...3D

Micro Edge Square

NSME100

$\phi 0.01 \sim \phi 0.05$

Slot Face

Smallest Dia.0.01mm. Single straight flute end mill for ultra micro milling

NSME230

$\phi 0.03 \sim \phi 0.09$

Slot Face

2-flute 30° square end mill for micro milling. Dia.0.03mm to Dia.0.09mm

Listed by every Main Series

Product page

Model

Product name

Size

Material • Coating

Machinable hardness

Machinable indication by ◎, ○

NS

CBN "MICRO EDGE Z"

High efficient machining on carbon steels. Continuous machining from plunging approach to slotting. Long neck type to prevent interference.

Material

Number of Flute

Helix Angle

Sharp Edge

R Tolerance

Shank Tolerance

Side milling...Side

Slotting...Slot

Face milling...Face

Plunging...Plunge

3D milling...3D

Shape of cutting edge

Tool drawing

Standard size

Code No.

Dia. (D)

Length of Cut (L)

Neck Taper Angle (°)

Shank Dia. (d)

Overall Length (L)

Unit: mm

How to Order

When you order, indicate SMEZ120 (D). (Y) is reference value.

## How to use NS catalog

## Semi-standard product / Original product (distributors inventory) page    Spread page

Semi-standard products with, mainly non-coated products, and original products in stock at specific distributors

| Name of Series |  | Semi-Standard Products |  |                       |  |                 |  |             |  |               |  |  |  |  |  |                 |  |      |  |
|----------------|--|------------------------|--|-----------------------|--|-----------------|--|-------------|--|---------------|--|--|--|--|--|-----------------|--|------|--|
| Model          |  | Size                   |  | Maximum Cutting Depth |  | Number of Flute |  | Helix Angle |  | Work Material |  |  |  |  |  | Number of Sizes |  | Page |  |
|                |  |                        |  |                       |  |                 |  |             |  |               |  |  |  |  |  |                 |  |      |  |
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## Semi-standard product / Original product (distributors inventory) page    Product page

Model
Product name
Size
Material • Coating
Machinable hardness

**NX-25**

LEAD 25 End Mill

Size  $\phi 0.5 \sim \phi 12$

MG  $\leq 40$  HRC

Material

Number of Flute

Helix Angle

Sharp Edge

R Tolerance

Shank Tolerance

Side milling...Side

Slotting...Slot

Face milling...Face

Plunging...Plunge

3D milling...3D

● L/D=1 and helix angle 25°. Low helix angle minimize the milling deflection of work piece.

Work Material
Unit : mm

|  | Carbon Steels | Alloy Steels-Tool Steels | Prehardened Steels | Hardened Steels |        | Stainless Steels | Titanium Alloy | Aluminum Alloy | Copper | Resin |
|--|---------------|--------------------------|--------------------|-----------------|--------|------------------|----------------|----------------|--------|-------|
|  |               |                          |                    | ~SS40C          | SS40C~ |                  |                |                |        |       |
|  | ○             | ○                        | ○                  |                 |        | ○                |                | ○              | ○      | ○     |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (T) | Shank Dia. (L) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 11-00025-00050 | 0.5      | 0.5               | 9°                   | 4              | 40                 |
| 11-00025-00060 | 0.6      | 0.6               | 9°                   | 4              | 40                 |
| 11-00025-00070 | 0.7      | 0.7               | 9°                   | 4              | 40                 |
| 11-00025-00080 | 0.8      | 0.8               | 9°                   | 4              | 40                 |
| 11-00025-00090 | 0.9      | 0.9               | 9°                   | 4              | 40                 |
| 11-00025-00100 | 1        | 1                 | 9°                   | 4              | 40                 |
| 11-00025-00110 | 1.1      | 1.1               | 9°                   | 4              | 40                 |
| 11-00025-00120 | 1.2      | 1.2               | 9°                   | 4              | 40                 |
| 11-00025-00130 | 1.3      | 1.3               | 9°                   | 4              | 40                 |
| 11-00025-00140 | 1.4      | 1.4               | 9°                   | 4              | 40                 |
| 11-00025-00150 | 1.5      | 1.5               | 9°                   | 4              | 40                 |
| 11-00025-00160 | 1.6      | 1.6               | 9°                   | 4              | 40                 |
| 11-00025-00170 | 1.7      | 1.7               | 9°                   | 4              | 40                 |
| 11-00025-00180 | 1.8      | 1.8               | 9°                   | 4              | 40                 |
| 11-00025-00190 | 1.9      | 1.9               | 9°                   | 4              | 40                 |
| 11-00025-00200 | 2        | 2                 | 9°                   | 4              | 40                 |
| 11-00025-00210 | 2.1      | 2.1               | 9°                   | 4              | 40                 |
| 11-00025-00220 | 2.2      | 2.2               | 9°                   | 4              | 40                 |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (T) | Shank Dia. (L) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00025-00340 | 3.4      | 3.4               | 9°                   | 6              | 40                 |
| 01-00025-00350 | 3.5      | 3.5               | 9°                   | 6              | 40                 |
| 01-00025-00360 | 3.6      | 3.6               | 9°                   | 6              | 40                 |
| 01-00025-00370 | 3.7      | 3.7               | 9°                   | 6              | 40                 |
| 01-00025-00380 | 3.8      | 3.8               | 9°                   | 6              | 40                 |
| 01-00025-00390 | 3.9      | 3.9               | 9°                   | 6              | 40                 |
| 01-00025-00400 | 4        | 4                 | 9°                   | 6              | 40                 |
| 01-00025-00410 | 4.1      | 4.1               | 9°                   | 6              | 45                 |
| 01-00025-00420 | 4.2      | 4.2               | 9°                   | 6              | 45                 |
| 01-00025-00430 | 4.3      | 4.3               | 9°                   | 6              | 45                 |
| 01-00025-00440 | 4.4      | 4.4               | 9°                   | 6              | 45                 |
| 01-00025-00450 | 4.5      | 4.5               | 9°                   | 6              | 45                 |
| 01-00025-00460 | 4.6      | 4.6               | 9°                   | 6              | 45                 |
| 01-00025-00470 | 4.7      | 4.7               | 9°                   | 6              | 45                 |
| 01-00025-00480 | 4.8      | 4.8               | 9°                   | 6              | 45                 |
| 01-00025-00490 | 4.9      | 4.9               | 9°                   | 6              | 45                 |
| 01-00025-00500 | 5        | 5                 | 9°                   | 6              | 45                 |
| 01-00025-00510 | 5.1      | 5.1               | 9°                   | 6              | 50                 |

Shape of cutting edge
Feature of tool

Standard size

## Recommended milling condition page

| MSBH230                        |               |                                                                                                                                                                                                                                                                                                                                     |       |        |                   |                                   |       |        |                   |                                   |       | Regular Line<br>MUGEN PREMIUM<br>Full Cutting Length Type |
|--------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|-----------------------------------|-------|--------|-------------------|-----------------------------------|-------|-----------------------------------------------------------|
| Recommended Milling Conditions |               |                                                                                                                                                                                                                                                                                                                                     |       |        |                   |                                   |       |        |                   |                                   |       |                                                           |
| ① Select work material         | Work Material | Hardened Steels<br>SKD61 STAVAX-HPM38 (～52HRC)                                                                                                                                                                                                                                                                                      |       |        |                   | Hardened Steels<br>SKD11 (～62HRC) |       |        |                   | High Speed Steels<br>SKH (～65HRC) |       |                                                           |
|                                | Radius        | Depth of Cut                                                                                                                                                                                                                                                                                                                        |       | Feed   | Spindle Speed     | Depth of Cut                      |       | Feed   | Spindle Speed     | Depth of Cut                      |       | Feed                                                      |
|                                |               | ap mm                                                                                                                                                                                                                                                                                                                               | ae mm | mm/min | min <sup>-1</sup> | ap mm                             | ae mm | mm/min | min <sup>-1</sup> | ap mm                             | ae mm | mm/min                                                    |
|                                | 0.05          | 0.005                                                                                                                                                                                                                                                                                                                               | 0.005 | 150    | 40,000            | 0.003                             | 0.005 | 100    | 40,000            | 0.002                             | 0.005 | 60                                                        |
|                                | 0.075         | 0.005                                                                                                                                                                                                                                                                                                                               | 0.005 | 180    | 40,000            | 0.003                             | 0.005 | 150    | 40,000            | 0.002                             | 0.005 | 100                                                       |
|                                | 0.1           | 0.01                                                                                                                                                                                                                                                                                                                                | 0.02  | 360    | 40,000            | 0.01                              | 0.01  | 320    | 40,000            | 0.003                             | 0.005 | 240                                                       |
|                                | 0.15          | 0.01                                                                                                                                                                                                                                                                                                                                | 0.03  | 420    | 40,000            | 0.01                              | 0.02  | 360    | 40,000            | 0.005                             | 0.01  | 300                                                       |
|                                | 0.2           | 0.02                                                                                                                                                                                                                                                                                                                                | 0.06  | 1,000  | 40,000            | 0.02                              | 0.05  | 820    | 40,000            | 0.01                              | 0.02  | 480                                                       |
|                                | 0.25          | 0.03                                                                                                                                                                                                                                                                                                                                | 0.07  | 1,200  | 40,000            | 0.025                             | 0.05  | 1,000  | 40,000            | 0.015                             | 0.03  | 600                                                       |
|                                | 0.3           | 0.05                                                                                                                                                                                                                                                                                                                                | 0.1   | 1,600  | 40,000            | 0.03                              | 0.06  | 1,200  | 40,000            | 0.02                              | 0.05  | 720                                                       |
|                                | 0.4           | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.15  | 2,200  | 40,000            | 0.07                              | 0.1   | 1,800  | 40,000            | 0.05                              | 0.1   | 1,200                                                     |
|                                | 0.5           | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.3   | 2,500  | 40,000            | 0.1                               | 0.2   | 2,000  | 30,000            | 0.08                              | 0.1   | 1,400                                                     |
|                                | 0.75          | 0.15                                                                                                                                                                                                                                                                                                                                | 0.3   | 3,000  | 30,000            | 0.1                               | 0.3   | 2,500  | 30,000            | 0.1                               | 0.2   | 2,000                                                     |
|                                | 1             | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.5   | 3,000  | 25,000            | 0.2                               | 0.5   | 2,500  | 25,000            | 0.15                              | 0.3   | 2,000                                                     |
|                                | 1.25          | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.6   | 3,000  | 25,000            | 0.2                               | 0.5   | 2,500  | 20,000            | 0.15                              | 0.3   | 2,000                                                     |
|                                | 1.5           | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.8   | 3,000  | 20,000            | 0.2                               | 0.6   | 2,500  | 18,000            | 0.2                               | 0.5   | 2,000                                                     |
|                                | 2             | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 20,000            | 0.2                               | 0.8   | 2,500  | 16,000            | 0.2                               | 0.6   | 2,000                                                     |
|                                | 2.5           | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 18,000            | 0.2                               | 1.2   | 2,500  | 12,000            | 0.2                               | 0.7   | 2,000                                                     |
|                                | 3             | 0.3                                                                                                                                                                                                                                                                                                                                 | 2     | 3,000  | 16,000            | 0.3                               | 1.2   | 2,500  | 8,000             | 0.2                               | 1     | 2,000                                                     |
|                                | 4             | 0.5                                                                                                                                                                                                                                                                                                                                 | 2     | 2,500  | 10,000            | 0.4                               | 1.2   | 1,800  | 7,000             | 0.3                               | 1     | 1,200                                                     |
|                                | 5             | 0.7                                                                                                                                                                                                                                                                                                                                 | 2.5   | 2,000  | 7,000             | 0.5                               | 1.5   | 1,500  | 5,000             | 0.4                               | 1.2   | 1,000                                                     |
|                                | 6             | 1                                                                                                                                                                                                                                                                                                                                   | 3     | 1,500  | 5,000             | 0.6                               | 2     | 1,200  | 4,000             | 0.5                               | 1.5   | 800                                                       |
| Notes                          |               | ※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 We recommend using oil mist coolant.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of depth of cut and rigidity of machine.<br>※5 Length of tool overhang must be as short as possible. |       |        |                   |                                   |       |        |                   |                                   |       |                                                           |

② Select tool size

③ It is a reference of cutting conditions

④ Please check notes

P Prehardened Steel

M Stainless Steel

S Titanium Alloy  
Heat Resistant Alloy

H High Speed Steels

~55 HRC

~65 HRC

## Common notes for all products

|                              |                                                                                                                                                                             |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Explanation                  | Recommended cutting conditions indicate just for reference.<br>It should be adjusted according to milling shape and machine tool.                                           |
| Preparation                  | Tool measurement required. In order to avoid interference to the work material.                                                                                             |
|                              | Recommend to assess the machine characters, such as expansion of the spindle and others before using the tool.                                                              |
|                              | Down-cut is recommended.                                                                                                                                                    |
|                              | Minimize chucking runout. (Recommend to measure actual runout at activated spindle speed.)                                                                                  |
|                              | Use a rigid machine and holder.                                                                                                                                             |
|                              | Extra care of handling when tool setting and measuring.                                                                                                                     |
|                              | Minimize a possible tool overhang length.                                                                                                                                   |
|                              | Select a cutting fluid appropriate to work material, milling shape and machining content.                                                                                   |
| Milling condition adjustment | When cutting high load sections or complex shapes, it requires attention to condition setting and tool path.                                                                |
|                              | Reduce the feed for high accurate machining to avoid breakage of work piece.                                                                                                |
|                              | Reduce both spindle speed and feed at same rate for chattering, and also for insufficient spindle speed of a machine.                                                       |
|                              | Adjust milling condition conforming with machine rigidity and clamping condition.<br>Final milling conditions are subject to machining profile, purpose and machine status. |
|                              | Spindle speed and feed are changed according to overhang length and depth of cut.                                                                                           |
|                              | For finishing process, please adjust to the optimized condition to meet the requirement of machining accuracy.                                                              |
|                              | Care for chip removal to avoid being stuck or caught during process for better surface quality.                                                                             |



Information of NS Connect

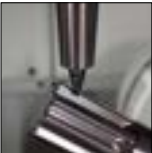


Always browse updated cloud data information all at once easily  
(From some products)



MUGEN COATING PREMIUM Plus  
3-Flute Ball End mill for 5-axis machining

Example for MSBSH330-5X You can check disclosure information



Feature of 5-axis machining



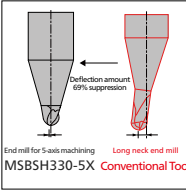
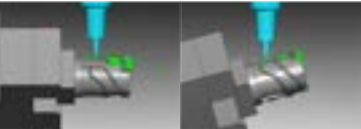
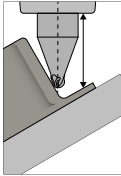
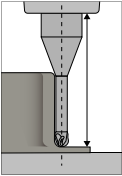
Feature of product



Standard Size table  
Recommended milling conditions



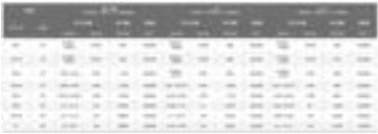
Machining case Video



End mill for 5-axis machining  
MSBSH330-5X  
Long neck end mill  
Conventional Tool



Standard Size table



Recommended milling conditions

Others

Corporate Web Site 



Contact us 



Product Leaflet 



Contact us by phone 

Twitter 

Facebook 

We will expand NS Tool Connect web service widely for future products.

Index

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Description of Icons

Material

| Material of end mill                                                             |                                        |
|----------------------------------------------------------------------------------|----------------------------------------|
|  | Super Micro Grain Carbide              |
|  | Micro Grain Carbide                    |
|  | Regular Grain Carbide                  |
|  | Cubic Boron Nitride                    |
|  | Polycrystalline Diamond                |
|  | Monocrystalline Diamond (Discontinued) |

Coating

| Coating on cutting edge                                                            |                            |
|------------------------------------------------------------------------------------|----------------------------|
|    | MUGEN COATING PREMIUM Plus |
|    | MUGEN COATING PREMIUM      |
|    | MUGEN COATING              |
|   | MUGEN MICRO COATING        |
|  | DLC COATING                |
|  | DIAMOND COATING            |
|  | X COATING (Discontinued)   |

Applications

| Cutting shape                                                                       |                |
|-------------------------------------------------------------------------------------|----------------|
|   | Side milling   |
|  | Drilling       |
|   | Slotting       |
|  | Drilling       |
|   | 3D milling     |
|  | Thread milling |
|   | Face milling   |
|  | C Chamfering   |
|   | Plunging       |
|  | R Chamfering   |

Number of Flute

| Flute number of end mill                                                          |          |
|-----------------------------------------------------------------------------------|----------|
|  | 1-Flute  |
|  | 6-Flute  |
|  | 2-Flute  |
|  | 8-Flute  |
|  | 3-Flute  |
|  | 10-Flute |
|  | 4-Flute  |

Helix Angle

| Helix angle of flute                                                               |          |
|------------------------------------------------------------------------------------|----------|
|   | Left 20° |
|   | 35°      |
|   | Left 11° |
|   | 35°/38°  |
|   | 0°       |
|   | 37.5°    |
|   | 12°      |
|   | 40°      |
|   | 20°      |
|   | 40°/42°  |
|   | 25°      |
|   | 45°      |
|  | 30°      |

Corner Shape

| Corner profile of cutting edge                                                      |            |
|-------------------------------------------------------------------------------------|------------|
|  | Sharp Edge |

Cutting Possibility of Work Material Hardness

| Machinable hardness of high hard materials                                           |                               |
|--------------------------------------------------------------------------------------|-------------------------------|
|   | Possible to cut up to 40HRC   |
|  | Possible to cut up to 68HRC   |
|   | Possible to cut up to 50HRC   |
|  | Possible to cut up to 70HRC   |
|   | Possible to cut up to 55HRC   |
|  | Possible to cut up to 92.5HRA |
|   | Possible to cut up to 60HRC   |
|   | Possible to cut up to 65HRC   |

Description of Icons

Tolerance Shank Dia.

| Tolerance of shank diameter                                                         |                        |
|-------------------------------------------------------------------------------------|------------------------|
|  | φ d - 0.001<br>- 0.003 |
|  | φ d h3                 |
|  | φ d h4                 |
|  | φ d h5                 |
|  | φ d h6                 |

Tolerance Ball Radius

| Tolerance of R for ball end mill                                                    |          |
|-------------------------------------------------------------------------------------|----------|
|  | R ±0.002 |
|  | R ±0.003 |
|  | R ±0.004 |
|  | R ±0.005 |
|  | R ±0.01  |
|  | R ±0.02  |

Corner Radius

| Tolerance of Corner R for radius end mill                                             |                      |
|---------------------------------------------------------------------------------------|----------------------|
|    | Corner Radius ±0.002 |
|    | Corner Radius ±0.005 |
|    | Corner Radius ±0.01  |
|   | Corner Radius ±0.015 |
|  | Corner Radius ±0.02  |

NS Connect

Always browse updated cloud data information all from 2D code on back of product case



Always browse feature of products, standard size table, recommended milling conditions and machining case video.



New Products

New

MUGEN COATING PREMIUM Plus High Efficient 3-Flute Small-Diameter Long Neck Ball End Mill for Hardened Steel

MRBSH330



R0.1~R1    Total 22 Sizes

● High efficiency 3-flute ball end mill optimizes shape of ball center and enables high depth of cut and high feed machining

Size Expansion

Long Neck Square End Mill for Copper Electrode

DHR237



φ0.1~φ6    Total 74 Sizes

● Long neck square end mill specialized for machining copper alloy. Sharpe cutting edge makes less burr and high quality surface

Size Expansion

Long Neck Ball End Mill for Copper Electrode

DRB230



R0.05~R3    Total 94 Sizes

● Long neck ball end mill specialized for machining copper alloy. Sharpe cutting edge makes less burr and high quality surface

Size Expansion

Long Neck Radius End Mill for Copper Electrode

DHR237R



φ0.2×R0.02~φ6×R1    Total 153 Sizes

● Long neck corner radius end mill specialized for machining copper alloy. Sharpe cutting edge makes less burr and high quality surface

New

CBN Super High Precision Radius End Mill

SHPR400



φ0.1×R0.01~φ3×R0.2    Total 142 Sizes

● 4-flute corner radius end mill from Dia.0.1mm. High precise type to pursue machining accuracy

New

MUGEN COATING PREMIUM Plus 3-Flute Ball End Mill for 5-axis machining

MSBSH330-5X



R0.1~R1    Total 8 Sizes

● 3-Flute high rigidity ball design conforms features of 5-axis machine to reduce total manufacturing cost with high precision and high efficiency machining

New

MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill with Short Shank for Hardened Steel and High accuracy cutting

MRBSH230SF



R0.05~R3    Total 83 Sizes

● High precision and long tool life even in hardened steels up to 70HRC

Size Expansion

MUGEN COATING Flat Drill

MFD



φ0.1~φ6    Total 69 Sizes

● Stable drilling is realized in various scenes such as inclined surface and curved surface

**Size Expansion** MUGEN COATING PREMIUM 4-Flute Long Neck Radius End Mill for Hardened Steel

## MHRH430R



**$\phi 0.1 \times R0.01 \sim \phi 6 \times R1$**  Total 336 Sizes

● 4-flute long neck corner radius end mill for prehardened steels and hardened steels(  $\sim 65\text{HRC}$ ). Maximum L/D=16

Page ▶ G-044

**New** MUGEN COATING PREMIUM 4-Flute High Efficient "Z" End Mill for Stainless Steels

## MSUSZ440



**$\phi 1 \sim \phi 6$**  Total 62 Sizes

● For machining on stainless steels and heat resistant alloy. Continuous machining from drilling to slotting  
Unequal flute spacing and unequal helix angle design

Page ▶ K-004

**New** MUGEN COATING PREMIUM 4-Flute Long Neck High Efficient "Z" End Mill for Stainless Steels

## MSUSZ440-LN



**$\phi 1 \sim \phi 6$**  Total 33 Sizes

● For machining on stainless steels and heat resistant alloy. Continuous machining from drilling to slotting  
Unequal flute spacing and unequal helix angle design

Page ▶ K-014

**New** MUGEN COATING 4-Flute High Efficient "Z" End Mill for Carbon Steels

## MSCZ440



**$\phi 1 \sim \phi 6$**  Total 62 Sizes

● High efficient machining on carbon steels. Continuous machining from plunging approach to slotting

Page ▶ K-006

**New** MUGEN COATING 4-Flute Long Neck High Efficient "Z" End Mill for Carbon Steels

## MSCZ440-LN



**$\phi 1 \sim \phi 6$**  Total 33 Sizes

● High efficient machining on carbon steels. Continuous machining from plunging approach to slotting.  
Long neck type to prevent interference

Page ▶ K-016

**Size Expansion** MUGEN COATING PREMIUM 2-Flute Long Taper Neck Ball End Mill

## MRBTNH230



**$R0.05 \times \text{Neck taper angle } 3^\circ \sim R2 \times \text{Neck taper angle } 1^\circ$**  Total 209 Sizes

● Taper neck to improve tool rigidity. Option of same taper angle as inclined working angle

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**Size Expansion** MUGEN COATING 2-Flute Radius End Mill

## MSRS230



**$\phi 1 \times R0.1 \sim \phi 6 \times R2$**  Total 38 Sizes

● 2-flute standard type corner radius end mill with helix angle  $30^\circ$ . For multi-purpose from roughing to finishing

Page ▶ H-074

**Size Expansion** MUGEN COATING 4-Flute Radius End Mill

## MSRS430



**$\phi 1 \times R0.1 \sim \phi 12 \times R3$**  Total 64 Sizes

● 4-flute standard type corner radius end mill with helix angle  $30^\circ$ . For multi-purpose from roughing to finishing

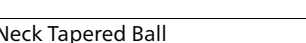
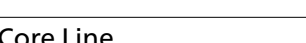
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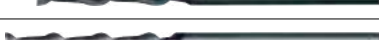
Search

|                      |       |
|----------------------|-------|
| Search from Series   | A-002 |
| Search from Shape    | A-026 |
| Search from Model    | A-050 |
| Search from Code No. | A-062 |



| Photo                                                                               | Product Name                                                  | Model                               | Size                                                |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------|-----------------------------------------------------|
| CBN Core Line                                                                       |                                                               |                                     |                                                     |
| Square                                                                              |                                                               |                                     |                                                     |
|    | CBN "MICRO EDGE Z"                                            | SMEZ120<br>※ Listed at "Micro Edge" | φ0.03 ~ φ0.1                                        |
|    | CBN Square End Mill                                           | SSE400                              | φ0.1                                                |
|    | CBN Square End Mill                                           | SSE600                              | φ0.2 ~ φ1                                           |
| Ball                                                                                |                                                               |                                     |                                                     |
|    | CBN Ball End Mill for precision machining<br>"CBN Micro Ball" | SMB120<br>※ Listed at "Micro Edge"  | R0.01 ~ R0.05                                       |
| Long Neck Ball                                                                      |                                                               |                                     |                                                     |
|    | CBN Super Finish Ball End Mill                                | SFB200                              | R0.1 ~ R1                                           |
|    | CBN Super Spiral Ball End Mill                                | SSPB220                             | R0.1 ~ R3                                           |
|   | CBN Super Speed Ball End Mill                                 | SSB200                              | R0.1 ~ R1                                           |
|  | CBN Super Spiral Long Neck Ball End Mill                      | SSPBL220                            | R0.1 ~ R1                                           |
|  | CBN Super Speed Long Neck Ball End Mill                       | SSBL200                             | R0.05 ~ R1                                          |
| Long Neck Tapered Ball                                                              |                                                               |                                     |                                                     |
|  | CBN Super Spiral Long Taper Neck Ball End Mill                | SSPBTN220                           | R0.1×neck taper angle30°<br>~ R1×neck taper angle2° |
| Long Neck Corner Radius                                                             |                                                               |                                     |                                                     |
|  | CBN Super Speed Radius End Mill                               | SSR200                              | φ0.1 × R0.02<br>~ φ2 × R0.5                         |
|  | CBN High Efficient Radius End Mill                            | SHR320                              | φ0.5 × R0.1<br>~ φ2 × R0.3                          |
|  | CBN Super High Precision Radius End Mill                      | SHPR400                             | φ0.1 × R0.01<br>~ φ3 × R0.2                         |
|  | CBN Super Surface End Mill                                    | SSF120                              | φ0.2 × R0.05<br>~ φ2 × R0.1                         |
| PCD Core Line                                                                       |                                                               |                                     |                                                     |
| Long Neck Square                                                                    |                                                               |                                     |                                                     |
|  | PCD Square End Mill                                           | PCDSE                               | φ0.1 ~ φ1                                           |
| Long Neck Ball                                                                      |                                                               |                                     |                                                     |
|  | PCD Ball End Mill                                             | PCDRB                               | R0.05 ~ R1                                          |
| Long Neck Corner Radius                                                             |                                                               |                                     |                                                     |
|  | PCD Radius End Mill                                           | PCDRS                               | φ0.3 × R0.05<br>~ φ1 × R0.1                         |

| Material • Coating                                                                    | Number of Flute | Helix Angle | Side Milling | Slot Milling                                                                                                                                                                   | Face Milling                                                                          | Plunging | 3D Milling                                                                            | Drilling | Thread Milling | C • R Chamfering | Work Material     |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       | Page  |
|---------------------------------------------------------------------------------------|-----------------|-------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|----------------|------------------|-------------------|------------------|---------------------------------------------------------------------------------------|----------------------|----------------------|-------------|----------------------|------------|---------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------|
|                                                                                       |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  | P<br>Carbon Steel | P<br>Alloy Steel | P<br>Prehardened Steel                                                                | M<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Copper Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material                                                            | S<br>Heat Resistant Alloy etc                                                         | H<br>Hardened Steel |                                                                                       |                                                                                       |                                                                                       |       |
|                                                                                       |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       | 55<br>HRC           | 65<br>HRC                                                                             | 70<br>HRC                                                                             |                                                                                       |       |
|                                                                                       |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
| CBN Core Line                                                                         |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
| Square                                                                                |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|    | 1               | -20°        | -            |                                                                                             | -                                                                                     | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | ○                                                                                     | ○                   | ○                                                                                     | B-004                                                                                 |                                                                                       |       |
|    | 4               | 0°          | -            | <br>     | Face                                                                                  | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | ○                                                                                     | ○                   | ○                                                                                     | B-006                                                                                 |                                                                                       |       |
|    | 6               | 0°          | -            | <br>     | Face                                                                                  | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | ○                                                                                     | ○                   | ○                                                                                     | B-008                                                                                 |                                                                                       |       |
| Ball                                                                                  |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|    | 1               | -20°        | -            | -                                                                                                                                                                              | -                                                                                     | -        |    | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-010                                                                                 |       |
| Long Neck Ball                                                                        |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|    | 2               | 0°          | -            | -                                                                                                                                                                              | -                                                                                     | -        |    | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-012                                                                                 |       |
|    | 2               | 20°         | -            | -                                                                                                                                                                              | -                                                                                     | -        |    | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-014                                                                                 |       |
|   | 2               | 0°          | -            | -                                                                                                                                                                              | -                                                                                     | -        |   | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-016                                                                                 |       |
|  | 2               | 20°         | -            | -                                                                                                                                                                              | -                                                                                     | -        |  | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-018                                                                                 |       |
|  | 2               | 0°          | -            | -                                                                                                                                                                              | -                                                                                     | -        |  | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-020                                                                                 |       |
| Long Neck Tapered Ball                                                                |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|  | 2               | 20°         | -            | -                                                                                                                                                                              | -                                                                                     | -        |  | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-022                                                                                 |       |
| Long Neck Corner Radius                                                               |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|  | 2               | 0°          | -            | <br> | Face                                                                                  | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-026                                                                                 |       |
|  | 3               | 20°         | -            | <br> | Face                                                                                  | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-032                                                                                 |       |
|  | 4               | 0°          | -            | <br> | Face                                                                                  | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-034                                                                                 |       |
|  | 1               | -20°        | -            | -                                                                                                                                                                              |  | -        | -                                                                                     | -        | -              | -                | -                 | -                | ○                                                                                     | -                    | -                    | -           | -                    | -          | -             | -                                                                                     | -                                                                                     | ○                   | ○                                                                                     | ○                                                                                     | B-040                                                                                 |       |
| PCD Core Line                                                                         |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
| Long Neck Square                                                                      |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|  | 2               | 6           | 0°           | -                                                                                                                                                                              |  | -        | -                                                                                     | -        | -              | -                | -                 | -                | -                                                                                     | -                    | -                    | -           | -                    | -          | -             |  | -                                                                                     | -                   | -                                                                                     | -                                                                                     | C-004                                                                                 |       |
| Long Neck Ball                                                                        |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|  | -               | -           | -            | -                                                                                                                                                                              | -                                                                                     | -        |  | -        | -              | -                | -                 | -                |  | -                    | -                    | -           | -                    | -          | -             | -                                                                                     |  | -                   |  |  |  | C-006 |
| Long Neck Corner Radius                                                               |                 |             |              |                                                                                                                                                                                |                                                                                       |          |                                                                                       |          |                |                  |                   |                  |                                                                                       |                      |                      |             |                      |            |               |                                                                                       |                                                                                       |                     |                                                                                       |                                                                                       |                                                                                       |       |
|  | 2               | 4           | 6            | 0°                                                                                                                                                                             |  | -        |  | -        | -              | -                | -                 | -                | -                                                                                     | -                    | -                    | -           | -                    | -          | -             |  | -                                                                                     | -                   | -                                                                                     | -                                                                                     | C-008                                                                                 |       |

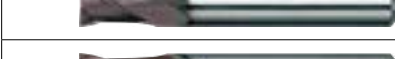
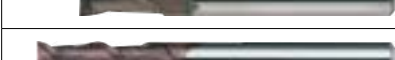
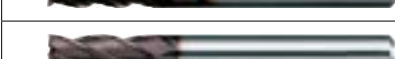
| Photo                                                                               | Product Name                                                                                                             | Model                                  | Size           |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------|
| Micro Edge                                                                          |                                                                                                                          |                                        |                |
| Square                                                                              |                                                                                                                          |                                        |                |
|    | CBN "MICRO EDGE Z"                                                                                                       | SMEZ120<br>※ Listed at "CBN Core Line" | φ0.03 ~ φ0.1   |
|    | Micro End Mill "MICRO EDGE"                                                                                              | NSME100                                | φ0.01 ~ φ0.05  |
|    | Micro End Mill "MICRO EDGE"                                                                                              | NSME230                                | φ0.03 ~ φ0.09  |
| Ball                                                                                |                                                                                                                          |                                        |                |
|    | CBN Ball End Mill for precision machining "CBN Micro Ball"                                                               | SMB120<br>※ Listed at "CBN Core Line"  | R0.01 ~ R0.05  |
|    | Ball End Mill for precision machining "Micro Ball"                                                                       | NSMB100                                | R0.005 ~ R0.05 |
| Regular Line MUGEN COATING PREMIUM Plus                                             |                                                                                                                          |                                        |                |
| Ball                                                                                |                                                                                                                          |                                        |                |
|    | MUGEN COATING PREMIUM Plus 3-Flute Ball End mill for 5-axis machining                                                    | MSBSH330-5X                            | R0.1 ~ R1      |
| Long Neck Ball                                                                      |                                                                                                                          |                                        |                |
|  | MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill with Short Shank for Hardened Steel and High accuracy cutting | MRBSH230SF                             | R0.05 ~ R3     |
|  | MUGEN COATING PREMIUM Plus High Efficient 3-Flute small-diameter Long Neck Ball End Mill for Hardened Steel              | MRBSH330                               | R0.1 ~ R1      |
| Regular Line MUGEN COATING PREMIUM                                                  |                                                                                                                          |                                        |                |
| Square                                                                              |                                                                                                                          |                                        |                |
|  | MUGEN COATING PREMIUM 2-Flute LEAD25 End Mill                                                                            | MXH225                                 | φ0.1 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute LEAD30 End Mill                                                                            | MXH230                                 | φ0.1 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute LEAD35 End Mill                                                                            | MXH235                                 | φ0.1 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute LEAD40 End Mill                                                                            | MXH240                                 | φ0.3 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute LEAD45 End Mill                                                                            | MXH245                                 | φ0.3 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute Sharp Edge LEAD25 End Mill                                                                 | MXH225P                                | φ0.1 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute Sharp Edge LEAD30 End Mill                                                                 | MXH230P                                | φ0.1 ~ φ6      |
|  | MUGEN COATING PREMIUM 2-Flute Sharp Edge LEAD35 End Mill                                                                 | MXH235P                                | φ0.1 ~ φ6      |
|  | MUGEN COATING PREMIUM 4-Flute Square End Mill for Hardened Steel                                                         | MHDH445                                | φ1 ~ φ4        |
|  | MUGEN COATING PREMIUM 6-Flute Square End Mill for Hardened Steel                                                         | MHDH645                                | φ5 ~ φ12       |

| Material • Coating                                                                    | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       | Page |
|---------------------------------------------------------------------------------------|-----------------|-------------|--------------|--------------|--------------|----------|------------|----------|----------------|------------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-----------------|-------|----------|-----------------------|--------------------------|--------|--------|--------|-------|------|
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | P             | P           | P                 | M               | N               | N      | N               | N     | N        | S                     | H                        |        |        |        |       |      |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Copper Tungsten | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC | 65 HRC | 70 HRC |       |      |
| Micro Edge                                                                            |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
| Square                                                                                |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
|    | 1               | -20°        | -            | Slot         | -            | -        | -          | -        | -              | -                | -             | -           | ○                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | ○      |        | D-004 |      |
|    | 1               | 0°          | -            | Slot         | Face         | -        | -          | -        | -              | -                | ○             | ○           | ○                 | ○               | ○               | -      | ○               | -     | -        | -                     | -                        | -      | -      |        | D-006 |      |
|    | 2               | 30°         | -            | Slot         | Face         | -        | -          | -        | -              | -                | ○             | ○           | ○                 | ○               | ○               | -      | ○               | -     | -        | -                     | -                        | -      | -      |        | D-008 |      |
| Ball                                                                                  |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
|    | 1               | -20°        | -            | -            | -            | -        | 3D         | -        | -              | -                | -             | -           | ○                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | ○      |        | D-010 |      |
|    | 1               | 0°          | -            | -            | -            | -        | 3D         | -        | -              | -                | ○             | ○           | ○                 | ○               | ○               | -      | ○               | -     | -        | -                     | -                        | -      | -      |        | D-012 |      |
| Regular Line MUGEN COATING PREMIUM Plus                                               |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
| Ball                                                                                  |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
|    | 3               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -             | -           | -                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | ○      |        | E-004 |      |
| Long Neck Ball                                                                        |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -             | -           | -                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | ○      |        | E-006 |      |
|  | 3               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -             | -           | -                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | ○      |        | E-010 |      |
| Regular Line MUGEN COATING PREMIUM                                                    |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
| Square                                                                                |                 |             |              |              |              |          |            |          |                |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |       |      |
|  | 2               | 25°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | ○                        | -      | -      |        | F-004 |      |
|  | 2               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | ○                        | -      | -      |        | F-006 |      |
|  | 2               | 35°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | ○                        | -      | -      |        | F-008 |      |
|  | 2               | 40°         | Side         | -            | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | ○                        | -      | -      |        | F-010 |      |
|  | 2               | 45°         | Side         | -            | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | ○                        | -      | -      |        | F-012 |      |
|  | 2               | 25°         | Side         | -            | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | -                        | -      | -      |        | F-014 |      |
|  | 2               | 30°         | Side         | -            | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | -                        | -      | -      |        | F-016 |      |
|  | 2               | 35°         | Side         | -            | Face         | -        | -          | -        | -              | -                | -             | ○           | ○                 | -               | -               | -      | -               | -     | -        | ○                     | -                        | -      | -      |        | F-018 |      |
|  | 4               | 45°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -             | ○           | -                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | -      |        | F-020 |      |
|  | 6               | 45°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -             | ○           | -                 | -               | -               | -      | -               | -     | -        | -                     | ○                        | ○      | -      |        | F-022 |      |

| Photo                                                                               | Product Name                                                                       | Model     | Size                                                |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------|-----------------------------------------------------|
| Regular Line MUGEN COATING PREMIUM                                                  |                                                                                    |           |                                                     |
| Ball                                                                                |                                                                                    |           |                                                     |
|    | MUGEN COATING PREMIUM<br>2-Flute Ball End Mill for Hardened Steel                  | MSBH230   | R0.05 ~ R6                                          |
|    | MUGEN COATING PREMIUM<br>3-Flute Ball End Mill for Hardened Steel                  | MSBH345   | R0.5 ~ R3                                           |
| Corner Radius                                                                       |                                                                                    |           |                                                     |
|    | MUGEN COATING PREMIUM<br>4-Flute Radius End Mill for Hardened Steel                | MHDH445R  | $\phi 3 \times R0.2$<br>~ $\phi 4 \times R0.5$      |
|    | MUGEN COATING PREMIUM<br>6-Flute Radius End Mill for Hardened Steel                | MHDH645R  | $\phi 5 \times R0.2$<br>~ $\phi 12 \times R2$       |
| Long Neck Square                                                                    |                                                                                    |           |                                                     |
|    | MUGEN COATING PREMIUM<br>2-Flute Long Neck End Mill for Hardened Steel             | MHRH230   | $\phi 0.1 \sim \phi 3$                              |
|    | MUGEN COATING PREMIUM<br>4-Flute Long Neck End Mill for Hardened Steel             | MHRH430   | $\phi 1 \sim \phi 6$                                |
| Long Neck Ball                                                                      |                                                                                    |           |                                                     |
|   | MUGEN COATING PREMIUM<br>2-Flute Long Neck Ball End Mill for Hardened Steel        | MRBH230   | R0.05 ~ R3                                          |
|  | MUGEN COATING PREMIUM<br>2-Flute Ball End Mill with Short Shank for Hardened Steel | MACH225SF | R0.1 ~ R3                                           |
|  | MUGEN COATING PREMIUM<br>2-Flute Ball End Mill for Hardened Steel                  | MACH225   | R0.1 ~ R3                                           |
| Long Neck Tapered Ball                                                              |                                                                                    |           |                                                     |
|  | MUGEN COATING PREMIUM<br>2-Flute Long Taper Neck Ball End Mill                     | MRBTNH230 | R0.05×neck taper angle3°<br>~ R2×neck taper angle1° |
|  | MUGEN COATING PREMIUM<br>3-Flute Long Taper Neck Ball End Mill                     | MRBTNH345 | R0.5×neck taper angle30°<br>~ R2×neck taper angle1° |
| Long Neck Corner Radius                                                             |                                                                                    |           |                                                     |
|  | MUGEN COATING PREMIUM<br>2-Flute Long Neck Radius End Mill for Hardened Steel      | MHRH230R  | $\phi 0.2 \times R0.02$<br>~ $\phi 0.9 \times R0.1$ |
|  | MUGEN COATING PREMIUM<br>4-Flute Long Neck Radius End Mill for Hardened Steel      | MHRH430R  | $\phi 0.1 \times R0.01$<br>~ $\phi 6 \times R1$     |
| Regular Line MUGEN COATING                                                          |                                                                                    |           |                                                     |
| Square                                                                              |                                                                                    |           |                                                     |
|  | MUGEN COATING 2-Flute LEAD25 End Mill                                              | MX225     | $\phi 0.3 \sim \phi 12$                             |
|  | MUGEN COATING 2-Flute LEAD30 End Mill                                              | MX230     | $\phi 0.1 \sim \phi 12$                             |
|  | MUGEN COATING 2-Flute LEAD35 End Mill                                              | MX235     | $\phi 0.1 \sim \phi 12$                             |
|  | MUGEN COATING 2-Flute LEAD40 End Mill                                              | MX240     | $\phi 0.3 \sim \phi 12$                             |

| Material • Coating                                                                    | Number of Flute | Helix Angle | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 | Page |
|---------------------------------------------------------------------------------------|-----------------|-------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|------------|----------|----------------|------------------|---------------|---|---|---|---|---|---|---|---|---|--------------|-------------|-------------------|-----------------|-----------------|------|
|                                                                                       |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  | P             | P | P | M | N | N | N | N | N | S | H            |             |                   |                 |                 |      |
|                                                                                       |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy |      |
| Regular Line MUGEN COATING PREMIUM                                                    |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
| Ball                                                                                  |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|    | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | F-024           |      |
|    | 3               | 45°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | F-026           |      |
| Corner Radius                                                                         |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|    | 4               | 45°         |    |    |    | -        | -          | -        | -              | -                | -             | - | ○ | - | - | - | - | - | - | - | -            | ○           | ○                 | -               | F-028           |      |
|    | 6               | 45°         |    |    |    | -        | -          | -        | -              | -                | -             | - | ○ | - | - | - | - | - | - | - | -            | ○           | ○                 | -               | F-030           |      |
| Long Neck Square                                                                      |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|    | 2               | 30°         |    |    |    | -        | -          | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-004           |      |
|    | 4               | 30°         |    |    |    | -        | -          | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-010           |      |
| Long Neck Ball                                                                        |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|   | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-014           |      |
|  | 2               | 25°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-024           |      |
|  | 2               | 25°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-026           |      |
| Long Neck Tapered Ball                                                                |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|  | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-028           |      |
|  | 3               | 45°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | 3D         | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-036           |      |
| Long Neck Corner Radius                                                               |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|  | 2               | 30°         |  |  |  | -        | -          | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-040           |      |
|  | 4               | 30°         |  |  |  | -        | -          | -        | -              | -                | -             | - | ○ | ○ | - | - | - | - | - | - | ○            | ○           | ○                 | -               | G-044           |      |
| Regular Line MUGEN COATING                                                            |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
| Square                                                                                |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                |                  |               |   |   |   |   |   |   |   |   |   |              |             |                   |                 |                 |      |
|  | 2               | 25°         |  |  |  | -        | -          | -        | -              | -                | ○             | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○            | -           | -                 | H-006           |                 |      |
|  | 2               | 30°         |  |  |  | -        | -          | -        | -              | -                | ○             | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○            | -           | -                 | H-008           |                 |      |
|  | 2               | 35°         |  |  |  | -        | -          | -        | -              | -                | ○             | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○            | -           | -                 | H-010           |                 |      |
|  | 2               | 40°         |  | -                                                                                     |  | -        | -          | -        | -              | -                | ○             | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○            | -           | -                 | H-012           |                 |      |

| Photo                      | Product Name | Model | Size |
|----------------------------|--------------|-------|------|
| Regular Line MUGEN COATING |              |       |      |

|                                                                                    |                                                       |          |             |
|------------------------------------------------------------------------------------|-------------------------------------------------------|----------|-------------|
| Square                                                                             |                                                       |          |             |
|    | MUGEN COATING 2-Flute LEAD45 End Mill                 | MX245    | φ0.3 ~ φ12  |
|    | MUGEN COATING 4-Flute LEAD25 End Mill                 | MX425    | φ1 ~ φ12    |
|    | MUGEN COATING 4-Flute LEAD30 End Mill                 | MX430    | φ1 ~ φ12    |
|    | MUGEN COATING 4-Flute LEAD35 End Mill                 | MX435    | φ1 ~ φ12    |
|    | MUGEN COATING 4-Flute LEAD40 End Mill                 | MX440    | φ1 ~ φ12    |
|    | MUGEN COATING 4-Flute LEAD45 End Mill                 | MX445    | φ1 ~ φ12    |
|    | MUGEN COATING 2-Flute Super Short End Mill            | MSE230SS | φ0.1 ~ φ6   |
|   | MUGEN COATING 2-Flute Sharp Edge Short End Mill       | MSES230P | φ0.1 ~ φ12  |
|  | MUGEN COATING 2-Flute End Mill                        | MSE230   | φ0.1 ~ φ12  |
|  | MUGEN COATING 2-Flute Medium End Mill                 | MSEM230  | φ0.5 ~ φ12  |
|  | MUGEN COATING 2-Flute End Mill with Measured Diameter | MSE230M  | φ0.1 ~ φ6   |
|  | MUGEN COATING 2-Flute End Mill                        | MSE245   | φ2 ~ φ12    |
|  | MUGEN COATING 3-Flute End Mill                        | MSE345   | φ3 ~ φ20    |
|  | MUGEN COATING 4-Flute Sharp Edge End Mill             | MSE430P  | φ1 ~ φ12    |
|  | MUGEN COATING 4-Flute End Mill                        | MSE430   | φ1 ~ φ20    |
|  | MUGEN COATING 4-Flute End Mill                        | MSE445   | φ2 ~ φ20    |
|  | MUGEN COATING 4-Flute Medium End Mill                 | MSEM430  | φ1 ~ φ20    |
|  | MUGEN COATING 4-Flute End Mill for Hardened Steel     | MHD445   | φ1 ~ φ4     |
|  | MUGEN COATING 6-Flute End Mill for Hardened Steel     | MHD645   | φ5 ~ φ12    |
| Ball                                                                               |                                                       |          |             |
|  | MUGEN COATING 2-Flute Ball End Mill                   | MSB230   | R0.05 ~ R10 |

| Page                       | Work Material            |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
|----------------------------|--------------------------|--------|----------|---|---|-------|---|---|-----------------|---|---|--------|--|--|-----------------|--|--|-----------------|--|--|-------------------|--|--|-------------|--|--|--------------|--|--|
|                            | H                        |        |          | S | N | N     | N | N | N               | N | N |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
|                            | Hardened Steel           |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
|                            | 55 HRC                   | 65 HRC | 70 HRC   |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
|                            | Heat Resistant Alloy etc |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Hard Brittle Material      |                          |        | Graphite |   |   | Resin |   |   | Copper Tungsten |   |   | Copper |  |  | Aluminium Alloy |  |  | Stainless Steel |  |  | Prehardened Steel |  |  | Alloy Steel |  |  | Carbon Steel |  |  |
| C • R Chamfering           |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Thread Milling             |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Drilling                   |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| 3D Milling                 |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Plunging                   |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Face Milling               |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Slot Milling               |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Side Milling               |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Helix Angle                |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Number of Flute            |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Material • Coating         |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |
| Regular Line MUGEN COATING |                          |        |          |   |   |       |   |   |                 |   |   |        |  |  |                 |  |  |                 |  |  |                   |  |  |             |  |  |              |  |  |

|        |   |     |      |      |      |   |    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |       |
|--------|---|-----|------|------|------|---|----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------|
| Square |   |     |      |      |      |   |    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |       |
| ∞      | 2 | 45° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-014 |
| ∞      | 4 | 25° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-016 |
| ∞      | 4 | 30° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-018 |
| ∞      | 4 | 35° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-020 |
| ∞      | 4 | 40° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-022 |
| ∞      | 4 | 45° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-024 |
| ∞      | 2 | 30° | Side | Slot | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-026 |
| ∞      | 2 | 30° | Side | Slot | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | - | - | - | H-030 |
| ∞      | 2 | 30° | Side | Slot | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-032 |
| ∞      | 2 | 30° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-036 |
| ∞      | 2 | 30° | Side | Slot | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-038 |
| ∞      | 2 | 45° | Side | Slot | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | ○ | ○ | - | - | H-040 |
| ∞      | 3 | 45° | Side | Slot | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | ○ | ○ | - | - | H-042 |
| ∞      | 4 | 30° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | - | - | - | H-044 |
| ∞      | 4 | 30° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-046 |
| ∞      | 4 | 45° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | ○ | ○ | - | - | H-048 |
| ∞      | 4 | 30° | Side | -    | Face | - | -  | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-050 |
| ∞      | 4 | 45° | Side | Slot | Face | - | -  | - | - | - | - | - | ○ | - | - | - | - | - | - | - | ○ | - | - | H-052 |
| ∞      | 6 | 45° | Side | Slot | Face | - | -  | - | - | - | - | - | ○ | - | - | - | - | - | - | - | ○ | - | - | H-054 |
| Ball   |   |     |      |      |      |   |    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |       |
| ∞      | 2 | 30° | -    | -    | -    | - | 3D | - | - | - | ○ | ○ | ○ | ○ | ○ | - | ○ | - | - | - | ○ | - | - | H-056 |



| Photo                      | Product Name | Model | Size |
|----------------------------|--------------|-------|------|
| Regular Line MUGEN COATING |              |       |      |

|                                                                                     |                                                                   |            |                                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------|
| Ball                                                                                |                                                                   |            |                                                                                                     |
|    | MUGEN COATING 3-Flute Ball End Mill                               | MSB345     | R0.5 ~ R6                                                                                           |
|    | MUGEN COATING Profit Ball End Mill                                | MSB230G2   | R0.05 ~ R3                                                                                          |
|    | MUGEN COATING<br>2-Flute Short Flute Ball End Mill                | MSB230S    | R0.1 ~ R6                                                                                           |
|    | MUGEN COATING<br>2-Flute Ball End Mill with Short Shank           | MSB230SF   | R0.1 ~ R6                                                                                           |
|    | MUGEN COATING 2-Flute Long Ball End Mill                          | MSBL230    | R0.1 ~ R5                                                                                           |
|     | MUGEN COATING 2-Flute Extra Long Ball End Mill                    | MSBXL230   | R0.5 ~ R5                                                                                           |
| Corner Radius                                                                       |                                                                   |            |                                                                                                     |
|    | MUGEN COATING 2-Flute Radius End Mill                             | MSRS230    | $\phi 1 \times R0.1$<br>~ $\phi 6 \times R2$                                                        |
|   | MUGEN COATING 4-Flute Radius End Mill                             | MSRS430    | $\phi 1 \times R0.1$<br>~ $\phi 12 \times R3$                                                       |
| Long Neck Square                                                                    |                                                                   |            |                                                                                                     |
|  | MUGEN COATING 2-Flute Long Neck End Mill                          | MHR230     | $\phi 0.1 \sim \phi 6$                                                                              |
|  | MUGEN COATING 4-Flute Long Neck End Mill                          | MHR430     | $\phi 1 \sim \phi 10$                                                                               |
|  | MUGEN COATING<br>2-Flute Long Neck End Mill (Shank Dia. 6)        | MHRLN230-6 | $\phi 0.3 \sim \phi 2$                                                                              |
| Long Neck Ball                                                                      |                                                                   |            |                                                                                                     |
|  | MUGEN COATING 2-Flute Long Neck Ball End Mill                     | MRB230     | R0.05 ~ R3                                                                                          |
|  | MUGEN COATING<br>2-Flute Long Neck Ball End Mill with Short Shank | MRB230SF   | R0.1 ~ R1.5                                                                                         |
|  | MUGEN COATING<br>2-Flute Long Neck Ball End Mill (Shank Dia. 6)   | MRBLN230-6 | R0.15 ~ R1                                                                                          |
| Long Neck Tapered Ball                                                              |                                                                   |            |                                                                                                     |
|  | MUGEN COATING<br>2-Flute Long Taper Neck Ball End Mill            | MRBTN230   | $R0.1 \times \text{neck taper angle} 30^\circ$<br>~ $R2 \times \text{neck taper angle} 1^\circ$     |
|  | MUGEN COATING<br>2-Flute Extra Long Taper Neck Ball End Mill      | MRBTN230L  | $R0.1 \times \text{neck taper angle} 30^\circ$<br>~ $R5 \times \text{neck taper angle} 1^\circ 30'$ |
| Long Neck Corner Radius                                                             |                                                                   |            |                                                                                                     |
|  | MUGEN COATING 2-Flute Long Neck Radius End Mill                   | MHR230R    | $\phi 0.2 \times R0.05$<br>~ $\phi 6 \times R1$                                                     |

| Page                       | Work Material  |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
|----------------------------|----------------|--------|--------|--------------------------|---|---|---|---|---|---|---|---|---|---|---|
|                            | H              |        |        | Heat Resistant Alloy etc | S | N | N | N | N | N | N | N | N | N | P |
|                            | Hardened Steel |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
|                            | 55 HRC         | 65 HRC | 70 HRC |                          |   |   |   |   |   |   |   |   |   |   |   |
| C • R Chamfering           |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Thread Milling             |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Drilling                   |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| 3D Milling                 |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Plunging                   |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Face Milling               |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Slot Milling               |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Side Milling               |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Helix Angle                |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Number of Flute            |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Material • Coating         |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |
| Regular Line MUGEN COATING |                |        |        |                          |   |   |   |   |   |   |   |   |   |   |   |

| Ball                                                                                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|---|---|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------|
|    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | - |    | - | - | - |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-060 |
|    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | - |    | - | - | - |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-062 |
|    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | - |    | - | - | - |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-064 |
|    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | - |    | - | - | - |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-068 |
|    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | - |    | - | - | - |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-072 |
|    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | - |    | - | - | - |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-073 |
| Corner Radius                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |
|   |   |   |   |   |   | - | -                                                                                     | - | - | - |   |   |   |   |   |   |   |   |   |   |   |   |   |   | H-074 |
|  |  |  |  |  |  | - | -                                                                                     | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | H-076 |
| Long Neck Square                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |
|  |  |  |  |  |  | - | -                                                                                     | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-004 |
|  |  |  |  |  |  | - | -                                                                                     | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-016 |
|  |  |  |  |  |  | - | -                                                                                     | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-024 |
| Long Neck Ball                                                                        |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | - |  | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-026 |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | - |  | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-038 |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | - |  | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-042 |
| Long Neck Tapered Ball                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | - |  | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-044 |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | - |  | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-054 |
| Long Neck Corner Radius                                                               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |
|  |  |  |  |  |  | - | -                                                                                     | - | - | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  | I-058 |





| Photo             | Product Name | Model | Size |
|-------------------|--------------|-------|------|
| Aluminium Milling |              |       |      |

|                                                                                     |                                                        |                                                                 |            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------|------------|
| Square                                                                              |                                                        |                                                                 |            |
|    | 2-Flute L/D=2 End Mill for Aluminium                   | AL2D-2                                                          | φ0.5 ~ φ12 |
|    | DLC COATING<br>2-Flute L/D=2 End Mill for Aluminium    | AL2D-2DLC                                                       | φ0.5 ~ φ12 |
|    | 2-Flute L/D=3 End Mill for Aluminium                   | AL3D-2                                                          | φ1 ~ φ12   |
|    | DLC COATING<br>2-Flute L/D=3 End Mill for Aluminium    | AL3D-2DLC                                                       | φ1 ~ φ12   |
|    | 2-Flute L/D=4 End Mill for Aluminium                   | AL4D-2                                                          | φ1 ~ φ12   |
|    | DLC COATING<br>2-Flute L/D=4 End Mill for Aluminium    | AL4D-2DLC                                                       | φ1 ~ φ12   |
|    | 2-Flute L/D=5 End Mill for Aluminium                   | AL5D-2                                                          | φ1 ~ φ12   |
|   | DLC COATING<br>2-Flute L/D=5 End Mill for Aluminium    | AL5D-2DLC                                                       | φ1 ~ φ12   |
|  | High efficient 3-Flute End Mill<br>for Aluminium L/D=3 | AL3D-345<br><small>* Listed at "High Efficient Milling"</small> | φ1 ~ φ12   |
|  | 3-Flute Long Shank End Mill for Aluminium              | AL-3LS                                                          | φ5 ~ φ12   |

|                                                                                     |                                                          |                                                               |          |
|-------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------|----------|
| Square / Long Neck Square                                                           |                                                          |                                                               |          |
|  | High efficient 3-Flute End Mill<br>for Aluminium L/D=1.5 | ALZ345<br><small>* Listed at "High Efficient Milling"</small> | φ1 ~ φ12 |

|                                                                                     |                                                                      |                                                                   |          |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------|----------|
| Long Neck Square                                                                    |                                                                      |                                                                   |          |
|  | DLC COATING high efficient 3-Flute End Mill<br>for Aluminium L/D=1.5 | ALZ345-DLC<br><small>* Listed at "High Efficient Milling"</small> | φ1 ~ φ12 |

|                                                                                     |                                         |            |           |
|-------------------------------------------------------------------------------------|-----------------------------------------|------------|-----------|
| Ball / Long Neck Ball                                                               |                                         |            |           |
|  | Ball End Mill for Aluminium             | ALB225     | R0.3 ~ R6 |
|  | DLC COATING Ball End Mill for Aluminium | ALB225-DLC | R0.3 ~ R6 |

Copper Electrode Milling

|                                                                                     |                                                |        |           |
|-------------------------------------------------------------------------------------|------------------------------------------------|--------|-----------|
| Long Neck Square                                                                    |                                                |        |           |
|  | Long Neck Square End Mill for Copper Electrode | DHR237 | φ0.1 ~ φ6 |

|                                                                                     |                                              |        |            |
|-------------------------------------------------------------------------------------|----------------------------------------------|--------|------------|
| Long Neck Ball                                                                      |                                              |        |            |
|  | Long Neck Ball End Mill for Copper Electrode | DRB230 | R0.05 ~ R3 |

| Page               | Work Material  |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
|--------------------|----------------|----------|----------|--------------------------|---|---|---|---|---|---|---|---|---|---|---|
|                    | H              |          |          | Heat Resistant Alloy etc | S | N | N | N | N | N | N | N | N | N | P |
|                    | Hardened Steel |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
|                    | ~ 55 HRC       | ~ 65 HRC | ~ 70 HRC |                          |   |   |   |   |   |   |   |   |   |   |   |
|                    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| C • R Chamfering   |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Thread Milling     |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Drilling           |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| 3D Milling         |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Plunging           |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Face Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Slot Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Side Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Helix Angle        |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Number of Flute    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Material • Coating |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Aluminium Milling  |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |

|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
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| Square                                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
|    |    |    |    |    |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-004 |
|    |    |    |    |    |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-006 |
|    |    |    |    |    |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-008 |
|    |    |    |    |    |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-010 |
|    |    |    |    | -                                                                                     |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-012 |
|    |    |    |    | -                                                                                     |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-014 |
|    |    |    |    | -                                                                                     |    | -                                                                                     | - | - | - | - | - | - | - | - |    |    | - |    | - | - | - | - | - | - | L-016 |
|   |   |   |   | -                                                                                     |   | -                                                                                     | - | - | - | - | - | - | - | - |   |   | - |   | - | - | - | - | - | - | L-018 |
|  |  |  |  |  |  |  | - | - | - | - | - | - | - | - |  |  | - |  | - | - | - | - | - | - | L-020 |
|  |  |  |  |  |  | -                                                                                     | - | - | - | - | - | - | - | - |  |  | - |  | - | - | - | - | - | - | L-022 |

|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|---|---|---|---|---|---|-------|
| Square / Long Neck Square                                                             |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
|  |  |  |  |  |  |  | - | - | - | - | - | - | - | - |  |  | - |  | - | - | - | - | - | - | L-024 |

|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
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| Long Neck Square                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
|  |  |  |  |  |  |  | - | - | - | - | - | - | - | - |  |  | - |  | - | - | - | - | - | - | L-028 |

|                                                                                       |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|---|---|---|---|---|---|-------|
| Ball / Long Neck Ball                                                                 |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |   |   |   |   |   |   |                                                                                       |                                                                                       |   |                                                                                       |   |   |   |   |   |   |       |
|  |  |  | - | - | - | - |  | - | - | - | - | - | - | - |  |  | - |  | - | - | - | - | - | - | L-030 |
|  |  |  | - | - | - | - |  | - | - | - | - | - | - | - |  |  | - |  | - | - | - | - | - | - | L-032 |

Copper Electrode Milling

|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---|---|-------|
| Long Neck Square                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |       |
|  |  |  |  |  |  | - | - | - | - | - | - | - | - | - |  |  |  |  | - | - | - | - | - | - | M-004 |

|                                                                                       |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |   |   |   |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---|---|-------|
| Long Neck Ball                                                                        |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |   |   |   |   |   |   |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |   |   |   |   |   |       |
|  |  |  | - | - | - | - |  | - | - | - | - | - | - | - |  |  |  |  | - | - | - | - | - | - | M-008 |

| Photo                                                                               | Product Name                                    | Model   | Size                                               |
|-------------------------------------------------------------------------------------|-------------------------------------------------|---------|----------------------------------------------------|
| Copper Electrode Milling                                                            |                                                 |         |                                                    |
| Long Neck Corner Radius                                                             |                                                 |         |                                                    |
|    | Long Neck Radius End Mill for Copper Electrode  | DHR237R | $\phi 0.2 \times R0.02$<br>$\sim \phi 6 \times R1$ |
| Resin Milling                                                                       |                                                 |         |                                                    |
| Square / Long Neck Square                                                           |                                                 |         |                                                    |
|    | Short Flute End Mill for Resin                  | RSES230 | $\phi 0.1 \sim \phi 6$                             |
|    | End Mill for Resin                              | RSE230  | $\phi 0.1 \sim \phi 6$                             |
| Ball / Long Neck Ball                                                               |                                                 |         |                                                    |
|    | Ball End Mill for Resin                         | RSB230  | R0.1 $\sim$ R3                                     |
| Hard Brittle Material Milling                                                       |                                                 |         |                                                    |
| Long Neck Square                                                                    |                                                 |         |                                                    |
|    | End Mill for Hard Brittle Materials             | DCMS    | $\phi 0.3 \sim \phi 2$                             |
| Ball / Long Neck Ball                                                               |                                                 |         |                                                    |
|  | Ball End Mill for Hard Brittle Materials        | DCMB    | R0.1 $\sim$ R1                                     |
| Graphite Milling                                                                    |                                                 |         |                                                    |
| Square                                                                              |                                                 |         |                                                    |
|  | DIAMOND COATING 2-Flute End Mill                | DCSE235 | $\phi 0.5 \sim \phi 6$                             |
| Long Neck Square                                                                    |                                                 |         |                                                    |
|  | DIAMOND COATING 2-Flute Long Neck End Mill      | DCHR230 | $\phi 0.5 \sim \phi 6$                             |
| Long Neck Ball                                                                      |                                                 |         |                                                    |
|  | DIAMOND COATING 2-Flute Long Neck Ball End Mill | DCRB230 | R0.2 $\sim$ R3                                     |
| Drill                                                                               |                                                 |         |                                                    |
| Flat Drill                                                                          |                                                 |         |                                                    |
|  | MUGEN COATING Flat Drill                        | MFD     | $\phi 0.1 \sim \phi 6$                             |
| Micro Drill                                                                         |                                                 |         |                                                    |
|  | MUGEN MICRO COATING Micro Drill Short           | NSMD-MS | $\phi 0.01 \sim \phi 0.05$                         |
|  | MUGEN MICRO COATING Micro Drill                 | NSMD-M  | $\phi 0.01 \sim \phi 0.1$                          |
|  | Micro Drill Short                               | NSMD-S  | $\phi 0.01 \sim \phi 0.05$                         |

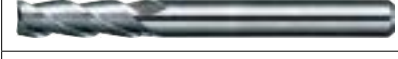
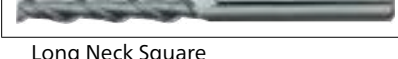
| Material • Coating            | Number of Flute | Helix Angle            | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling   | Thread Milling | C • R Chamfering | Work Material     |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        | Page  |        |
|-------------------------------|-----------------|------------------------|--------------|--------------|--------------|----------|------------|------------|----------------|------------------|-------------------|------------------|------------------------|----------------------|----------------------|-------------|----------------------|------------|---------------|----------------------------|-------------------------------|----------------|--------|-------|--------|
|                               |                 |                        |              |              |              |          |            |            |                |                  | P<br>Carbon Steel | A<br>Alloy Steel | A<br>Prehardened Steel | M<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Copper Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H              |        |       |        |
|                               |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               | Hardened Steel |        |       |        |
|                               |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               | 55 HRC         | 65 HRC |       | 70 HRC |
| Copper Electrode Milling      |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| Long Neck Corner Radius       |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| DLC                           | 2               | 37.5°                  | Side         | Slot         | Face         | -        | -          | -          | -              | -                | -                 | -                | -                      | -                    | ○                    | ○           | ○                    | -          | -             | -                          | -                             | -              | -      | -     | M-014  |
| Resin Milling                 |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| Square / Long Neck Square     |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| MG                            | 2               | 30°                    | Side         | Slot         | Face         | -        | -          | -          | -              | -                | -                 | -                | -                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | -                             | -              | -      | -     | N-004  |
| MG                            | 2               | 30°                    | Side         | Slot         | Face         | -        | -          | -          | -              | -                | -                 | -                | -                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | -                             | -              | -      | -     | N-012  |
| Ball / Long Neck Ball         |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| MG                            | 2               | 30°                    | -            | -            | -            | -        | 3D         | -          | -              | -                | -                 | -                | -                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | -                             | -              | -      | -     | N-020  |
| Hard Brittle Material Milling |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| Long Neck Square              |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| DIA                           | 6               | 8                      | 10           | 30°          | -            | -        | Face       | -          | -              | -                | -                 | -                | -                      | -                    | -                    | -           | -                    | ○          | -             | -                          | -                             | -              | -      | -     | O-004  |
| Ball / Long Neck Ball         |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| DIA                           | 2               | 20°                    | -            | -            | -            | -        | 3D         | -          | -              | -                | -                 | -                | -                      | -                    | -                    | -           | -                    | ○          | -             | -                          | -                             | -              | -      | -     | O-006  |
| Graphite Milling              |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| Square                        |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| DIA                           | 2               | 35°                    | Side         | Slot         | Face         | -        | -          | -          | -              | -                | -                 | -                | -                      | -                    | -                    | -           | ○                    | -          | -             | -                          | -                             | -              | -      | P-004 |        |
| Long Neck Square              |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| DIA                           | 2               | 30°                    | Side         | Slot         | Face         | -        | -          | -          | -              | -                | -                 | -                | -                      | -                    | -                    | -           | ○                    | -          | -             | -                          | -                             | -              | -      | P-006 |        |
| Long Neck Ball                |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| DIA                           | 2               | 30°                    | -            | -            | -            | -        | 3D         | -          | -              | -                | -                 | -                | -                      | -                    | -                    | -           | ○                    | -          | -             | -                          | -                             | -              | -      | P-008 |        |
| Drill                         |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| Flat Drill                    |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| ∞                             | 2               | 20°/30°<br>(P0.5/D0.5) | -            | -            | -            | -        | -          | Flat Drill | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | -                    | -          | -             | -                          | -                             | -              | -      | -     | Q-004  |
| Micro Drill                   |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                |        |       |        |
| ∞<br>Micro                    | 2               | 30°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | -                    | -          | -             | -                          | ○                             | -              | -      | -     | Q-008  |
| ∞<br>Micro                    | 2               | 30°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | -                    | -          | -             | -                          | ○                             | -              | -      | -     | Q-012  |
| SMG                           | 2               | 30°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | -                 | -                | -                      | ○                    | ○                    | ○           | -                    | ○          | -             | -                          | -                             | -              | -      | -     | Q-010  |

| Photo                                                                               | Product Name                                                               | Model  | Size                      |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------|---------------------------|
| Drill                                                                               |                                                                            |        |                           |
| Micro Drill                                                                         |                                                                            |        |                           |
|    | Micro Drill                                                                | NSMD   | φ0.01 ~ φ0.1              |
|    | MUGEN MICRO COATING<br>Micro Point Drill (Drill for Guide Hole)            | NSPD-M | φ0.01 ~ φ0.1              |
|    | Micro Point Drill (Drill for Guide Hole)                                   | NSPD   | φ0.01 ~ φ0.1              |
| Drill                                                                               |                                                                            |        |                           |
|    | MUGEN COATING Miniature Drill                                              | MDR-R  | φ0.1 ~ φ1                 |
|    | MUGEN COATING Point Drill (Drill for Guide Hole)                           | MDR-PD | φ0.1 ~ φ1                 |
|    | MUGEN COATING PREMIUM<br>Precision Drill for Hardened Steel                | MSDH   | φ0.1 ~ φ1                 |
| Thread Mill                                                                         |                                                                            |        |                           |
| Thread mill                                                                         |                                                                            |        |                           |
|  | MUGEN COATING<br>M-Thread Mill (for Internal Thread)                       | MMTM   | M1 ~ M6                   |
|  | MUGEN COATING PREMIUM<br>Thread Cutting Tool (Unify : for Internal Thread) | MMTU   | No.0-80UNF<br>~ 1/4-28UNF |
|  | MUGEN COATING<br>Micro Thread Cutting Tool (for Internal Thread)           | MMTS   | S0.1 ~ S1.4               |
| Chamfering                                                                          |                                                                            |        |                           |
| Chamfering                                                                          |                                                                            |        |                           |
|  | MUGEN COATING 2-Flute Inner Radius Cutter                                  | MIR200 | R0.1 ~ R5                 |
|  | Chamfer Cutter                                                             | NSCV   | φ4<br>φ6                  |
|  | MUGEN COATING Chamfer Cutter                                               | NSCV-M | φ4<br>φ6                  |
| Semi-Standard Products                                                              |                                                                            |        |                           |
| Square                                                                              |                                                                            |        |                           |
|  | LEAD 25 End Mill                                                           | NX-25  | φ0.5 ~ φ12                |
|  | LEAD 30 End Mill                                                           | NX-30  | φ0.5 ~ φ12                |
|  | LEAD 35 End Mill                                                           | NX-35  | φ0.5 ~ φ12                |
|  | LEAD 40 End Mill                                                           | NX-40  | φ0.5 ~ φ12                |

| Material • Coating                                                                    | Number of Flute | Helix Angle | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling | Drilling | Thread Milling                                                                        | C • R Chamfering | Work Material |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   | Page |       |
|---------------------------------------------------------------------------------------|-----------------|-------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|------------|----------|---------------------------------------------------------------------------------------|------------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-----------------|-------|----------|-----------------------|--------------------------|--------|--------|--------|---|------|-------|
|                                                                                       |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  | P             | P           | P                 | M               | N               | N      | N               | N     | N        | S                     | H                        |        |        |        |   |      |       |
|                                                                                       |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       | Hardened Steel           |        |        |        |   |      |       |
|                                                                                       |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Copper Tungsten | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC | 65 HRC | 70 HRC |   |      |       |
| Drill                                                                                 |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
| Micro Drill                                                                           |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
|    | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Drill    | -                                                                                     | -                | -             | -           | -                 | ○               | ○               | ○      | -               | ○     | -        | -                     | -                        | -      | -      | -      | - | -    | Q-014 |
|    | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Drill    | -                                                                                     | -                | ○             | ○           | ○                 | ○               | ○               | -      | -               | -     | -        | -                     | ○                        | -      | -      | -      | - | -    | Q-016 |
|    | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Drill    | -                                                                                     | -                | -             | -           | -                 | ○               | ○               | ○      | -               | ○     | -        | -                     | -                        | -      | -      | -      | - | -    | Q-018 |
| Drill                                                                                 |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
|    | 2               | 30°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Drill    | -                                                                                     | -                | ○             | ○           | ○                 | ○               | ○               | ○      | -               | -     | -        | -                     | -                        | -      | -      | -      | - | -    | Q-020 |
|    | 2               | 25°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Drill    | -                                                                                     | -                | ○             | ○           | ○                 | ○               | ○               | ○      | -               | -     | -        | -                     | -                        | -      | -      | -      | - | -    | Q-024 |
|    | 2               | 20°         | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Drill    | -                                                                                     | -                | -             | -           | ○                 | -               | -               | -      | -               | -     | -        | -                     | -                        | ○      | ○      | -      | - | -    | Q-026 |
| Thread Mill                                                                           |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
| Thread mill                                                                           |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
|  | 4               | 6           | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Thread   | -                                                                                     | -                | ○             | ○           | ○                 | ○               | ○               | ○      | -               | ○     | -        | -                     | -                        | -      | -      | -      | - | -    | R-004 |
|  | 4               | 6           | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Thread   | -                                                                                     | -                | ○             | ○           | ○                 | ○               | ○               | ○      | -               | ○     | -        | -                     | ○                        | -      | -      | -      | - | -    | R-006 |
|  | 2               |             | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | Thread   | -                                                                                     | -                | ○             | ○           | ○                 | ○               | ○               | ○      | -               | ○     | -        | -                     | -                        | -      | -      | -      | - | -    | R-008 |
| Chamfering                                                                            |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
| Chamfering                                                                            |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
|  | 2               |             | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | -        |  | ○                | ○             | ○           | ○                 | ○               | ○               | -      | ○               | -     | -        | -                     | -                        | ○      | -      | -      | - | -    | S-004 |
|  | 3               |             | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | -        |  | -                | -             | -           | -                 | ○               | ○               | -      | ○               | -     | -        | -                     | -                        | -      | -      | -      | - | -    | S-006 |
|  | 3               |             | -                                                                                     | -                                                                                     | -                                                                                     | -        | -          | -        |  | ○                | ○             | ○           | ○                 | -               | -               | -      | -               | -     | -        | -                     | -                        | -      | -      | -      | - | -    | S-008 |
| Semi-Standard Products                                                                |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
| Square                                                                                |                 |             |                                                                                       |                                                                                       |                                                                                       |          |            |          |                                                                                       |                  |               |             |                   |                 |                 |        |                 |       |          |                       |                          |        |        |        |   |      |       |
|  | 2               | 25°         |  |  |  | -        | -          | -        | -                                                                                     | -                | ※1            | ※1          | ※1                | ※1              | ※1              | ※1     | -               | ※1    | -        | -                     | -                        | -      | -      | -      | - | -    | T-006 |
|  | 2               | 30°         |  |  |  | -        | -          | -        | -                                                                                     | -                | ※1            | ※1          | ※1                | ※1              | ※1              | ※1     | -               | ※1    | -        | -                     | -                        | -      | -      | -      | - | -    | T-010 |
|  | 2               | 35°         |  |  |  | -        | -          | -        | -                                                                                     | -                | ※1            | ※1          | ※1                | ※1              | ※1              | ※1     | -               | ※1    | -        | -                     | -                        | -      | -      | -      | - | -    | T-014 |
|  | 2               | 40°         |  | -                                                                                     |  | -        | -          | -        | -                                                                                     | -                | ※1            | ※1          | ※1                | ※1              | ※1              | ※1     | -               | ※1    | -        | -                     | -                        | -      | -      | -      | - | -    | T-018 |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                  | Product Name | Model | Size |
|------------------------|--------------|-------|------|
| Semi-Standard Products |              |       |      |

|                                                                                    |                                            |         |            |
|------------------------------------------------------------------------------------|--------------------------------------------|---------|------------|
| Square                                                                             |                                            |         |            |
|    | LEAD 45 End Mill                           | NX-45   | φ0.5 ~ φ12 |
|    | CHAMPION SOLID 2-Flute End Mill            | NC-2    | φ0.5 ~ φ20 |
|    | CHAMPION SOLID 2-Flute Medium End Mill     | NCM-2   | φ0.5 ~ φ20 |
|    | CHAMPION SOLID 2-Flute Long End Mill       | NCL-2   | φ1 ~ φ12   |
|    | CHAMPION SOLID 2-Flute Long Shank End Mill | NC-LS-2 | φ1 ~ φ12   |
|    | CHAMPION SOLID 4-Flute End Mill            | NC-4    | φ1 ~ φ20   |
|    | CHAMPION SOLID 4-Flute Medium End Mill     | NCM-4   | φ1 ~ φ20   |
|   | CHAMPION SOLID 4-Flute Long End Mill       | NCL-4   | φ2 ~ φ12   |
|  | POWER SOLID 2-Flute End Mill               | NE-2    | φ1 ~ φ20   |
|  | POWER SOLID 3-Flute End Mill               | NE-3    | φ3 ~ φ20   |
|  | POWER SOLID 3-Flute Long End Mill          | NEL-3   | φ6 ~ φ20   |
|  | POWER SOLID 4-Flute End Mill               | NE-4    | φ3 ~ φ20   |
|  | Straight End Mill for Reforming            | NSL-2   | φ1 ~ φ12   |
|  | 2-Flute End Mill for Nonferrous            | DX      | φ0.5 ~ φ20 |
|  | 2-Flute Medium End Mill for Nonferrous     | DXM     | φ3 ~ φ20   |
|  | 2-Flute Long End Mill for Nonferrous       | DXL     | φ3 ~ φ20   |
|  | 2-Flute End Mill for Aluminium             | NEA-2   | φ3 ~ φ25   |

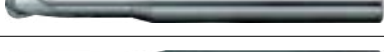
|                                                                                    |                                 |       |           |
|------------------------------------------------------------------------------------|---------------------------------|-------|-----------|
| Long Neck Square                                                                   |                                 |       |           |
|  | Surface End Mill for Nonferrous | DSF   | φ1 ~ φ20  |
|  | 2-Flute Long Neck End Mill      | NHR-2 | φ0.5 ~ φ5 |

| Page                   | Work Material |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
|------------------------|---------------|--------|--------|--------------------------|-----------------------|----------|-------|-----------------|--------|-----------------|-----------------|-------------------|-------------|--------------|--|
|                        | H             |        |        | Heat Resistant Alloy etc | Hard Brittle Material | Graphite | Resin | Copper Tungsten | Copper | Aluminium Alloy | Stainless Steel | Prehardened Steel | Alloy Steel | Carbon Steel |  |
|                        | 55 HRC        | 65 HRC | 70 HRC |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
|                        |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
|                        |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| C • R Chamferin        |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Thread Milling         |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Drilling               |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| 3D Milling             |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Plunging               |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Face Milling           |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Slot Milling           |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Side Milling           |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Helix Angle            |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Number of Flute        |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Material • Coating     |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |
| Semi-Standard Products |               |        |        |                          |                       |          |       |                 |        |                 |                 |                   |             |              |  |

|                                                                                       |   |     |      |      |      |   |   |   |   |   |    |    |    |    |    |    |   |    |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---|-----|------|------|------|---|---|---|---|---|----|----|----|----|----|----|---|----|---|---|---|---|---|-------|
| Square                                                                                |   |     |      |      |      |   |   |   |   |   |    |    |    |    |    |    |   |    |   |   |   |   |   |       |
|    | 2 | 45° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-022 |
|    | 2 | 30° | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-026 |
|    | 2 | 30° | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-028 |
|    | 2 | 30° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-030 |
|    | 2 | 30° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-032 |
|    | 4 | 30° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-034 |
|    | 4 | 30° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-038 |
|   | 4 | 30° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-040 |
|  | 2 | 45° | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-042 |
|  | 3 | 45° | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-044 |
|  | 3 | 45° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-046 |
|  | 4 | 45° | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-048 |
|  | 2 | 0°  | -    | -    | -    | - | - | - | - | - | ※1 | ※1 | ※1 | -  | -  | -  | - | -  | - | - | - | - | - | T-050 |
|  | 2 | 25° | Side | Slot | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-052 |
|  | 2 | 25° | Side | -    | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-054 |
|  | 2 | 25° | Side | -    | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-056 |
|  | 2 | 45° | Side | Slot | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-058 |

|                                                                                       |   |                           |      |      |      |   |   |   |   |   |    |    |    |    |    |    |   |    |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---|---------------------------|------|------|------|---|---|---|---|---|----|----|----|----|----|----|---|----|---|---|---|---|---|-------|
| Long Neck Square                                                                      |   |                           |      |      |      |   |   |   |   |   |    |    |    |    |    |    |   |    |   |   |   |   |   |       |
|  | 1 | 12°                       | -    | -    | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-060 |
|  | 2 | 30°/45°<br>(R=0.5)(P=1.5) | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | T-062 |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                                                                               | Product Name                                   | Model  | Size                                                                                            |
|-------------------------------------------------------------------------------------|------------------------------------------------|--------|-------------------------------------------------------------------------------------------------|
| Semi-Standard Products                                                              |                                                |        |                                                                                                 |
| Tapered Square                                                                      |                                                |        |                                                                                                 |
|    | 2-Flute Taper End Mill                         | NTE-2  | $\phi 0.5 \times \text{taper angle} 30^\circ$<br>~ $\phi 10 \times \text{taper angle} 10^\circ$ |
|    | 2-Flute Medium Taper End Mill                  | NTEM-2 | $\phi 1 \times \text{taper angle} 4^\circ$<br>~ $\phi 4 \times \text{taper angle} 20^\circ$     |
|    | 2-Flute Long Taper End Mill                    | NTEL-2 | $\phi 1 \times \text{taper angle} 30^\circ$<br>~ $\phi 3 \times \text{taper angle} 20^\circ$    |
|    | 4-Flute Taper End Mill                         | NTE-4  | $\phi 3 \times \text{taper angle} 30^\circ$<br>~ $\phi 16 \times \text{taper angle} 10^\circ$   |
|    | 4-Flute Long Taper End Mill                    | NTEL-4 | $\phi 3 \times \text{taper angle} 30^\circ$<br>~ $\phi 6 \times \text{taper angle} 5^\circ$     |
|    | 2-Flute Taper End Mill for Nonferrous          | DTE    | $\phi 1 \times \text{taper angle} 30^\circ$<br>~ $\phi 10 \times \text{taper angle} 5^\circ$    |
|    | 2-Flute Long Taper End Mill for Nonferrous     | DTEL   | $\phi 1 \times \text{taper angle} 30^\circ$<br>~ $\phi 8 \times \text{taper angle} 5^\circ$     |
|   | 2-Flute Taper End Mill for Runner              | NER-2  | $\phi 2 \times \text{taper angle} 7^\circ$<br>~ $\phi 6 \times \text{taper angle} 15^\circ$     |
| Ball                                                                                |                                                |        |                                                                                                 |
|  | 2-Flute Miniature Ball End Mill                | NCB-2  | R0.2 ~ R0.9                                                                                     |
|  | 2-Flute Ball End Mill                          | NSB-2  | R1 ~ R10                                                                                        |
|  | 2-Flute Long Ball End Mill                     | NSBL-2 | R3 ~ R10                                                                                        |
|  | 2-Flute Extra Long Ball End Mill               | NLBL-2 | R0.5 ~ R10                                                                                      |
|  | 2-Flute Ball End Mill for Nonferrous           | DB     | R0.5 ~ R10                                                                                      |
| Long Neck Ball                                                                      |                                                |        |                                                                                                 |
|  | 2-Flute Long Neck Ball End Mill for Nonferrous | DHB    | R0.5 ~ R6                                                                                       |
|  | 2-Flute Long Neck Ball End Mill                | NHB-2  | R0.4 ~ R5                                                                                       |
| Tapered Ball                                                                        |                                                |        |                                                                                                 |
|  | 2-Flute Taper Ball End Mill                    | NTB-2  | $R0.5 \times \text{taper angle} 30^\circ$<br>~ $R5 \times \text{taper angle} 10^\circ$          |
|  | 2-Flute Taper Ball End Mill for Runner         | NERB-2 | $R1 \times \text{taper angle} 10^\circ$<br>~ $R3 \times \text{taper angle} 20^\circ$            |
| Corner Radius                                                                       |                                                |        |                                                                                                 |
|  | 2-Flute Radius End Mill                        | NSR-2  | $\phi 1 \times R0.2$<br>~ $\phi 20 \times R5$                                                   |

| Material • Coating     | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamferin | Work Material     |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           | Page |       |
|------------------------|-----------------|-------------|--------------|--------------|--------------|----------|------------|----------|----------------|-----------------|-------------------|------------------|------------------------|----------------------|----------------------|-------------|----------------------|------------|---------------|----------------------------|-------------------------------|---------------------|-----------|-----------|------|-------|
|                        |                 |             |              |              |              |          |            |          |                |                 | P<br>Carbon Steel | P<br>Alloy Steel | P<br>Prehardened Steel | M<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Copper Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H<br>Hardened Steel |           |           |      |       |
|                        |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               | 55<br>HRC           | 65<br>HRC | 70<br>HRC |      |       |
|                        |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| Semi-Standard Products |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| Tapered Square         |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| MG                     | 2               | 30°         |              |              | -            | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-066 |
| MG                     | 2               | 30°         |              |              | -            | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-070 |
| MG                     | 2               | 40°         |              |              | -            | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-072 |
| MG                     | 4               | 30°         |              |              | -            | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-074 |
| MG                     | 4               | 40°         |              |              | -            | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-078 |
| SMG                    | 2               | 25°         |              |              | -            | -        | -          | -        | -              | -               | -                 | -                | -                      | -                    |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-080 |
| SMG                    | 2               | 25°         |              |              | -            | -        | -          | -        | -              | -               | -                 | -                | -                      | -                    |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-082 |
| MG                     | 2               | 30°         |              |              | -            | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-084 |
| Ball                   |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| MG                     | 2               | 30°         | -            | -            | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-086 |
| MG                     | 2               | 30°         | -            | -            | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-088 |
| MG                     | 2               | 30°         | -            | -            | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-090 |
| MG                     | 2               | 30°         | -            | -            | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-092 |
| SMG                    | 2               | 25°         | -            | -            | -            | -        |            | -        | -              | -               | -                 | -                | -                      | -                    |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-094 |
| Long Neck Ball         |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| SMG                    | 2               | 25°         | -            | -            | -            | -        |            | -        | -              | -               | -                 | -                | -                      | -                    |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-096 |
| MG                     | 2               | 30°         | -            | -            | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-098 |
| Tapered Ball           |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| MG                     | 2               | 35°         |              |              | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-102 |
| MG                     | 2               | 30°         |              |              | -            | -        |            | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-104 |
| Corner Radius          |                 |             |              |              |              |          |            |          |                |                 |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |           |           |      |       |
| MG                     | 2               | 30°         |              |              |              | -        | -          | -        | -              | -               |                   |                  |                        |                      |                      |             | -                    |            | -             | -                          | -                             | -                   | -         | -         | -    | T-106 |

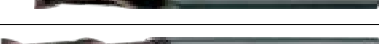


| Photo                                                                               | Product Name                                       | Model   | Size                                               |
|-------------------------------------------------------------------------------------|----------------------------------------------------|---------|----------------------------------------------------|
| Semi-Standard Products                                                              |                                                    |         |                                                    |
| Chamfering                                                                          |                                                    |         |                                                    |
|    | 2-Flute Inner Radius Cutter                        | NCR-2   | R0.5 ~ R5                                          |
|    | 2-Flute Inner Radius Cutter for Nonferrous         | DIR     | R0.1 ~ R5                                          |
| Original Products Specified distributor inventory                                   |                                                    |         |                                                    |
| Square                                                                              |                                                    |         |                                                    |
|    | X COATING 2-Flute End Mill                         | NX-30X  | φ 1 ~ φ 12                                         |
|    | 3-Flute Semi-finishing End Mill for Nonferrous     | DHS     | φ 6 ~ φ 20                                         |
| Long Neck Square                                                                    |                                                    |         |                                                    |
|    | Monocrystalline Diamond End Mill "CLEAR EDGE"      | CED100  | φ 0.1 ~ φ 2                                        |
|   | X COATING 2-Flute Long Neck End Mill               | NHR-2X  | φ 0.5 ~ φ 5                                        |
| Tapered Square                                                                      |                                                    |         |                                                    |
|  | X COATING 2-Flute Taper End Mill                   | NTE-2X  | φ 0.5×taper angle30°<br>~ φ 2.5×taper angle5°      |
|  | X COATING 4-Flute Taper End Mill                   | NTE-4X  | φ 3×taper angle30°<br>~ φ 10×taper angle5°         |
|  | X COATING 2-Flute Medium Taper End Mill            | NTEM-2X | φ 0.5×taper angle30°<br>~ φ 6×taper angle15°       |
|  | 4-Flute Taper End Mill for Deep Rib                | NRF-4   | φ 0.5×taper angle30°<br>~ φ 2×taper angle3°        |
| Ball                                                                                |                                                    |         |                                                    |
|  | X COATING 2-Flute Miniature Ball End Mill          | NCB-2X  | R0.2 ~ R0.9                                        |
|  | X COATING 2-Flute Ball End Mill                    | NSB-2X  | R1 ~ R10                                           |
| Tapered Corner Radius                                                               |                                                    |         |                                                    |
|  | X COATING 2-Flute Taper Radius End Mill            | NTER-2X | φ 1×taper angle30°×R0.2<br>~ φ 6×taper angle10°×R2 |
|  | X COATING 2-Flute Taper Radius End Mill for Runner | NERR-2X | φ 2×taper angle7°×R0.3<br>~ φ 6×taper angle15°×R2  |
| Chamfering                                                                          |                                                    |         |                                                    |
|  | X COATING 2-Flute Inner Radius Cutter              | NCR-2X  | R0.5 ~ R3                                          |

| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                            | Drilling | Thread Milling | C • R Chamferin                                                                       | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        | Page  |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|----------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------|--------------------------|----------------|--------|-------|-------|
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       | P                                                                                     | P                                                                                     | P                                                                                     | M                                                                                     | N                                                                                     | N                                                                                     | N               | N                                                                                     | N                                                                                   | N                     | S                        | H              |        |       |       |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       | Carbon Steel                                                                          | Alloy Steel                                                                           | Prehardened Steel                                                                     | Stainless Steel                                                                       | Aluminium Alloy                                                                       | Copper                                                                                | Copper Tungsten | Resin                                                                                 | Graphite                                                                            | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |        |       |       |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       | 55 HRC                   | 65 HRC         | 70 HRC |       |       |
| Semi-Standard Products                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
| Chamfering                                                                            |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     | -        | -              |    |    |    |    |    |    |    | -               |    | -                                                                                   | -                     | -                        | -              | -      | -     | T-108 |
|    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     | -        | -              |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |    |    | -               |    | -                                                                                   | -                     | -                        | -              | -      | -     | T-110 |
| Original Products Specified distributor inventory                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
| Square                                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|    |    |    |    |    |    | -        | -                                                                                     | -        | -              | -                                                                                     |    |    |    |    |    |    | -               |    | -                                                                                   | -                     | -                        | -              | -      | U-004 |       |
|    |    |    |    |    |    | -        | -                                                                                     | -        | -              | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |    |    | -               |    | -                                                                                   | -                     | -                        | -              | -      | U-006 |       |
| Long Neck Square                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|    |    |    | -                                                                                     | -                                                                                     |    | -        | -                                                                                     | -        | -              | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |    |    | -               | -                                                                                     |  | -                     | -                        | -              | -      | U-008 |       |
|   |   |   |   |   |   | -        | -                                                                                     | -        | -              | -                                                                                     |   |   |   |   |   |   | -               |   | -                                                                                   | -                     | -                        | -              | -      | U-010 |       |
| Tapered Square                                                                        |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|  |  |  |  |  | -                                                                                     | -        | -                                                                                     | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-014 |       |
|  |  |  |  |  | -                                                                                     | -        | -                                                                                     | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-016 |       |
|  |  |  |  |  | -                                                                                     | -        | -                                                                                     | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-018 |       |
|  |  |  | -                                                                                     |  | -                                                                                     | -        | -                                                                                     | -        | -              | -                                                                                     |  |  |  |  | -                                                                                     | -                                                                                     | -               | -                                                                                     | -                                                                                   | -                     | -                        | -              | -      | U-020 |       |
| Ball                                                                                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -        |  | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-024 |       |
|  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -        |  | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-026 |       |
| Tapered Corner Radius                                                                 |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|  |  |  |  |  |  | -        | -                                                                                     | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-030 |       |
|  |  |  |  |  |  | -        | -                                                                                     | -        | -              | -                                                                                     |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-034 |       |
| Chamfering                                                                            |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |          |                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |                                                                                     |                       |                          |                |        |       |       |
|  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     | -        | -              |  |  |  |  |  |  |  | -               |  | -                                                                                   | -                     | -                        | -              | -      | U-036 |       |

| Photo                                                                               | Product Name                               | Model   | Size         |
|-------------------------------------------------------------------------------------|--------------------------------------------|---------|--------------|
| Square End Mill                                                                     |                                            |         |              |
| CBN Square End Mill                                                                 |                                            |         |              |
|    | CBN "MICRO EDGE Z"                         | SMEZ120 | φ0.03 ~ φ0.1 |
|    | CBN Square End Mill                        | SSE400  | φ0.1         |
|    | CBN Square End Mill                        | SSE600  | φ0.2 ~ φ1    |
| PCD Square End Mill                                                                 |                                            |         |              |
|    | PCD Square End Mill                        | PCDSE   | φ0.1 ~ φ1    |
| DIAMOND COATING                                                                     |                                            |         |              |
|    | End Mill for Hard Brittle Materials        | DCMS    | φ0.3 ~ φ2    |
|    | DIAMOND COATING 2-Flute Long Neck End Mill | DCHR230 | φ0.5 ~ φ6    |
|  | DIAMOND COATING 2-Flute End Mill           | DCSE235 | φ0.5 ~ φ6    |
| MUGEN COATING PREMIUM                                                               |                                            |         |              |
|  | 2-Flute LEAD25 End Mill                    | MXH225  | φ0.1 ~ φ6    |
|  | 2-Flute LEAD30 End Mill                    | MXH230  | φ0.1 ~ φ6    |
|  | 2-Flute LEAD35 End Mill                    | MXH235  | φ0.1 ~ φ6    |
|  | 2-Flute LEAD40 End Mill                    | MXH240  | φ0.3 ~ φ6    |
|  | 2-Flute LEAD45 End Mill                    | MXH245  | φ0.3 ~ φ6    |
|  | 2-Flute Sharp Edge LEAD25 End Mill         | MXH225P | φ0.1 ~ φ6    |
|  | 2-Flute Sharp Edge LEAD30 End Mill         | MXH230P | φ0.1 ~ φ6    |
|  | 2-Flute Sharp Edge LEAD35 End Mill         | MXH235P | φ0.1 ~ φ6    |
|  | 4-Flute Square End Mill for Hardened Steel | MHDH445 | φ1 ~ φ4      |
|  | 6-Flute Square End Mill for Hardened Steel | MHDH645 | φ5 ~ φ12     |

| Material • Coating                                                                    | Number of Flute                                                                                                                                                                                                                                             | Helix Angle                                                                           | Side Milling                                                                                                                                                                | Slot Milling                                                                                                                                                            | Face Milling                                                                        | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                 |        | Page            |       |          |                       |                          |        |        |        |  |  |  |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|------------|----------|----------------|------------------|---------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---|---|---|---------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|--------|-----------------|-------|----------|-----------------------|--------------------------|--------|--------|--------|--|--|--|
|                                                                                       |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  | P             | A                                                                                     | A                                                                                     | M | N | N | N | N                                                                                     | N | S                                                                                     | H                                                                                     |                                                                                       |                                                                                     |                                                                                     |                 |        |                 |       |          |                       |                          |        |        |        |  |  |  |
|                                                                                       |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  |               |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       | Carbon Steel                                                                          | Alloy Steel                                                                           | Prehardened Steel                                                                   | Stainless Steel                                                                     | Aluminium Alloy | Copper | Copper Tungsten | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC | 65 HRC | 70 HRC |  |  |  |
| Square End Mill                                                                       |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  |               |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                 |        |                 |       |          |                       |                          |        |        |        |  |  |  |
| CBN Square End Mill                                                                   |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  |               |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                 |        |                 |       |          |                       |                          |        |        |        |  |  |  |
|    |                                                                                                                                                                          |    | -                                                                                                                                                                           |                                                                                      | -                                                                                   | -        | -          | -        | -              | -                | -             | -                                                                                     |    | - | - | - | - | -                                                                                     | - | -                                                                                     | -                                                                                     |    |  |  | -               | -      | B-004<br>D-004  |       |          |                       |                          |        |        |        |  |  |  |
|    |                                                                                                                                                                          |    | -                                                                                                                                                                           |   | -                                                                                   | -        | -          | -        | -              | -                | -             | -                                                                                     |    | - | - | - | - | -                                                                                     | - | -                                                                                     | -                                                                                     |    |  |  | -               | -      | B-006           |       |          |                       |                          |        |        |        |  |  |  |
|    |                                                                                                                                                                          |    | -                                                                                                                                                                           |   | -                                                                                   | -        | -          | -        | -              | -                | -             | -                                                                                     |    | - | - | - | - | -                                                                                     | - | -                                                                                     | -                                                                                     |    |  |  | -               | -      | B-008           |       |          |                       |                          |        |        |        |  |  |  |
| PCD Square End Mill                                                                   |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  |               |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                 |        |                 |       |          |                       |                          |        |        |        |  |  |  |
|    |                                                                                       |    | -                                                                                                                                                                           | -                                                                                                                                                                       |  | -        | -          | -        | -              | -                | -             | -                                                                                     | -                                                                                     | - | - | - | - | -                                                                                     | - |    | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   | -               | -      | C-004           |       |          |                       |                          |        |        |        |  |  |  |
| DIAMOND COATING                                                                       |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  |               |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                 |        |                 |       |          |                       |                          |        |        |        |  |  |  |
|    |    |    | -                                                                                                                                                                           | -                                                                                                                                                                       |  | -        | -          | -        | -              | -                | -             | -                                                                                     | -                                                                                     | - | - | - | - | -                                                                                     | - |    | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   | -               | -      | O-004           |       |          |                       |                          |        |        |        |  |  |  |
|    |                                                                                                                                                                          |    |       |                                                                                      | -                                                                                   | -        | -          | -        | -              | -                | -             | -                                                                                     | -                                                                                     | - | - | - | - |    | - | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   | -               | P-006  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |   |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             | -                                                                                     | -                                                                                     | - | - | - | - |  | - | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   | -               | P-004  |                 |       |          |                       |                          |        |        |        |  |  |  |
| MUGEN COATING PREMIUM                                                                 |                                                                                                                                                                                                                                                             |                                                                                       |                                                                                                                                                                             |                                                                                                                                                                         |                                                                                     |          |            |          |                |                  |               |                                                                                       |                                                                                       |   |   |   |   |                                                                                       |   |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                 |        |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |   |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-004  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |   |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-006  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |   |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-008  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |                                                                                        |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-010  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |                                                                                        |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-012  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |                                                                                        |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-014  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |                                                                                        |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-016  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |                                                                                        |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  |  | - | - | - | - | -                                                                                     | - |  |  | -                                                                                     | -                                                                                   | -                                                                                   | -               | F-018  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |   |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  | -                                                                                     | - | - | - | - | -                                                                                     | - | -                                                                                     |  |  | -                                                                                   | -                                                                                   | -               | F-020  |                 |       |          |                       |                          |        |        |        |  |  |  |
|  |                                                                                                                                                                        |  |   |                                                                                    | -                                                                                   | -        | -          | -        | -              | -                | -             |  | -                                                                                     | - | - | - | - | -                                                                                     | - | -                                                                                     |  |  | -                                                                                   | -                                                                                   | -               | F-022  |                 |       |          |                       |                          |        |        |        |  |  |  |

| Photo                                                                               | Product Name                                                       | Model       | Size                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------|---------------------------------------|
| Square End Mill                                                                     |                                                                    |             |                                       |
| MUGEN COATING PREMIUM                                                               |                                                                    |             |                                       |
|    | 2-Flute Long Neck End Mill for Hardened Steel                      | MHRH230     | $\varnothing 0.1 \sim \varnothing 3$  |
|    | 4-Flute Long Neck End Mill for Hardened Steel                      | MHRH430     | $\varnothing 1 \sim \varnothing 6$    |
|    | 4-Flute High Efficient "Z" End Mill for Stainless Steels           | MSUSZ440    | $\varnothing 1 \sim \varnothing 6$    |
|    | 4-Flute Long Neck High Efficient "Z" End Mill for Stainless Steels | MSUSZ440-LN | $\varnothing 1 \sim \varnothing 6$    |
| MUGEN COATING                                                                       |                                                                    |             |                                       |
|    | 2-Flute LEAD25 End Mill                                            | MX225       | $\varnothing 0.3 \sim \varnothing 12$ |
|    | 2-Flute LEAD30 End Mill                                            | MX230       | $\varnothing 0.1 \sim \varnothing 12$ |
|   | 2-Flute LEAD35 End Mill                                            | MX235       | $\varnothing 0.1 \sim \varnothing 12$ |
|  | 2-Flute LEAD40 End Mill                                            | MX240       | $\varnothing 0.3 \sim \varnothing 12$ |
|  | 2-Flute LEAD45 End Mill                                            | MX245       | $\varnothing 0.3 \sim \varnothing 12$ |
|  | 4-Flute LEAD25 End Mill                                            | MX425       | $\varnothing 1 \sim \varnothing 12$   |
|  | 4-Flute LEAD30 End Mill                                            | MX430       | $\varnothing 1 \sim \varnothing 12$   |
|  | 4-Flute LEAD35 End Mill                                            | MX435       | $\varnothing 1 \sim \varnothing 12$   |
|  | 4-Flute LEAD40 End Mill                                            | MX440       | $\varnothing 1 \sim \varnothing 12$   |
|   | 4-Flute LEAD45 End Mill                                            | MX445       | $\varnothing 1 \sim \varnothing 12$   |
|  | 2-Flute Super Short End Mill                                       | MSE230SS    | $\varnothing 0.1 \sim \varnothing 6$  |
|  | 2-Flute Sharp Edge Short End Mill                                  | MSES230P    | $\varnothing 0.1 \sim \varnothing 12$ |
|  | 2-Flute End Mill                                                   | MSE230      | $\varnothing 0.1 \sim \varnothing 12$ |
|  | 2-Flute Medium End Mill                                            | MSEM230     | $\varnothing 0.5 \sim \varnothing 12$ |

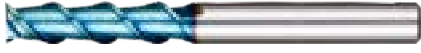
| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging                                                                            | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |          |                       |                                                                                       |                                                                                     |                                                                                     |       |       | Page |  |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------|----------|----------------|------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|-------|------|--|
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  | P                                                                                     | A                                                                                     | A                                                                                     | M                                                                                     | N                                                                                     | N                                                                                     | N               | N                                                                                     | N        | S                     | H                                                                                     |                                                                                     |                                                                                     |       |       |      |  |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |          |                       | Hardened Steel                                                                        | 55 HRC                                                                              | 65 HRC                                                                              |       |       |      |  |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |          |                       |                                                                                       |                                                                                     |                                                                                     |       |       |      |  |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  | Carbon Steel                                                                          | Alloy Steel                                                                           | Prehardened Steel                                                                     | Stainless Steel                                                                       | Aluminium Alloy                                                                       | Copper                                                                                | Copper Tungsten | Resin                                                                                 | Graphite | Hard Brittle Material | Heat Resistant Alloy etc                                                              |                                                                                     |                                                                                     |       |       |      |  |
| Square End Mill                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |          |                       |                                                                                       |                                                                                     |                                                                                     |       |       |      |  |
| MUGEN COATING PREMIUM                                                                 |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |          |                       |                                                                                       |                                                                                     |                                                                                     |       |       |      |  |
|    |    |    |    |    |    | -                                                                                   | -          | -        | -              | -                | -                                                                                     | -                                                                                     |    |    | -                                                                                     | -                                                                                     | -               | -                                                                                     | -        | -                     |    |  |  | -     | G-004 |      |  |
|    |    |    |    |    |    | -                                                                                   | -          | -        | -              | -                | -                                                                                     | -                                                                                     |    |    | -                                                                                     | -                                                                                     | -               | -                                                                                     | -        | -                     |    |  |  | -     | G-010 |      |  |
|    |    |    |    |    |    |  | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     |    | -                                                                                     | -                                                                                     | -               | -                                                                                     | -        | -                     |    | -                                                                                   | -                                                                                   | -     | K-004 |      |  |
|    |    |    |    |    |    |  | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     |    | -                                                                                     | -                                                                                     | -               | -                                                                                     | -        | -                     |    | -                                                                                   | -                                                                                   | -     | K-014 |      |  |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |                                                                                       |          |                       |                                                                                       |                                                                                     |                                                                                     |       |       |      |  |
|    |    |    |    |    |    | -                                                                                   | -          | -        | -              | -                |    |    |    |    |    |    | -               |    | -        | -                     |    | -                                                                                   | -                                                                                   | H-006 |       |      |  |
|    |    |    |    |    |    | -                                                                                   | -          | -        | -              | -                |    |    |    |    |    |    | -               |    | -        | -                     |    | -                                                                                   | -                                                                                   | H-008 |       |      |  |
|   |   |   |   |   |   | -                                                                                   | -          | -        | -              | -                |   |   |   |   |   |   | -               |   | -        | -                     |   | -                                                                                   | -                                                                                   | H-010 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-012 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-014 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-016 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-018 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-020 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-022 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-024 |       |      |  |
|  |  |  |  |  |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-026 |       |      |  |
|  |  |  |  |  |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-030 |       |      |  |
|  |  |  |  |  |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-032 |       |      |  |
|  |  |  |  | -                                                                                     |  | -                                                                                   | -          | -        | -              | -                |  |  |  |  |  |  | -               |  | -        | -                     |  | -                                                                                   | -                                                                                   | H-036 |       |      |  |

| Photo                                                                               | Product Name                                                    | Model      | Size       |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------|------------|
| Square End Mill                                                                     |                                                                 |            |            |
| MUGEN COATING                                                                       |                                                                 |            |            |
|    | 2-Flute End Mill with Measured Diameter                         | MSE230M    | φ0.1 ~ φ6  |
|    | 2-Flute End Mill                                                | MSE245     | φ2 ~ φ12   |
|    | 3-Flute End Mill                                                | MSE345     | φ3 ~ φ20   |
|    | 4-Flute Sharp Edge End Mill                                     | MSE430P    | φ1 ~ φ12   |
|    | 4-Flute End Mill                                                | MSE430     | φ1 ~ φ20   |
|    | 4-Flute End Mill                                                | MSE445     | φ2 ~ φ20   |
|    | 4-Flute Medium End Mill                                         | MSEM430    | φ1 ~ φ20   |
|  | 4-Flute End Mill for Hardened Steel                             | MHD445     | φ1 ~ φ4    |
|  | 6-Flute End Mill for Hardened Steel                             | MHD645     | φ5 ~ φ12   |
|  | 2-Flute Long Neck End Mill                                      | MHR230     | φ0.1 ~ φ6  |
|  | 4-Flute Long Neck End Mill                                      | MHR430     | φ1 ~ φ10   |
|  | 2-Flute Long Neck End Mill (Shank Dia. 6)                       | MHRLN230-6 | φ0.3 ~ φ2  |
|  | 4-Flute High Efficient "Z" End Mill for Carbon Steels           | MSCZ440    | φ1 ~ φ6    |
|  | 4-Flute Long Neck High Efficient "Z" End Mill for Carbon Steels | MSCZ440-LN | φ1 ~ φ6    |
|  | 3-Flute POWER"Z" End Mill                                       | MSZ345     | φ1 ~ φ12   |
| Solid Carbide End Mill / DLC COATING                                                |                                                                 |            |            |
|  | 2-Flute L/D=2 End Mill for Aluminium                            | AL2D-2     | φ0.5 ~ φ12 |
|  | DLC COATING<br>2-Flute L/D=2 End Mill for Aluminium             | AL2D-2DLC  | φ0.5 ~ φ12 |
|  | 2-Flute L/D=3 End Mill for Aluminium                            | AL3D-2     | φ1 ~ φ12   |

| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging                                                                              | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |                                                                                     |                                                                                       |                                                                                     |   |   |       | Page  |  |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------|----------|----------------|------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------|---|---|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---|---|-------|-------|--|
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |            |          |                |                  | P                                                                                     | A                                                                                     | A                                                                                     | M                                                                                     | N                                                                                     | N                                                                                     | N | N                                                                                     | N | S | H                                                                                   |                                                                                       |                                                                                     |   |   |       |       |  |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   | Hardened Steel                                                                      |                                                                                       |                                                                                     |   |   |       |       |  |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   | 55 HRC                                                                              | 65 HRC                                                                                | 70 HRC                                                                              |   |   |       |       |  |
| Square End Mill                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |                                                                                     |                                                                                       |                                                                                     |   |   |       |       |  |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |                                                                                     |                                                                                       |                                                                                     |   |   |       |       |  |
|    |    |    |    |    |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - | -                                                                                   |    |  | - | - | -     | H-038 |  |
|    |    |    |    |    |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - | -                                                                                   |    |  | - | - | -     | H-040 |  |
|    |    |    |    |    |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - | -                                                                                   |    |  | - | - | -     | H-042 |  |
|    |    |    |    | -                                                                                     |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | H-044 |  |
|    |    |    |    | -                                                                                     |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - | -                                                                                   | -                                                                                     |  | - | - | -     | H-046 |  |
|    |    |    |    | -                                                                                     |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - |  |    | -                                                                                   | - | - | H-048 |       |  |
|    |    |    |    | -                                                                                     |    | -                                                                                     | -          | -        | -              | -                |    |    |    |    |    |    | - |    | - | - | -                                                                                   | -                                                                                     |  | - | - | -     | H-050 |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                | -                                                                                     | -                                                                                     |  | -                                                                                     | -                                                                                     | -                                                                                     | - | -                                                                                     | - | - | -                                                                                   |  | -                                                                                   | - | - | H-052 |       |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                | -                                                                                     | -                                                                                     |  | -                                                                                     | -                                                                                     | -                                                                                     | - | -                                                                                     | - | - | -                                                                                   |  | -                                                                                   | - | - | H-054 |       |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                |  |  |  |  |  |  | - |  | - | - | -                                                                                   |  | -                                                                                   | - | - | I-004 |       |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                |  |  |  |  |  |  | - |  | - | - | -                                                                                   |  | -                                                                                   | - | - | I-016 |       |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                |  |  |  |  |  |  | - |  | - | - | -                                                                                   |  | -                                                                                   | - | - | I-024 |       |  |
|  |  |  |  |  |  |  | -          | -        | -              | -                |  |  |  |  | -                                                                                     | -                                                                                     | - | -                                                                                     | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | K-006 |  |
|  |  |  |  |  |  |  | -          | -        | -              | -                |  |  |  |  | -                                                                                     | -                                                                                     | - | -                                                                                     | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | K-016 |  |
|  |  |  |  |  |  |  | -          | -        | -              | -                |  |  |  |  | -                                                                                     | -                                                                                     | - | -                                                                                     | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | K-008 |  |
| Solid Carbide End Mill / DLC COATING                                                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |   |                                                                                       |   |   |                                                                                     |                                                                                       |                                                                                     |   |   |       |       |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | - |  | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | L-004 |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | - |  | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | L-006 |  |
|  |  |  |  |  |  | -                                                                                     | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | - |  | - | - | -                                                                                   | -                                                                                     | -                                                                                   | - | - | -     | L-008 |  |

| Photo           | Product Name | Model | Size |
|-----------------|--------------|-------|------|
| Square End Mill |              |       |      |

Solid Carbide End Mill / DLC COATING

|                                                                                     |                                                                   |            |                                          |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------|------------------------------------------|
|    | DLC COATING 2-Flute L/D=3 End Mill for Aluminium                  | AL3D-2DLC  | $\varnothing 1 \sim \varnothing 12$      |
|    | 2-Flute L/D=4 End Mill for Aluminium                              | AL4D-2     | $\varnothing 1 \sim \varnothing 12$      |
|    | DLC COATING 2-Flute L/D=4 End Mill for Aluminium                  | AL4D-2DLC  | $\varnothing 1 \sim \varnothing 12$      |
|    | 2-Flute L/D=5 End Mill for Aluminium                              | AL5D-2     | $\varnothing 1 \sim \varnothing 12$      |
|    | DLC COATING 2-Flute L/D=5 End Mill for Aluminium                  | AL5D-2DLC  | $\varnothing 1 \sim \varnothing 12$      |
|    | High efficient 3-Flute End Mill for Aluminium L/D=1.5             | ALZ345     | $\varnothing 1 \sim \varnothing 12$      |
|    | DLC COATING high efficient 3-Flute End Mill for Aluminium L/D=1.5 | ALZ345-DLC | $\varnothing 1 \sim \varnothing 12$      |
|  | High efficient 3-Flute End Mill for Aluminium L/D=3               | AL3D-345   | $\varnothing 1 \sim \varnothing 12$      |
|  | 3-Flute Long Shank End Mill for Aluminium                         | AL-3LS     | $\varnothing 5 \sim \varnothing 12$      |
|  | Long Neck Square End Mill for Copper Electrode                    | DHR237     | $\varnothing 0.1 \sim \varnothing 6$     |
|  | Micro End Mill "MICRO EDGE"                                       | NSME100    | $\varnothing 0.01 \sim \varnothing 0.05$ |
|  | Micro End Mill "MICRO EDGE"                                       | NSME230    | $\varnothing 0.03 \sim \varnothing 0.09$ |
|  | Short Flute End Mill for Resin                                    | RSES230    | $\varnothing 0.1 \sim \varnothing 6$     |
|  | End Mill for Resin                                                | RSE230     | $\varnothing 0.1 \sim \varnothing 6$     |
|  | LEAD 25 End Mill                                                  | NX-25      | $\varnothing 0.5 \sim \varnothing 12$    |
|  | LEAD 30 End Mill                                                  | NX-30      | $\varnothing 0.5 \sim \varnothing 12$    |
|  | LEAD 35 End Mill                                                  | NX-35      | $\varnothing 0.5 \sim \varnothing 12$    |
|  | LEAD 40 End Mill                                                  | NX-40      | $\varnothing 0.5 \sim \varnothing 12$    |

| Page               | Work Material  |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
|--------------------|----------------|----------|----------|--------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
|                    | H              |          |          | Heat Resistant Alloy etc | S | Z | Z | Z | Z | Z | Z | N | N | M | A | A |
|                    | Hardened Steel |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
|                    | ~ 55 HRC       | ~ 65 HRC | ~ 70 HRC |                          |   |   |   |   |   |   |   |   |   |   |   |   |
|                    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| C • R Chamfering   |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Thread Milling     |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Drilling           |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| 3D Milling         |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Plunging           |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Face Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Slot Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Side Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Helix Angle        |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Number of Flute    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Material • Coating |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |
| Square End Mill    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |   |

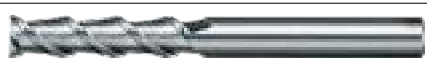
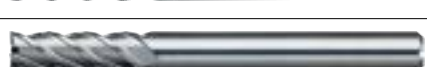
Solid Carbide End Mill / DLC COATING

|     |   |       |      |      |      |        |   |   |   |   |    |    |    |    |   |   |   |   |   |   |   |   |   |   |   |   |                |
|-----|---|-------|------|------|------|--------|---|---|---|---|----|----|----|----|---|---|---|---|---|---|---|---|---|---|---|---|----------------|
| DLC | 2 | 45°   | Side | Slot | Face | -      | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | L-010          |
| WC  | 2 | 45°   | Side | -    | Face | -      | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | L-012          |
| DLC | 2 | 45°   | Side | -    | Face | -      | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | L-014          |
| WC  | 2 | 45°   | Side | -    | Face | -      | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | L-016          |
| DLC | 2 | 45°   | Side | -    | Face | -      | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | L-018          |
| WC  | 3 | 45°   | Side | Slot | Face | Plunge | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | K-020<br>L-024 |
| DLC | 3 | 45°   | Side | Slot | Face | Plunge | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | K-018<br>L-028 |
| WC  | 3 | 45°   | Side | Slot | Face | Plunge | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | K-012<br>L-020 |
| WC  | 3 | 45°   | Side | Slot | Face | -      | - | - | - | - | -  | -  | -  | -  | ◎ | ○ | - | ○ | - | - | - | - | - | - | - | - | L-022          |
| DLC | 2 | 37.5° | Side | Slot | Face | -      | - | - | - | - | -  | -  | -  | -  | ○ | ◎ | ◎ | ○ | - | - | - | - | - | - | - | - | M-004          |
| SMG | 1 | 0°    | -    | Slot | Face | -      | - | - | - | - | ○  | ○  | ○  | ○  | ○ | ○ | - | ○ | - | - | - | - | - | - | - | - | D-006          |
| SMG | 2 | 30°   | -    | Slot | Face | -      | - | - | - | - | ○  | ○  | ○  | ○  | ○ | ○ | - | ○ | - | - | - | - | - | - | - | - | D-008          |
| MG  | 2 | 30°   | Side | Slot | Face | -      | - | - | - | - | -  | -  | -  | -  | ○ | ○ | - | ◎ | - | - | - | - | - | - | - | - | N-004          |
| MG  | 2 | 30°   | Side | Slot | Face | -      | - | - | - | - | -  | -  | -  | -  | ○ | ○ | - | ◎ | - | - | - | - | - | - | - | - | N-012          |
| MG  | 2 | 25°   | Side | Slot | Face | -      | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ◎ | ◎ | - | ◎ | - | - | - | - | - | - | - | - | T-006          |
| MG  | 2 | 30°   | Side | Slot | Face | -      | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ◎ | ◎ | - | ◎ | - | - | - | - | - | - | - | - | T-010          |
| MG  | 2 | 35°   | Side | Slot | Face | -      | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ◎ | ◎ | - | ◎ | - | - | - | - | - | - | - | - | T-014          |
| MG  | 2 | 40°   | Side | -    | Face | -      | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ◎ | ◎ | - | ◎ | - | - | - | - | - | - | - | - | T-018          |

※ 1 Positioned as a semi-standard products and original products(distributor stock)



| Photo                  | Product Name | Model | Size |
|------------------------|--------------|-------|------|
| Square End Mill        |              |       |      |
| Solid Carbide End Mill |              |       |      |

|                                                                                     |                                            |         |            |
|-------------------------------------------------------------------------------------|--------------------------------------------|---------|------------|
|    | LEAD 45 End Mill                           | NX-45   | φ0.5 ~ φ12 |
|    | CHAMPION SOLID 2-Flute End Mill            | NC-2    | φ0.5 ~ φ20 |
|    | CHAMPION SOLID 2-Flute Medium End Mill     | NCM-2   | φ0.5 ~ φ20 |
|    | CHAMPION SOLID 2-Flute Long End Mill       | NCL-2   | φ1 ~ φ12   |
|    | CHAMPION SOLID 2-Flute Long Shank End Mill | NC-LS-2 | φ1 ~ φ12   |
|    | CHAMPION SOLID 4-Flute End Mill            | NC-4    | φ1 ~ φ20   |
|   | CHAMPION SOLID 4-Flute Medium End Mill     | NCM-4   | φ1 ~ φ20   |
|  | CHAMPION SOLID 4-Flute Long End Mill       | NCL-4   | φ2 ~ φ12   |
|  | POWER SOLID 2-Flute End Mill               | NE-2    | φ1 ~ φ20   |
|  | POWER SOLID 3-Flute End Mill               | NE-3    | φ3 ~ φ20   |
|  | POWER SOLID 3-Flute Long End Mill          | NEL-3   | φ6 ~ φ20   |
|  | POWER SOLID 4-Flute End Mill               | NE-4    | φ3 ~ φ20   |
|  | Straight End Mill for Reforming            | NSL-2   | φ1 ~ φ12   |
|  | 2-Flute Long Neck End Mill                 | NHR-2   | φ0.5 ~ φ5  |
|  | 2-Flute End Mill for Nonferrous            | DX      | φ0.5 ~ φ20 |
|  | 2-Flute Medium End Mill for Nonferrous     | DXM     | φ3 ~ φ20   |
|  | 2-Flute Long End Mill for Nonferrous       | DXL     | φ3 ~ φ20   |
|  | Surface End Mill for Nonferrous            | DSF     | φ1 ~ φ20   |

| Page               | Work Material  |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
|--------------------|----------------|----------|----------|--------------------------|---|---|---|---|---|---|---|---|---|---|---|
|                    | H              |          |          | Heat Resistant Alloy etc | S | Z | Z | Z | Z | Z | N | N | M | A | A |
|                    | Hardened Steel |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
|                    | ~ 55 HRC       | ~ 65 HRC | ~ 70 HRC |                          |   |   |   |   |   |   |   |   |   |   |   |
|                    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| C • R Chamfering   |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Thread Milling     |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Drilling           |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| 3D Milling         |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Plunging           |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Face Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Slot Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Side Milling       |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Helix Angle        |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Number of Flute    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Material • Coating |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |
| Square End Mill    |                |          |          |                          |   |   |   |   |   |   |   |   |   |   |   |

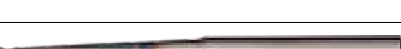
|                                                                                       |   |                          |      |      |      |   |   |   |   |   |    |    |    |    |    |    |   |    |   |   |   |   |   |   |       |
|---------------------------------------------------------------------------------------|---|--------------------------|------|------|------|---|---|---|---|---|----|----|----|----|----|----|---|----|---|---|---|---|---|---|-------|
|    | 2 | 45°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-022 |
|    | 2 | 30°                      | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-026 |
|    | 2 | 30°                      | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-028 |
|    | 2 | 30°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-030 |
|    | 2 | 30°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-032 |
|    | 4 | 30°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-034 |
|   | 4 | 30°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-038 |
|  | 4 | 30°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-040 |
|  | 2 | 45°                      | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-042 |
|  | 3 | 45°                      | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-044 |
|  | 3 | 45°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-046 |
|  | 4 | 45°                      | Side | -    | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-048 |
|  | 2 | 0°                       | -    | -    | -    | - | - | - | - | - | ※1 | ※1 | ※1 | -  | -  | -  | - | -  | - | - | - | - | - | - | T-050 |
|  | 2 | 30°/45°<br>(D/2.5/D/2.5) | Side | Slot | Face | - | - | - | - | - | ※1 | ※1 | ※1 | ※1 | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-062 |
|  | 2 | 25°                      | Side | Slot | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-052 |
|  | 2 | 25°                      | Side | -    | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-054 |
|  | 2 | 25°                      | Side | -    | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-056 |
|  | 1 | 12°                      | -    | -    | Face | - | - | - | - | - | -  | -  | -  | -  | ※1 | ※1 | - | ※1 | - | - | - | - | - | - | T-060 |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                                                                               | Product Name                                               | Model     | Size                                                                       |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|-----------|----------------------------------------------------------------------------|
| Square End Mill                                                                     |                                                            |           |                                                                            |
| Solid Carbide End Mill / X COATING                                                  |                                                            |           |                                                                            |
|    | 3-Flute Semi-finishing End Mill for Nonferrous             | DHS       | $\varnothing 6 \sim \varnothing 20$                                        |
|    | 2-Flute End Mill for Aluminium                             | NEA-2     | $\varnothing 3 \sim \varnothing 25$                                        |
|    | X COATING 2-Flute End Mill                                 | NX-30X    | $\varnothing 1 \sim \varnothing 12$                                        |
|    | X COATING 2-Flute Long Neck End Mill                       | NHR-2X    | $\varnothing 0.5 \sim \varnothing 5$                                       |
| Monocrystalline Diamond End Mill                                                    |                                                            |           |                                                                            |
|    | Monocrystalline Diamond End Mill "CLEAR EDGE"              | CED100    | $\varnothing 0.1 \sim \varnothing 2$                                       |
| Ball End Mill                                                                       |                                                            |           |                                                                            |
| CBN Ball End Mill                                                                   |                                                            |           |                                                                            |
|   | CBN Ball End Mill for precision machining "CBN Micro Ball" | SMB120    | R0.01 $\sim$ R0.05                                                         |
|  | CBN Super Finish Ball End Mill                             | SFB200    | R0.1 $\sim$ R1                                                             |
|  | CBN Super Spiral Ball End Mill                             | SSPB220   | R0.1 $\sim$ R3                                                             |
|  | CBN Super Spiral Long Neck Ball End Mill                   | SSPBL220  | R0.1 $\sim$ R1                                                             |
|  | CBN Super Spiral Long Taper Neck Ball End Mill             | SSPBTN220 | R0.1 $\times$ neck taper angle30'<br>$\sim$ R1 $\times$ neck taper angle2° |
|  | CBN Super Speed Ball End Mill                              | SSB200    | R0.1 $\sim$ R1                                                             |
|  | CBN Super Speed Long Neck Ball End Mill                    | SSBL200   | R0.05 $\sim$ R1                                                            |
| PCD Ball End Mill                                                                   |                                                            |           |                                                                            |
|  | PCD Ball End Mill                                          | PCDRB     | R0.05 $\sim$ R1                                                            |
| DIAMOND COATING                                                                     |                                                            |           |                                                                            |
|  | Ball End Mill for Hard Brittle Materials                   | DCMB      | R0.1 $\sim$ R1                                                             |
|  | DIAMOND COATING 2-Flute Long Neck Ball End Mill            | DCRB230   | R0.2 $\sim$ R3                                                             |

| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle              | Side Milling                                                                        | Slot Milling                                                                        | Face Milling                                                                        | Plunging | 3D Milling                                                                            | Drilling | Thread Milling | C • R Chamfering | Work Material                                                                       |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       | Page           |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|----------|----------------|------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------|
|                                                                                       |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  | P                                                                                   | P                                                                                   | P                                                                                     | M                                                                                   | N                                                                                   | N      | N                                                                                   | N                                                                                     | N                                                                                     | S                                                                                     | H                        |                                                                                       |                                                                                       |                                                                                       |                |
|                                                                                       |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  | Carbon Steel                                                                        | Alloy Steel                                                                         | Prehardened Steel                                                                     | Stainless Steel                                                                     | Aluminium Alloy                                                                     | Copper | Copper Tungsten                                                                     | Resin                                                                                 | Graphite                                                                              | Hard Brittle Material                                                                 | Heat Resistant Alloy etc | Hardened Steel                                                                        |                                                                                       |                                                                                       |                |
|                                                                                       |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       | 55 HRC                   | 65 HRC                                                                                | 70 HRC                                                                                |                                                                                       |                |
| Square End Mill                                                                       |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
| Solid Carbide End Mill / X COATING                                                    |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
|    |    | 40°                      |  |  |  | -        | -                                                                                     | -        | -              | -                | -                                                                                   | -                                                                                   | -                                                                                     |  |  | -      |  | -                                                                                     | -                                                                                     | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | U-006          |
|    |    | 45°                      |  |  |  | -        | -                                                                                     | -        | -              | -                | -                                                                                   | -                                                                                   | -                                                                                     |  |  | -      |  | -                                                                                     | -                                                                                     | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | T-058          |
|    |    | 30°                      |  |  |  | -        | -                                                                                     | -        | -              | -                |  |  |    |  |  | -      |  | -                                                                                     | -                                                                                     | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | U-004          |
|    |    | 30°/45°<br>(D2.5)/(D2.5) |  |  |  | -        | -                                                                                     | -        | -              | -                |  |  |    |  |  | -      |  | -                                                                                     | -                                                                                     | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | U-010          |
| Monocrystalline Diamond End Mill                                                      |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
|    |    | 0°                       | -                                                                                   | -                                                                                   |  | -        | -                                                                                     | -        | -              | -                | -                                                                                   | -                                                                                   | -                                                                                     |  |  | -      | -                                                                                   | -                                                                                     |    | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | U-008          |
| Ball End Mill                                                                         |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
| CBN Ball End Mill                                                                     |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
|   |   | -20°                     | -                                                                                   | -                                                                                   | -                                                                                   | -        |   | -        | -              | -                | -                                                                                   | -                                                                                   |   | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |   |   |   | B-010<br>D-010 |
|  |  | 0°                       | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |  |  |  | B-012          |
|  |  | 20°                      | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |  |  |  | B-014          |
|  |  | 20°                      | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |  |  |  | B-018          |
|  |  | 20°                      | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |  |  |  | B-022          |
|  |  | 0°                       | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |  |  |  | B-016          |
|  |  | 0°                       | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                        |  |  |  | B-020          |
| PCD Ball End Mill                                                                     |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
|  | -                                                                                     | -                        | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     | -                                                                                     |  | -                        |  |  |  | C-006          |
| DIAMOND COATING                                                                       |                                                                                       |                          |                                                                                     |                                                                                     |                                                                                     |          |                                                                                       |          |                |                  |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |        |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                          |                                                                                       |                                                                                       |                                                                                       |                |
|  |  | 20°                      | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -      | -                                                                                   | -                                                                                     |  | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | O-006          |
|  |  | 30°                      | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -        | -              | -                | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -      | -                                                                                   |  | -                                                                                     | -                                                                                     | -                        | -                                                                                     | -                                                                                     | -                                                                                     | P-008          |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                                                                               | Product Name                                                                                  | Model       | Size                                                |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------|
| Ball End Mill                                                                       |                                                                                               |             |                                                     |
| MUGEN COATING PREMIUM Plus                                                          |                                                                                               |             |                                                     |
|    | 2-Flute Long Neck Ball End Mill with Short Shank for Hardened Steel and High accuracy cutting | MRBSH230SF  | R0.05 ~ R3                                          |
|    | High Efficient 3-Flute Small-Diameter Long Neck Ball End Mill for Hardened Steel              | MRBSH330    | R0.1 ~ R1                                           |
|    | 3-Flute Ball End mill for 5-axis machining                                                    | MSBSH330-5X | R0.1 ~ R1                                           |
| MUGEN COATING PREMIUM                                                               |                                                                                               |             |                                                     |
|    | 2-Flute Ball End Mill for Hardened Steel                                                      | MSBH230     | R0.05 ~ R6                                          |
|    | 3-Flute Ball End Mill for Hardened Steel                                                      | MSBH345     | R0.5 ~ R3                                           |
|    | 2-Flute Long Neck Ball End Mill for Hardened Steel                                            | MRBH230     | R0.05 ~ R3                                          |
|  | 2-Flute Ball End Mill with Short Shank for Hardened Steel                                     | MACH225SF   | R0.1 ~ R3                                           |
|  | 2-Flute Ball End Mill for Hardened Steel                                                      | MACH225     | R0.1 ~ R3                                           |
|  | 2-Flute Long Taper Neck Ball End Mill                                                         | MRBTNH230   | R0.05×neck taper angle3°<br>~ R2×neck taper angle1° |
|  | 3-Flute Long Taper Neck Ball End Mill                                                         | MRBTNH345   | R0.5×neck taper angle30°<br>~ R2×neck taper angle1° |
| MUGEN COATING                                                                       |                                                                                               |             |                                                     |
|  | 2-Flute Ball End Mill                                                                         | MSB230      | R0.05 ~ R10                                         |
|  | 3-Flute Ball End Mill                                                                         | MSB345      | R0.5 ~ R6                                           |
|  | Profit Ball End Mill                                                                          | MSB230G2    | R0.05 ~ R3                                          |
|  | 2-Flute Short Flute Ball End Mill                                                             | MSB230S     | R0.1 ~ R6                                           |
|  | 2-Flute Ball End Mill with Short Shank                                                        | MSB230SF    | R0.1 ~ R6                                           |
|  | 2-Flute Long Ball End Mill                                                                    | MSBL230     | R0.1 ~ R5                                           |
|  | 2-Flute Extra Long Ball End Mill                                                              | MSBXL230    | R0.5 ~ R5                                           |
|  | 2-Flute Long Neck Ball End Mill                                                               | MRB230      | R0.05 ~ R3                                          |

| Page                                                                                  | Work Material   |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 |                |                 |        |          |                       |       |                          |   |       |       |
|---------------------------------------------------------------------------------------|-----------------|-------------|--------------|--------------|--------------|----------|------------|----------|----------------|------------------|--------------|-------------|-------------------|-----------------|-----------------|----------------|-----------------|--------|----------|-----------------------|-------|--------------------------|---|-------|-------|
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 | H              |                 |        | E-006    |                       |       |                          |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 | Hardened Steel |                 |        |          |                       |       |                          |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 | 55 HRC         | 65 HRC          | 70 HRC |          |                       |       |                          |   |       |       |
| Material • Coating                                                                    | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamfering | P            | P           | P                 | M               | N               | N              | N               | N      | N        | S                     | E-010 |                          |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Alloy Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
|                                                                                       |                 |             |              |              |              |          |            |          |                |                  | Carbon Steel | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper         | Copper Tungsten | Resin  | Graphite | Hard Brittle Material |       | Heat Resistant Alloy etc |   |       |       |
| Ball End Mill                                                                         |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 |                |                 |        |          |                       |       |                          |   |       |       |
| MUGEN COATING PREMIUM Plus                                                            |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 |                |                 |        |          |                       |       |                          |   |       |       |
|    | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | -                 | -               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | E-006 |       |
|    | 3               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | -                 | -               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | E-010 |       |
|    | 3               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | -                 | -               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | E-004 |       |
| MUGEN COATING PREMIUM                                                                 |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 |                |                 |        |          |                       |       |                          |   |       |       |
|    | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | F-024 |
|    | 3               | 45°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | F-026 |
|   | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | G-014 |
|  | 2               | 25°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | G-024 |
|  | 2               | 25°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | G-026 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | G-028 |
|  | 3               | 45°         | -            | -            | -            | -        | 3D         | -        | -              | -                | -            | -           | ○                 | ○               | -               | -              | -               | -      | -        | -                     | ○     | ○                        | ○ | -     | G-036 |
| MUGEN COATING                                                                         |                 |             |              |              |              |          |            |          |                |                  |              |             |                   |                 |                 |                |                 |        |          |                       |       |                          |   |       |       |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | ○                 | ○               | ○               | -              | ○               | -      | -        | -                     | ○     | -                        | - | -     | H-056 |
|  | 3               | 45°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | ○                 | ○               | ○               | -              | ○               | -      | -        | -                     | ○     | -                        | - | -     | H-060 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | ○                 | ○               | ○               | -              | ○               | -      | -        | -                     | ○     | -                        | - | -     | H-062 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | ○                 | ○               | ○               | -              | ○               | -      | -        | -                     | ○     | -                        | - | -     | H-064 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | ○                 | ○               | ○               | -              | ○               | -      | -        | -                     | ○     | -                        | - | -     | H-068 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | -                 | -               | ○               | ○              | -               | ○      | -        | -                     | -     | -                        | - | -     | H-072 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | -                 | -               | ○               | ○              | -               | ○      | -        | -                     | -     | -                        | - | -     | H-073 |
|  | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ○            | ○           | ○                 | ○               | ○               | -              | ○               | -      | -        | -                     | ○     | -                        | - | -     | I-026 |

| Photo                                                                               | Product Name                                       | Model      | Size                                                   |
|-------------------------------------------------------------------------------------|----------------------------------------------------|------------|--------------------------------------------------------|
| Ball End Mill                                                                       |                                                    |            |                                                        |
| MUGEN COATING                                                                       |                                                    |            |                                                        |
|    | 2-Flute Long Neck Ball End Mill with Short Shank   | MRB230SF   | R0.1 ~ R1.5                                            |
|    | 2-Flute Long Neck Ball End Mill (Shank Dia. 6)     | MRBLN230-6 | R0.15 ~ R1                                             |
|    | 2-Flute Long Taper Neck Ball End Mill              | MRBTN230   | R0.1×neck taper angle30°<br>~ R2×neck taper angle1°    |
|    | 2-Flute Extra Long Taper Neck Ball End Mill        | MRBTN230L  | R0.1×neck taper angle30°<br>~ R5×neck taper angle1°30' |
| DLC COATING                                                                         |                                                    |            |                                                        |
|    | DLC COATING Ball End Mill for Aluminium            | ALB225-DLC | R0.3 ~ R6                                              |
|    | Long Neck Ball End Mill for Copper Electrode       | DRB230     | R0.05 ~ R3                                             |
| Solid Carbide End Mill / X COATING                                                  |                                                    |            |                                                        |
|  | Ball End Mill for precision machining "Micro Ball" | NSMB100    | R0.005 ~ R0.05                                         |
|  | Ball End Mill for Aluminium                        | ALB225     | R0.3 ~ R6                                              |
|  | Ball End Mill for Resin                            | RSB230     | R0.1 ~ R3                                              |
|  | 2-Flute Ball End Mill                              | NSB-2      | R1 ~ R10                                               |
|  | 2-Flute Miniature Ball End Mill                    | NCB-2      | R0.2~R0.9                                              |
|  | 2-Flute Long Ball End Mill                         | NSBL-2     | R3 ~ R10                                               |
|  | 2-Flute Extra Long Ball End Mill                   | NLBL-2     | R0.5 ~ R10                                             |
|  | 2-Flute Long Neck Ball End Mill                    | NHB-2      | R0.4 ~ R5                                              |
|  | 2-Flute Ball End Mill for Nonferrous               | DB         | R0.5 ~ R10                                             |
|  | 2-Flute Long Neck Ball End Mill for Nonferrous     | DHB        | R0.5 ~ R6                                              |
|  | X COATING 2-Flute Miniature Ball End Mill          | NCB-2X     | R0.2 ~ R0.9                                            |

| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling                                                                            | Drilling | Thread Milling | C • R Chamfering | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               |                     |                                                                                     |        |   |   | Page  |  |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------|--------------|--------------|----------|---------------------------------------------------------------------------------------|----------|----------------|------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------|-------------------------------|---------------------|-------------------------------------------------------------------------------------|--------|---|---|-------|--|
|                                                                                       |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  | P<br>Carbon Steel                                                                     | P<br>Alloy Steel                                                                      | P<br>Prehardened Steel                                                                | M<br>Stainless Steel                                                                  | N<br>Aluminium Alloy                                                                  | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H<br>Hardened Steel |                                                                                     |        |   |   |       |  |
|                                                                                       |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               | 55 HRC              | 65 HRC                                                                              | 70 HRC |   |   |       |  |
|                                                                                       |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               |                     |                                                                                     |        |   |   |       |  |
| Ball End Mill                                                                         |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               |                     |                                                                                     |        |   |   |       |  |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               |                     |                                                                                     |        |   |   |       |  |
|    |    |    | -            | -            | -            | -        |    | -        | -              | -                |    |    |    |    |    |    | -                                                                                   |    | -                                                                                     | -                          | -                             | -                   |  | -      | - | - | I-038 |  |
|    |    |    | -            | -            | -            | -        |    | -        | -              | -                |    |    |    |    |    |    | -                                                                                   |    | -                                                                                     | -                          | -                             | -                   |  | -      | - | - | I-042 |  |
|    |    |    | -            | -            | -            | -        |    | -        | -              | -                |    |    |    |    |    |    | -                                                                                   |    | -                                                                                     | -                          | -                             | -                   |  | -      | - | - | I-044 |  |
|    |    |    | -            | -            | -            | -        |    | -        | -              | -                |    |    |    |    |    |    | -                                                                                   |    | -                                                                                     | -                          | -                             | -                   |  | -      | - | - | I-054 |  |
| DLC COATING                                                                           |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               |                     |                                                                                     |        |   |   |       |  |
|    |    |    | -            | -            | -            | -        |    | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |    |    | -                                                                                   |    | -                                                                                     | -                          | -                             | -                   | -                                                                                   | -      | - | - | L-032 |  |
|    |    |    | -            | -            | -            | -        |    | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |    |    |  |    |    | -                          | -                             | -                   | -                                                                                   | -      | - | - | M-008 |  |
| Solid Carbide End Mill / X COATING                                                    |                                                                                       |                                                                                       |              |              |              |          |                                                                                       |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                                                                                       |                            |                               |                     |                                                                                     |        |   |   |       |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  | -                                                                                     | -                          | -                             | -                   | -                                                                                   | -      | - | - | D-012 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | -                                                                                   |  | -                                                                                     | -                          | -                             | -                   | -                                                                                   | -      | - | - | L-030 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | N-020 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-088 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-086 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-090 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-092 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-098 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-094 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | T-096 |  |
|  |  |  | -            | -            | -            | -        |  | -        | -              | -                |  |  |  |  |  |  | -                                                                                   |  |  | -                          | -                             | -                   | -                                                                                   | -      | - | - | U-024 |  |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                                                                               | Product Name                                         | Model    | Size                                                |
|-------------------------------------------------------------------------------------|------------------------------------------------------|----------|-----------------------------------------------------|
| Ball End Mill                                                                       |                                                      |          |                                                     |
| X COATING                                                                           |                                                      |          |                                                     |
|    | X COATING 2-Flute Ball End Mill                      | NSB-2X   | R1 ~ R10                                            |
| Corner Radius End Mill                                                              |                                                      |          |                                                     |
| CBN Corner Radius End Mill                                                          |                                                      |          |                                                     |
|    | CBN Super Speed Radius End Mill                      | SSR200   | $\phi 0.1 \times R0.02$<br>~ $\phi 2 \times R0.5$   |
|    | CBN High Efficient Radius End Mill                   | SHR320   | $\phi 0.5 \times R0.1$<br>~ $\phi 2 \times R0.3$    |
|    | CBN Super High Precision Radius End Mill             | SHPR400  | $\phi 0.1 \times R0.01$<br>~ $\phi 3 \times R0.2$   |
|    | CBN Super Surface End Mill                           | SSF120   | $\phi 0.2 \times R0.05$<br>~ $\phi 2 \times R0.1$   |
| PCD Corner Radius End Mill                                                          |                                                      |          |                                                     |
|   | PCD Radius End Mill                                  | PCDRS    | $\phi 0.3 \times R0.05$<br>~ $\phi 1 \times R0.1$   |
| MUGEN COATING PREMIUM                                                               |                                                      |          |                                                     |
|  | 4-Flute Radius End Mill for Hardened Steel           | MHDH445R | $\phi 3 \times R0.2$<br>~ $\phi 4 \times R0.5$      |
|  | 6-Flute Radius End Mill for Hardened Steel           | MHDH645R | $\phi 5 \times R0.2$<br>~ $\phi 12 \times R2$       |
|  | 2-Flute Long Neck Radius End Mill for Hardened Steel | MHRH230R | $\phi 0.2 \times R0.02$<br>~ $\phi 0.9 \times R0.1$ |
|  | 4-Flute Long Neck Radius End Mill for Hardened Steel | MHRH430R | $\phi 0.1 \times R0.01$<br>~ $\phi 6 \times R1$     |
|  | Power Radius End Mill                                | MSXH440R | $\phi 3 \times R0.3$<br>~ $\phi 12 \times R2$       |
| MUGEN COATING                                                                       |                                                      |          |                                                     |
|  | 2-Flute Radius End Mill                              | MSRS230  | $\phi 1 \times R0.1$<br>~ $\phi 6 \times R2$        |
|  | 4-Flute Radius End Mill                              | MSRS430  | $\phi 1 \times R0.1$<br>~ $\phi 12 \times R3$       |
|  | 2-Flute Long Neck Radius End Mill                    | MHR230R  | $\phi 0.2 \times R0.05$<br>~ $\phi 6 \times R1$     |
|  | 4-Flute Long Neck Radius End Mill                    | MHR430R  | $\phi 1 \times R0.05$<br>~ $\phi 6 \times R1$       |

| Material • Coating         | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material     |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       | Page |
|----------------------------|-----------------|-------------|--------------|--------------|--------------|----------|------------|----------|----------------|------------------|-------------------|------------------|------------------------|----------------------|----------------------|-------------|----------------------|------------|---------------|----------------------------|-------------------------------|---------------------|--------|--------|-------|------|
|                            |                 |             |              |              |              |          |            |          |                |                  | P<br>Carbon Steel | P<br>Alloy Steel | P<br>Prehardened Steel | M<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Copper Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H<br>Hardened Steel |        |        |       |      |
|                            |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               | 55 HRC              | 65 HRC | 70 HRC |       |      |
| Ball End Mill              |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| X COATING                  |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| X                          | 2               | 30°         | -            | -            | -            | -        | 3D         | -        | -              | -                | ※1                | ※1               | ※1                     | ※1                   | ※1                   | ※1          | -                    | ※1         | -             | -                          | -                             | -                   | -      | -      | U-026 |      |
| Corner Radius End Mill     |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| CBN Corner Radius End Mill |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| CBN                        | 2               | 0°          | -            | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | ○      | B-026 |      |
| CBN                        | 3               | 20°         | -            | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | ○      | B-032 |      |
| CBN                        | 4               | 0°          | -            | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | ○      | B-034 |      |
| CBN                        | 1               | -20°        | -            | -            | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | ○      | B-040 |      |
| PCD Corner Radius End Mill |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| PCD                        | 2               | 4           | 6            | 0°           | -            | -        | Face       | -        | 3D             | -                | -                 | -                | -                      | -                    | -                    | -           | -                    | -          | -             | ○                          | -                             | -                   | -      | -      | C-008 |      |
| MUGEN COATING PREMIUM      |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| ∞ Premium                  | 4               | 45°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | -      | F-028 |      |
| ∞ Premium                  | 6               | 45°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | -      | F-030 |      |
| ∞ Premium                  | 2               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | ○                    | -                    | -           | -                    | -          | -             | -                          | ○                             | ○                   | ○      | -      | G-040 |      |
| ∞ Premium                  | 4               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -                 | -                | ○                      | ○                    | -                    | -           | -                    | -          | -             | -                          | ○                             | ○                   | ○      | -      | G-044 |      |
| ∞ Premium                  | 4               | 40°/42°     | Side         | Slot         | Face         | -        | -          | -        | -              | -                | -                 | ○                | ○                      | ○                    | -                    | -           | -                    | -          | -             | -                          | ○                             | -                   | -      | -      | K-024 |      |
| MUGEN COATING              |                 |             |              |              |              |          |            |          |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |       |      |
| ∞                          | 2               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | ○                             | -                   | -      | H-074  |       |      |
| ∞                          | 4               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | ○                             | -                   | -      | H-076  |       |      |
| ∞                          | 2               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | ○                             | -                   | -      | I-058  |       |      |
| ∞                          | 4               | 30°         | Side         | Slot         | Face         | -        | -          | -        | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | ○                    | -          | -             | -                          | ○                             | -                   | -      | I-072  |       |      |

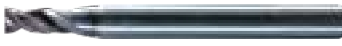
※ 1 Positioned as a semi-standard products and original products(distributor stock)



| Photo                                                                               | Product Name                                   | Model    | Size                                                                                                                               |
|-------------------------------------------------------------------------------------|------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------|
| Corner Radius End Mill                                                              |                                                |          |                                                                                                                                    |
| MUGEN COATING                                                                       |                                                |          |                                                                                                                                    |
|    | 2-Flute Long Taper Neck Radius End Mill        | MSTNR230 | $\phi 0.2 \times R0.05 \times \text{neck taper angle} 1^\circ$<br>$\sim \phi 3 \times R0.5 \times \text{neck taper angle} 1^\circ$ |
|    | Power Radius End Mill                          | MSX440   | $\phi 3 \times R0.2$<br>$\sim \phi 20 \times R1$                                                                                   |
| DLC COATING                                                                         |                                                |          |                                                                                                                                    |
|    | Long Neck Radius End Mill for Copper Electrode | DHR237R  | $\phi 0.2 \times R0.02$<br>$\sim \phi 6 \times R1$                                                                                 |
| Solid Carbide End Mill                                                              |                                                |          |                                                                                                                                    |
|    | 2-Flute Radius End Mill                        | NSR-2    | $\phi 1 \times R0.2$<br>$\sim \phi 20 \times R5$                                                                                   |
| Tapered Square End Mill                                                             |                                                |          |                                                                                                                                    |
| MUGEN COATING                                                                       |                                                |          |                                                                                                                                    |
|   | 2-Flute Taper End Mill                         | MTE230   | $\phi 0.2 \times \text{taper angle} 30^\circ$<br>$\sim \phi 10 \times \text{taper angle} 5^\circ$                                  |
|  | 4-Flute Taper End Mill for Deep Rib            | MRT425   | $\phi 0.2 \times \text{taper angle} 30^\circ$<br>$\sim \phi 3 \times \text{taper angle} 2^\circ$                                   |
| Solid Carbide End Mill                                                              |                                                |          |                                                                                                                                    |
|  | 2-Flute Taper End Mill                         | NTE-2    | $\phi 0.5 \times \text{taper angle} 30^\circ$<br>$\sim \phi 10 \times \text{taper angle} 10^\circ$                                 |
|  | 2-Flute Medium Taper End Mill                  | NTEM-2   | $\phi 1 \times \text{taper angle} 4^\circ$<br>$\sim \phi 4 \times \text{taper angle} 20^\circ$                                     |
|  | 2-Flute Long Taper End Mill                    | NTEL-2   | $\phi 1 \times \text{taper angle} 30^\circ$<br>$\sim \phi 3 \times \text{taper angle} 20^\circ$                                    |
|  | 4-Flute Taper End Mill                         | NTE-4    | $\phi 3 \times \text{taper angle} 30^\circ$<br>$\sim \phi 16 \times \text{taper angle} 10^\circ$                                   |
|  | 4-Flute Long Taper End Mill                    | NTEL-4   | $\phi 3 \times \text{taper angle} 30^\circ$<br>$\sim \phi 6 \times \text{taper angle} 5^\circ$                                     |
|  | 2-Flute Taper End Mill for Nonferrous          | DTE      | $\phi 1 \times \text{taper angle} 30^\circ$<br>$\sim \phi 10 \times \text{taper angle} 5^\circ$                                    |
|  | 2-Flute Long Taper End Mill for Nonferrous     | DTL      | $\phi 1 \times \text{taper angle} 30^\circ$<br>$\sim \phi 8 \times \text{taper angle} 5^\circ$                                     |
|  | 2-Flute Taper End Mill for Runner              | NER-2    | $\phi 2 \times \text{taper angle} 7^\circ$<br>$\sim \phi 6 \times \text{taper angle} 15^\circ$                                     |
|  | 4-Flute Taper End Mill for Deep Rib            | NRF-4    | $\phi 0.5 \times \text{taper angle} 30^\circ$<br>$\sim \phi 2 \times \text{taper angle} 3^\circ$                                   |

| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                        | Plunging | 3D Milling | Drilling | Thread Milling | C • R Chamfering | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  | Page |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|------------|----------|----------------|------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|-------|--|------|
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  | P<br>Carbon Steel                                                                     | P<br>Alloy Steel                                                                      | P<br>Prehardened Steel                                                                | M<br>Stainless Steel                                                                  | N<br>Aluminium Alloy                                                                  | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material                                                          | S<br>Heat Resistant Alloy etc                                                       | H<br>Hardened Steel                                                                   |                                                                                     |                                                                                     |       |       |  |      |
|                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     | 55 HRC                                                                                | 65 HRC                                                                              | 70 HRC                                                                              |       |       |  |      |
| Corner Radius End Mill                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
|    |    |    |    |    |  | -        | -          | -        | -              | -                |    |    |    |    |    |    |    |    |    |  |  |    |  |  | I-078 |       |  |      |
|    |    |    |    |    |  | -        | -          | -        | -              | -                |    |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | K-026 |  |      |
| DLC COATING                                                                           |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
|    |    |    |    |    |  | -        | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    |    | -                                                                                     | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | M-014 |       |  |      |
| Solid Carbide End Mill                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
|    |    |    |    |    |  | -        | -          | -        | -              | -                |    |    |    |    |    |    |    | -                                                                                     |    | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-106 |  |      |
| Tapered Square End Mill                                                               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
|    |    |    |    |    | -                                                                                   | -        | -          | -        | -              | -                |    |    |    |    | -                                                                                     |    |    | -                                                                                     |    | -                                                                                   | -                                                                                   | -                                                                                     |  | -                                                                                   | -     | J-004 |  |      |
|  |  |  | -                                                                                     |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | J-010 |       |  |      |
| Solid Carbide End Mill                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |          |            |          |                |                  |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                     |                                                                                     |       |       |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  |  |  |  | -                                                                                     |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-066 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  |  |  |  | -                                                                                     |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-070 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  |  |  |  | -                                                                                     |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-072 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  |  |  |  | -                                                                                     |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-074 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  |  |  |  | -                                                                                     |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-078 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | -                                                                                     |  | -                                                                                     | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-080 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  | -                                                                                     |  | -                                                                                     | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-082 |  |      |
|  |  |  |  |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  |  |  |  | -                                                                                     |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | T-084 |  |      |
|  |  |  | -                                                                                     |  | -                                                                                   | -        | -          | -        | -              | -                |  |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                   | -                                                                                   | -     | U-020 |  |      |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                                                                               | Product Name                                       | Model   | Size                                                                                                                     |
|-------------------------------------------------------------------------------------|----------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------|
| Tapered Square End Mill                                                             |                                                    |         |                                                                                                                          |
| X COATING                                                                           |                                                    |         |                                                                                                                          |
|    | X COATING 2-Flute Taper End Mill                   | NTE-2X  | $\varphi 0.5 \times \text{taper angle} 30^\circ$<br>~ $\varphi 2.5 \times \text{taper angle} 5^\circ$                    |
|    | X COATING 4-Flute Taper End Mill                   | NTE-4X  | $\varphi 0.5 \times \text{taper angle} 30^\circ$<br>~ $\varphi 2.5 \times \text{taper angle} 5^\circ$                    |
|    | X COATING 2-Flute Medium Taper End Mill            | NTEM-2X | $\varphi 0.5 \times \text{taper angle} 30^\circ$<br>$\varphi 6 \times \text{taper angle} 15^\circ$                       |
| Tapered Square End Mill                                                             |                                                    |         |                                                                                                                          |
| MUGEN COATING                                                                       |                                                    |         |                                                                                                                          |
|    | 2-Flute Taper Ball End Mill                        | MTB230  | $R0.1 \times \text{taper angle} 1^\circ$<br>~ $R2 \times \text{taper angle} 15^\circ$                                    |
| Solid Carbide End Mill                                                              |                                                    |         |                                                                                                                          |
|    | 2-Flute Taper Ball End Mill for Runner             | NERB-2  | $R1 \times \text{taper angle} 10^\circ$<br>~ $R3 \times \text{taper angle} 20^\circ$                                     |
|   | 2-Flute Taper Ball End Mill                        | NTB-2   | $R0.5 \times \text{taper angle} 30^\circ$<br>~ $R5 \times \text{taper angle} 10^\circ$                                   |
| Tapered Corner Radius End Mill                                                      |                                                    |         |                                                                                                                          |
| X COATING                                                                           |                                                    |         |                                                                                                                          |
|  | X COATING 2-Flute Taper Radius End Mill for Runner | NERR-2X | $\varphi 2 \times \text{taper angle} 7^\circ \times R0.3$<br>~ $\varphi 6 \times \text{taper angle} 15^\circ \times R2$  |
|  | X COATING 2-Flute Taper Radius End Mill            | NTER-2X | $\varphi 1 \times \text{taper angle} 30^\circ \times R0.2$<br>~ $\varphi 6 \times \text{taper angle} 10^\circ \times R2$ |
| Drill                                                                               |                                                    |         |                                                                                                                          |
| MUGEN COATING PREMIUM                                                               |                                                    |         |                                                                                                                          |
|  | Precision Drill for Hardened Steel                 | MSDH    | $\varphi 0.1 \sim \varphi 1$                                                                                             |
| MUGEN MICRO COATING                                                                 |                                                    |         |                                                                                                                          |
|  | Micro Drill                                        | NSMD-M  | $\varphi 0.01 \sim \varphi 0.1$                                                                                          |
|  | Micro Drill Short                                  | NSMD-MS | $\varphi 0.01 \sim \varphi 0.05$                                                                                         |
|  | Micro Point Drill (Drill for Guide Hole)           | NSPD-M  | $\varphi 0.01 \sim \varphi 0.1$                                                                                          |
| MUGEN COATING                                                                       |                                                    |         |                                                                                                                          |
|  | Flat Drill                                         | MFD     | $\varphi 0.1 \sim \varphi 6$                                                                                             |

| Material • Coating             | Number of Flute | Helix Angle            | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling   | Thread Milling | C • R Chamfering | Work Material     |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   | Page  |  |
|--------------------------------|-----------------|------------------------|--------------|--------------|--------------|----------|------------|------------|----------------|------------------|-------------------|------------------|------------------------|----------------------|----------------------|-------------|----------------------|------------|---------------|----------------------------|-------------------------------|---------------------|--------|--------|---|-------|--|
|                                |                 |                        |              |              |              |          |            |            |                |                  | P<br>Carbon Steel | P<br>Alloy Steel | P<br>Prehardened Steel | M<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Copper Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H<br>Hardened Steel |        |        |   |       |  |
|                                |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               | 55 HRC              | 65 HRC | 70 HRC |   |       |  |
|                                |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| Tapered Square End Mill        |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| X COATING                      |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| X                              | 2               | 30°                    | Side         | Slot         | -            | -        | -          | -          | -              | -                | ※1                | ※1               | ※1                     | ※1                   | ※1                   | ※1          | -                    | ※1         | -             | -                          | -                             | -                   | -      | -      | - | U-014 |  |
| X                              | 4               | 30°                    | Side         | Slot         | -            | -        | -          | -          | -              | -                | ※1                | ※1               | ※1                     | ※1                   | ※1                   | ※1          | -                    | ※1         | -             | -                          | -                             | -                   | -      | -      | - | U-016 |  |
| X                              | 2               | 30°                    | Side         | Slot         | -            | -        | -          | -          | -              | -                | ※1                | ※1               | ※1                     | ※1                   | ※1                   | ※1          | -                    | ※1         | -             | -                          | -                             | -                   | -      | -      | - | U-018 |  |
| Tapered Square End Mill        |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| MUGEN COATING                  |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| ∞                              | 2               | 30°                    | Side         | Slot         | -            | -        | 3D         | -          | -              | -                | ○                 | ○                | ○                      | -                    | ○                    | ○           | -                    | ○          | -             | -                          | -                             | ○                   | -      | -      | - | J-014 |  |
| Solid Carbide End Mill         |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| MG                             | 2               | 30°                    | Side         | Slot         | -            | -        | 3D         | -          | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | ○           | -                    | ○          | -             | -                          | -                             | -                   | -      | -      | - | T-104 |  |
| MG                             | 2               | 35°                    | Side         | Slot         | -            | -        | 3D         | -          | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | ○           | -                    | ○          | -             | -                          | -                             | -                   | -      | -      | - | T-102 |  |
| Tapered Corner Radius End Mill |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| X COATING                      |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| X                              | 2               | 30°                    | Side         | Slot         | Face         | -        | -          | -          | -              | -                | ※1                | ※1               | ※1                     | ○                    | ○                    | ○           | -                    | ○          | -             | -                          | -                             | -                   | -      | -      | - | U-034 |  |
| X                              | 2               | 30°                    | Side         | Slot         | Face         | -        | -          | -          | -              | -                | ※1                | ※1               | ※1                     | ○                    | ○                    | ○           | -                    | ○          | -             | -                          | -                             | -                   | -      | -      | - | U-030 |  |
| Drill                          |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| MUGEN COATING PREMIUM          |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| ∞ Premium                      | 2               | 20°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | -                 | -                | ○                      | -                    | -                    | -           | -                    | -          | -             | -                          | -                             | ○                   | ○      | -      | - | Q-026 |  |
| MUGEN MICRO COATING            |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| ∞ Micro                        | 2               | 30°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | -                    | -          | -             | -                          | ○                             | -                   | -      | -      | - | Q-012 |  |
| ∞ Micro                        | 2               | 30°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | -                    | -          | -             | -                          | ○                             | -                   | -      | -      | - | Q-008 |  |
| ∞ Micro                        | 2               | 30°                    | -            | -            | -            | -        | -          | Drill      | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | -           | -                    | -          | -             | -                          | ○                             | -                   | -      | -      | - | Q-016 |  |
| MUGEN COATING                  |                 |                        |              |              |              |          |            |            |                |                  |                   |                  |                        |                      |                      |             |                      |            |               |                            |                               |                     |        |        |   |       |  |
| ∞                              | 2               | 20°/30°<br>(D0.5/D1.0) | -            | -            | -            | -        | -          | Flat Drill | -              | -                | ○                 | ○                | ○                      | ○                    | ○                    | ○           | -                    | -          | -             | -                          | -                             | -                   | -      | -      | - | Q-004 |  |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Photo                                                                               | Product Name                                     | Model  | Size                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------|--------|---------------------------|
| Drill                                                                               |                                                  |        |                           |
| MUGEN COATING                                                                       |                                                  |        |                           |
|    | Miniature Drill                                  | MDR-R  | φ0.1 ~ φ1                 |
|    | Point Drill (Drill for Guide Hole)               | MDR-PD | φ0.1 ~ φ1                 |
| Micro Drill                                                                         |                                                  |        |                           |
|    | Micro Drill                                      | NSMD   | φ0.01 ~ φ0.1              |
|    | Micro Drill Short                                | NSMD-S | φ0.01 ~ φ0.05             |
|    | Micro Point Drill (Drill for Guide Hole)         | NSPD   | φ0.01 ~ φ0.1              |
| Thread Mill                                                                         |                                                  |        |                           |
| MUGEN COATING PREMIUM                                                               |                                                  |        |                           |
|  | Thread Cutting Tool (Unify: for Internal Thread) | MMTU   | No.0-80UNF<br>~ 1/4-28UNF |
| MUGEN COATING                                                                       |                                                  |        |                           |
|  | M-Thread Mill (for Internal Thread)              | MMTM   | M1 ~ M6                   |
|  | Micro Thread Cutting Tool (for Internal Thread)  | MMTS   | S0.1 ~ S1.4               |
| Chamfering                                                                          |                                                  |        |                           |
| C Chamfering Cutter                                                                 |                                                  |        |                           |
|  | MUGEN COATING Chamfer Cutter                     | NSCV-M | φ4<br>φ6                  |
|  | Chamfer Cutter                                   | NSCV   | φ4<br>φ6                  |
| Inner Radius Cutter                                                                 |                                                  |        |                           |
|  | MUGEN COATING 2-Flute Inner Radius Cutter        | MIR200 | R0.1 ~ R5                 |
|  | 2-Flute Inner Radius Cutter for Nonferrous       | DIR    | R0.1 ~ R5                 |
|  | 2-Flute Inner Radius Cutter                      | NCR-2  | R0.5 ~ R5                 |
|  | X COATING 2-Flute Inner Radius Cutter            | NCR-2X | R0.5 ~ R3                 |

| Material • Coating                                                                    | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Drilling                                                                            | Thread Milling                                                                        | C • R Chamfering                                                                      | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       | Page |  |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------|--------------|--------------|----------|------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------|------|--|
|                                                                                       |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       | P                                                                                     | P                                                                                     | P                                                                                     | M                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | S                                                                                     | H                                                                                     |                                                                                       |                                                                                       |       |      |  |
|                                                                                       |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       | Carbon Steel                                                                          | Alloy Steel                                                                           | Prehardened Steel                                                                     | Stainless Steel                                                                       | Aluminium Alloy                                                                       | Copper                                                                                | Copper Tungsten                                                                       | Resin                                                                                 | Graphite                                                                              | Hard Brittle Material                                                                 | Heat Resistant Alloy etc                                                              | Hardened Steel                                                                        |                                                                                       |                                                                                       |       |      |  |
|                                                                                       |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |       |      |  |
| Drill                                                                                 |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
|    |    |    | -            | -            | -            | -        | -          |  | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | Q-020 |      |  |
|    |    |    | -            | -            | -            | -        | -          |  | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | Q-024 |      |  |
| Micro Drill                                                                           |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
|    |    |    | -            | -            | -            | -        | -          |  | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | Q-014 |      |  |
|    |    |    | -            | -            | -            | -        | -          |  | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | Q-010 |      |  |
|    |    |    | -            | -            | -            | -        | -          |  | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | Q-018 |      |  |
| Thread Mill                                                                           |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
| MUGEN COATING PREMIUM                                                                 |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
|   |   |   | -            | -            | -            | -        | -          | -                                                                                   |   | -                                                                                     |   |   |   |   |   |   |   |   |   |   |   |   |   |   | R-006 |      |  |
| MUGEN COATING                                                                         |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
|  |  |  | -            | -            | -            | -        | -          | -                                                                                   |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  | R-004 |      |  |
|  |  |                                                                                       | -            | -            | -            | -        | -          | -                                                                                   |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  | R-008 |      |  |
| Chamfering                                                                            |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
| C Chamfering Cutter                                                                   |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
|  |  | -                                                                                     | -            | -            | -            | -        | -          | -                                                                                   | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | S-008 |      |  |
|  |  | -                                                                                     | -            | -            | -            | -        | -          | -                                                                                   | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | S-006 |      |  |
| Inner Radius Cutter                                                                   |                                                                                       |                                                                                       |              |              |              |          |            |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |      |  |
|  |  | -                                                                                     | -            | -            | -            | -        | -          | -                                                                                   | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | S-004 |      |  |
|  |  | -                                                                                     | -            | -            | -            | -        | -          | -                                                                                   | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T-110 |      |  |
|  |  | -                                                                                     | -            | -            | -            | -        | -          | -                                                                                   | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T-108 |      |  |
|  |  | -                                                                                     | -            | -            | -            | -        | -          | -                                                                                   | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | U-036 |      |  |

| Model      | Shape                     | Size       | Material Coating | Number of Flute | Side Milling                                                                        | Slot Milling                                                                        | Face Milling                                                                        | Plunging                                                                            | 3D Milling                                                                          | Work Material     |                  |                        |                      |                     |             |               |            |               |                            |                               | Page |                |        |        |
|------------|---------------------------|------------|------------------|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------|------------------|------------------------|----------------------|---------------------|-------------|---------------|------------|---------------|----------------------------|-------------------------------|------|----------------|--------|--------|
|            |                           |            |                  |                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P<br>Carbon Steel | P<br>Alloy Steel | P<br>Prehardened Steel | M<br>Stainless Steel | N<br>Aluminum Alloy | N<br>Copper | N<br>Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc |      | Hardened Steel |        |        |
|            |                           |            |                  |                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                   |                  |                        |                      |                     |             |               |            |               |                            |                               |      | H              | 55 HRC | 65 HRC |
|            |                           |            |                  |                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                   |                  |                        |                      |                     |             |               |            |               |                            |                               |      |                |        |        |
| AL-3LS     | Square                    | φ5 ~ φ12   | WC               | 3               |    |    |    | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-022          |        |        |
| AL2D-2     | Square                    | φ0.5 ~ φ12 | WC               | 2               |    |    |    | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-004          |        |        |
| AL2D-2DLC  | Square                    | φ0.5 ~ φ12 | DLC              | 2               |    |    |    | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-006          |        |        |
| AL3D-2     | Square                    | φ1 ~ φ12   | WC               | 2               |    |    |    | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-008          |        |        |
| AL3D-2DLC  | Square                    | φ1 ~ φ12   | DLC              | 2               |    |    |    | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-010          |        |        |
| AL3D-345   | Square                    | φ1 ~ φ12   | WC               | 3               |    |    |    |    | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | K-012<br>L-020 |        |        |
| AL4D-2     | Square                    | φ1 ~ φ12   | WC               | 2               |   | -                                                                                   |   | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-012          |        |        |
| AL4D-2DLC  | Square                    | φ1 ~ φ12   | DLC              | 2               |  | -                                                                                   |  | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-014          |        |        |
| AL5D-2     | Square                    | φ1 ~ φ12   | WC               | 2               |  | -                                                                                   |  | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-016          |        |        |
| AL5D-2DLC  | Square                    | φ1 ~ φ12   | DLC              | 2               |  | -                                                                                   |  | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-018          |        |        |
| ALB225     | Ball / Long Neck Ball     | R0.3 ~ R6  | WC               | 2               | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |  | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-030          |        |        |
| ALB225-DLC | Ball / Long Neck Ball     | R0.3 ~ R6  | DLC              | 2               | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |  | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | L-032          |        |        |
| ALZ345     | Square / Long Neck Square | φ1 ~ φ12   | WC               | 3               |  |  |  |  | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | K-020<br>L-024 |        |        |
| ALZ345-DLC | Long Neck Square          | φ1 ~ φ12   | DLC              | 3               |  |  |  |  | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | ○             | -          | -             | -                          | -                             | -    | K-018<br>L-028 |        |        |
| CED100     | Long Neck Square          | φ0.1 ~ φ2  | SCD              | 1               | -                                                                                   | -                                                                                   |  | -                                                                                   | -                                                                                   | -                 | -                | -                      | ○                    | ○                   | -           | -             | ○          | -             | -                          | -                             | -    | U-008          |        |        |
| DB         | Ball                      | R0.5 ~ R10 | SMG              | 2               | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |  | -                 | -                | -                      | ○※1                  | ○※1                 | -           | ○※1           | -          | -             | -                          | -                             | -    | T-094          |        |        |
| DCHR230    | Long Neck Square          | φ0.5 ~ φ6  | DIA              | 2               |  |  |  | -                                                                                   | -                                                                                   | -                 | -                | -                      | -                    | -                   | -           | ○             | -          | -             | -                          | -                             | -    | P-006          |        |        |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Model   | Shape                   | Size                                  | Material Coating | Number of Flute | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Work Material |             |                   |                 |                |        |          |       |          |                       |                          | Page  |                |        |  |
|---------|-------------------------|---------------------------------------|------------------|-----------------|--------------|--------------|--------------|----------|------------|---------------|-------------|-------------------|-----------------|----------------|--------|----------|-------|----------|-----------------------|--------------------------|-------|----------------|--------|--|
|         |                         |                                       |                  |                 |              |              |              |          |            | P             | P           | M                 | N               | N              | N      | N        | N     | S        | H                     |                          |       |                |        |  |
|         |                         |                                       |                  |                 |              |              |              |          |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Tungsten | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc |       | Hardened Steel |        |  |
|         |                         |                                       |                  |                 |              |              |              |          |            |               |             |                   |                 |                |        |          |       |          |                       | 55 HRC                   |       | 65 HRC         | 70 HRC |  |
| DCMB    | Ball / Long Neck Ball   | R0.1 ~ R1                             | DIA              | 2               | -            | -            | -            | -        | 3D         | -             | -           | -                 | -               | -              | -      | -        | ○     | -        | -                     | -                        | O-006 |                |        |  |
| DCMS    | Long Neck Square        | φ0.3 ~ φ2                             | DIA              | 6<br>8<br>10    | -            | -            | Face         | -        | -          | -             | -           | -                 | -               | -              | -      | -        | ○     | -        | -                     | -                        | O-004 |                |        |  |
| DCRB230 | Long Neck Ball          | R0.2 ~ R3                             | DIA              | 2               | -            | -            | -            | -        | 3D         | -             | -           | -                 | -               | -              | -      | -        | ○     | -        | -                     | -                        | P-008 |                |        |  |
| DCSE235 | Square                  | φ0.5 ~ φ6                             | DIA              | 2               | Side         | Slot         | Face         | -        | -          | -             | -           | -                 | -               | -              | -      | -        | ○     | -        | -                     | -                        | P-004 |                |        |  |
| DHB     | Long Neck Ball          | R0.5 ~ R6                             | SMG              | 2               | -            | -            | -            | -        | 3D         | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-096 |                |        |  |
| DHR237  | Long Neck Square        | φ0.1 ~ φ6                             | DLC              | 2               | Side         | Slot         | Face         | -        | -          | -             | -           | -                 | ○               | ○              | ○      | ○        | -     | -        | -                     | -                        | M-004 |                |        |  |
| DHR237R | Long Neck Corner Radius | φ0.2 × R0.02 ~ φ6 × R1                | DLC              | 2               | Side         | Slot         | Face         | -        | -          | -             | -           | -                 | ○               | ○              | ○      | ○        | -     | -        | -                     | -                        | M-014 |                |        |  |
| DHS     | Square                  | φ6 ~ φ20                              | SMG              | 3               | Side         | Slot         | Face         | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | U-006 |                |        |  |
| DIR     | Chamfering              | R0.1 ~ R5                             | SMG              | 2               | -            | -            | -            | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-110 |                |        |  |
| DRB230  | Long Neck Ball          | R0.05 ~ R3                            | DLC              | 2               | -            | -            | -            | -        | 3D         | -             | -           | -                 | -               | ○              | ○      | ○        | ○     | -        | -                     | -                        | M-008 |                |        |  |
| DSF     | Long Neck Square        | φ1 ~ φ20                              | SMG              | 1               | -            | -            | Face         | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-060 |                |        |  |
| DTE     | Tapered Square          | φ1×taper angle30° ~ φ10×taper angle5° | SMG              | 2               | Side         | Slot         | -            | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-080 |                |        |  |
| DTEL    | Tapered Square          | φ1×taper angle30° ~ φ8×taper angle5°  | SMG              | 2               | Side         | Slot         | -            | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-082 |                |        |  |
| DX      | Square                  | φ0.5 ~ φ20                            | SMG              | 2               | Side         | Slot         | Face         | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-052 |                |        |  |
| DXL     | Square                  | φ3 ~ φ20                              | SMG              | 2               | Side         | -            | Face         | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-056 |                |        |  |
| DXM     | Square                  | φ3 ~ φ20                              | SMG              | 2               | Side         | -            | Face         | -        | -          | -             | -           | -                 | ○※1             | ○※1            | -      | ○※1      | -     | -        | -                     | -                        | T-054 |                |        |  |
| MACH225 | Long Neck Ball          | R0.1 ~ R3                             | ∞ Premium        | 2               | -            | -            | -            | -        | 3D         | -             | ○           | ○                 | -               | -              | -      | -        | -     | ○        | ○                     | ○                        | G-026 |                |        |  |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Model     | Shape                   | Size                       | Material Coating                                                                    | Number of Flute                                                                     | Side Milling                                                                        | Slot Milling                                                                        | Face Milling                                                                        | Plunging | 3D Milling                                                                        | Work Material                                                                       |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                               |                                                                                       |                                                                                       |                                                                                       | Page |       |       |
|-----------|-------------------------|----------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------|-------|-------|
|           |                         |                            |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |          |                                                                                   | P<br>Carbon Steel                                                                   | P<br>Alloy Steel                                                                     | M<br>Stainless Steel<br>Prehardened Steel                                             | N<br>Aluminum Alloy                                                                   | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material                                                            | S<br>Heat Resistant Alloy etc | H                                                                                     |                                                                                       |                                                                                       |      |       |       |
|           |                         |                            |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |          |                                                                                   |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                               | Hardened Steel                                                                        |                                                                                       |                                                                                       |      |       |       |
|           |                         |                            |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |          |                                                                                   |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                               | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |      |       |       |
| MACH225SF | Long Neck Ball          | R0.1 ~ R3                  |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -                                                                                   | -                                                                                    |      |     |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             |    |    |    | -    | G-024 |       |
| MDR-PD    | Drill                   | φ0.1 ~ φ1                  |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -        | -                                                                                 |    |    |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     | -                                                                                     | -                                                                                     | -    | -     | Q-024 |
| MDR-R     | Drill                   | φ0.1 ~ φ1                  |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -        | -                                                                                 |    |    |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     | -                                                                                     | -                                                                                     | -    | -     | Q-020 |
| MFD       | Flat Drill              | φ0.1 ~ φ6                  |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -        | -                                                                                 |    |    |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     | -                                                                                     | -                                                                                     | -    | -     | Q-004 |
| MHD445    | Square                  | φ1 ~ φ4                    |    |    |    |    |    | -        | -                                                                                 | -                                                                                   | -                                                                                    |      | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     |    | -                                                                                     | -    | -     | H-052 |
| MHD645    | Square                  | φ5 ~ φ12                   |    |    |    |    |    | -        | -                                                                                 | -                                                                                   | -                                                                                    |      | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     |    | -                                                                                     | -    | -     | H-054 |
| MHDH445   | Square                  | φ1 ~ φ4                    |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  |  | -    | -     | F-020 |
| MHDH445R  | Corner Radius           | φ3 × R0.2 ~ φ4 × R0.5      |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  |  | -    | -     | F-028 |
| MHDH645   | Square                  | φ5 ~ φ12                   |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  |  | -    | -     | F-022 |
| MHDH645R  | Corner Radius           | φ5 × R0.2 ~ φ12 × R2       |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  |  | -    | -     | F-030 |
| MHR230    | Long Neck Square        | φ0.1 ~ φ6                  |  |  |  |  |  | -        | -                                                                                 |  |  |  |  |  |  |  | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  | -                                                                                     | -    | I-004 |       |
| MHR230R   | Long Neck Corner Radius | φ0.2 × R0.05 ~ φ6 × R1     |  |  |  |  |  | -        | -                                                                                 |  |  |  |  |  |  |  | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  | -                                                                                     | -    | I-058 |       |
| MHR430    | Long Neck Square        | φ1 ~ φ10                   |  |  |  |  |  | -        | -                                                                                 |  |  |  |  |  |  |  | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  | -                                                                                     | -    | I-016 |       |
| MHR430R   | Long Neck Corner Radius | φ1 × R0.05 ~ φ6 × R1       |  |  |  |  |  | -        | -                                                                                 |  |  |  |  |  |  |  | -                                                                                     | -                                                                                     | -                             | -                                                                                     |  | -                                                                                     | -    | I-072 |       |
| MHRH230   | Long Neck Square        | φ0.1 ~ φ3                  |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    |   |  |  |  |  |  | -                             |  |  |  | -    | G-004 |       |
| MHRH230R  | Long Neck Corner Radius | φ0.2 × R0.02 ~ φ0.9 × R0.1 |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    |   |  |  |  |  |  | -                             |  |  |  | -    | G-040 |       |
| MHRH430   | Long Neck Square        | φ1 ~ φ6                    |  |  |  |  |  | -        | -                                                                                 | -                                                                                   | -                                                                                    |    |   |  |  |  |  |  | -                             |  |  |  | -    | G-010 |       |

| Model      | Shape                   | Size                                                                                              | Material Coating                                                                      | Number of Flute                                                                                                                                                            | Side Milling                                                                        | Slot Milling                                                                          | Face Milling                                                                        | Plunging | 3D Milling                                                                            | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |          |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Page  |       |
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|            |                         |                                                                                                   |                                                                                       |                                                                                                                                                                            |                                                                                     |                                                                                       |                                                                                     |          |                                                                                       | P                                                                                     | P                                                                                     | M                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N     | S        | H                                                                                     |                                                                                       |                                                                                       |                                                                                       |       |       |
|            |                         |                                                                                                   |                                                                                       |                                                                                                                                                                            |                                                                                     |                                                                                       |                                                                                     |          |                                                                                       | Carbon Steel                                                                          | Alloy Steel                                                                           | Prehardened Steel                                                                     | Stainless Steel                                                                       | Aluminum Alloy                                                                        | Copper                                                                                | Copper Tungsten                                                                       | Resin | Graphite | Hard Brittle Material                                                                 | Heat Resistant Alloy etc                                                              | Hardened Steel                                                                        |                                                                                       |       |       |
|            |                         |                                                                                                   |                                                                                       |                                                                                                                                                                            |                                                                                     |                                                                                       |                                                                                     |          |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |       |          |                                                                                       | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |       |       |
| MHRH430R   | Long Neck Corner Radius | $\varphi 0.1 \times R0.01 \sim \varphi 6 \times R1$                                               |    |                                                                                         |  |    |  | -        | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    | -                                                                                     | -                                                                                     | -     | -        | -                                                                                     |    |    |    | -     | G-044 |
| MHRLN230-6 | Long Neck Square        | $\varphi 0.3 \sim \varphi 2$                                                                      |    |                                                                                         |  |    |  | -        | -                                                                                     |    |    |    |    |    |    | -                                                                                     | -     | -        | -                                                                                     |    | -                                                                                     | -                                                                                     | I-024 |       |
| MIR200     | Chamfering              | R0.1 ~ R5                                                                                         |    |                                                                                         | -                                                                                   | -                                                                                     | -                                                                                   | -        | -                                                                                     |    |    |    |    |    |    | -                                                                                     | -     | -        | -                                                                                     |    | -                                                                                     | -                                                                                     | S-004 |       |
| MMTM       | Thread Mill             | M1 ~ M6                                                                                           |    | <br> | -                                                                                   | -                                                                                     | -                                                                                   | -        | -                                                                                     |    |    |    |    |    |    | -                                                                                     | -     | -        | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | R-004 |       |
| MMTS       | Thread Mill             | S0.1 ~ S1.4                                                                                       |    |                                                                                         | -                                                                                   | -                                                                                     | -                                                                                   | -        | -                                                                                     |    |    |    |    |    |    | -                                                                                     | -     | -        | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | R-008 |       |
| MMTU       | Thread Mill             | No.0-80UNF ~ 1/4-28UNF                                                                            |    | <br> | -                                                                                   | -                                                                                     | -                                                                                   | -        | -                                                                                     |    |    |    |    |    |    | -                                                                                     | -     | -        |    | -                                                                                     | -                                                                                     | -                                                                                     | R-006 |       |
| MRB230     | Long Neck Ball          | R0.05 ~ R3                                                                                        |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  |  |  |  |  |  |  |  | -     | -        | -                                                                                     |  | -                                                                                     | -                                                                                     | I-026 |       |
| MRB230SF   | Long Neck Ball          | R0.1 ~ R1.5                                                                                       |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  |  |  |  |  |  |  |  | -     | -        | -                                                                                     |  | -                                                                                     | -                                                                                     | I-038 |       |
| MRBH230    | Long Neck Ball          | R0.05 ~ R3                                                                                        |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  | -                                                                                     | -                                                                                     |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -     | -        |  |  |  | -                                                                                     | G-014 |       |
| MRBLN230-6 | Long Neck Ball          | R0.15 ~ R1                                                                                        |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  |  |  |  |  |  |  |  | -     | -        | -                                                                                     |  | -                                                                                     | -                                                                                     | I-042 |       |
| MRBSH230SF | Long Neck Ball          | R0.05 ~ R3                                                                                        |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -     | -        | -                                                                                     |  |  |  | E-006 |       |
| MRBSH330   | Long Neck Ball          | R0.1 ~ R1                                                                                         |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -     | -        | -                                                                                     |  |  |  | E-010 |       |
| MRBTN230   | Long Neck Tapered Ball  | $R0.1 \times \text{neck taper angle} 30^\circ \sim R2 \times \text{neck taper angle} 1^\circ$     |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  |  |  |  |  |  |  |  | -     | -        | -                                                                                     |  | -                                                                                     | -                                                                                     | I-044 |       |
| MRBTN230L  | Long Neck Tapered Ball  | $R0.1 \times \text{neck taper angle} 30^\circ \sim R5 \times \text{neck taper angle} 1^\circ 30'$ |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  |  |  |  |  |  |  |  | -     | -        | -                                                                                     |  | -                                                                                     | -                                                                                     | I-054 |       |
| MRBTNH230  | Long Neck Tapered Ball  | $R0.05 \times \text{neck taper angle} 30^\circ \sim R2 \times \text{neck taper angle} 1^\circ$    |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  | -                                                                                     | -                                                                                     |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -     | -        |  |  |  | -                                                                                     | G-028 |       |
| MRBTNH345  | Long Neck Tapered Ball  | $R0.5 \times \text{neck taper angle} 30^\circ \sim R2 \times \text{neck taper angle} 1^\circ$     |  |                                                                                       | -                                                                                   | -                                                                                     | -                                                                                   | -        |  | -                                                                                     | -                                                                                     |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -     | -        |  |  |  | -                                                                                     | G-036 |       |
| MRT425     | Tapered Square          | $\varphi 0.2 \times \text{taper angle} 30^\circ \sim \varphi 3 \times \text{taper angle} 2^\circ$ |  |                                                                                       | -                                                                                   |  | -                                                                                   | -        | -                                                                                     |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -     | -        | -                                                                                     |  | -                                                                                     | -                                                                                     | J-010 |       |



| Model       | Shape            | Size        | Material Coating                                                                    | Number of Flute                                                                     | Side Milling                                                                        | Slot Milling                                                                        | Face Milling                                                                        | Plunging                                                                            | 3D Milling                                                                          | Work Material                                                                       |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |           | Page |
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|             |                  |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P<br>Carbon Steel                                                                   | P<br>Alloy Steel                                                                    | M<br>Stainless Steel                                                                | N<br>Aluminum Alloy                                                                  | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material                                                            | S<br>Heat Resistant Alloy etc                                                         | H<br>Hardened Steel                                                                   |                                                                                       |           |      |
|             |                  |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | 55<br>HRC                                                                             | 65<br>HRC                                                                             | 70<br>HRC |      |
|             |                  |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |           |      |
| MSB230      | Ball             | R0.05 ~ R10 |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | H-056     |      |
| MSB230G2    | Ball             | R0.05 ~ R3  |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | H-062     |      |
| MSB230S     | Ball             | R0.1 ~ R6   |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | H-064     |      |
| MSB230SF    | Ball             | R0.1 ~ R6   |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | H-068     |      |
| MSB345      | Ball             | R0.5 ~ R6   |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | H-060     |      |
| MSBH230     | Ball             | R0.05 ~ R6  |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | F-024     |      |
| MSBH345     | Ball             | R0.5 ~ R3   |    |    | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | F-026     |      |
| MSBL230     | Ball             | R0.1 ~ R5   |   |   | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |   |   |   |   |   |   |   |   |   |   |   |   |   | H-072     |      |
| MSBSH330-5X | Ball             | R0.1 ~ R1   |  |  | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  | E-004     |      |
| MSBXL230    | Ball             | R0.5 ~ R5   |  |  | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  | H-073     |      |
| MSCZ440     | Square           | φ1 ~ φ6     |  |  |  |  |  |  | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | K-006     |      |
| MSCZ440-LN  | Long Neck Square | φ1 ~ φ6     |  |  |  |  |  |  | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | K-016     |      |
| MSDH        | Drill            | φ0.1 ~ φ1   |  |  | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | Q-026     |      |
| MSE230      | Square           | φ0.1 ~ φ12  |  |  |  |  |  | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | H-032     |      |
| MSE230M     | Square           | φ0.1 ~ φ6   |  |  |  |  |  | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | H-038     |      |
| MSE230SS    | Square           | φ0.1 ~ φ6   |  |  |  |  |  | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | H-026     |      |
| MSE245      | Square           | φ2 ~ φ12    |  |  |  |  |  | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  | H-040     |      |

| Model       | Shape                           | Size                                                                                                                                | Material Coating                                                                      | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging                                                                              | 3D Milling                                                                            | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |           | Page |
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|             |                                 |                                                                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | P<br>Carbon Steel                                                                     | P<br>Alloy Steel                                                                      | M<br>Stainless Steel                                                                  | N<br>Aluminum Alloy                                                                   | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material                                                            | S<br>Heat Resistant Alloy etc                                                         | H<br>Hardened Steel                                                                   |                                                                                       |           |      |
|             |                                 |                                                                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | 55<br>HRC                                                                             | 65<br>HRC                                                                             | 70<br>HRC |      |
|             |                                 |                                                                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |           |      |
| MSE345      | Square                          | $\varphi 3 \sim \varphi 20$                                                                                                         |    |    |    |    |    | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    | H-042     |      |
| MSE430      | Square                          | $\varphi 1 \sim \varphi 20$                                                                                                         |    |    |    | -                                                                                     |    | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    | H-046     |      |
| MSE430P     | Square                          | $\varphi 1 \sim \varphi 12$                                                                                                         |    |    |    | -                                                                                     |    | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    | H-044     |      |
| MSE445      | Square                          | $\varphi 2 \sim \varphi 20$                                                                                                         |    |    |    | -                                                                                     |    | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    | H-048     |      |
| MSEM230     | Square                          | $\varphi 0.5 \sim \varphi 12$                                                                                                       |    |    |    | -                                                                                     |    | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    | H-036     |      |
| MSEM430     | Square                          | $\varphi 1 \sim \varphi 20$                                                                                                         |    |    |    | -                                                                                     |    | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    | H-050     |      |
| MSES230P    | Square                          | $\varphi 0.1 \sim \varphi 12$                                                                                                       |   |   |   |   |   | -                                                                                     | -                                                                                     |   |   |   |   |   |   |   |   |   |   |   |   | H-030     |      |
| MSRS230     | Corner Radius                   | $\varphi 1 \times R0.1 \sim \varphi 6 \times R2$                                                                                    |  |  |  |  |  | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | H-074     |      |
| MSRS430     | Corner Radius                   | $\varphi 1 \times R0.1 \sim \varphi 12 \times R3$                                                                                   |  |  |  |  |  | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | H-076     |      |
| MSTNR230    | Long Neck Tapered Corner Radius | $\varphi 0.2 \times R0.05 \times \text{neck taper angle} 1^\circ \sim \varphi 3 \times R0.5 \times \text{neck taper angle} 1^\circ$ |  |  |  |  |  | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | I-078     |      |
| MSUSZ440    | Square                          | $\varphi 1 \sim \varphi 6$                                                                                                          |  |  |  |  |  |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | K-004     |      |
| MSUSZ440-LN | Long Neck Square                | $\varphi 1 \sim \varphi 6$                                                                                                          |  |  |  |  |  |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | K-014     |      |
| MSX440      | Corner Radius                   | $\varphi 3 \times R0.2 \sim \varphi 20 \times R1$                                                                                   |  |  |  |  |  | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | K-026     |      |
| MSXH440R    | Corner Radius                   | $\varphi 3 \times R0.3 \sim \varphi 12 \times R2$                                                                                   |  |  |  |  |  | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | K-024     |      |
| MSZ345      | Square                          | $\varphi 1 \sim \varphi 12$                                                                                                         |  |  |  |  |  |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | K-008     |      |
| MTB230      | Tapered Ball                    | $R0.1 \times \text{taper angle} 1^\circ \sim R2 \times \text{taper angle} 15^\circ$                                                 |  |  |  |  | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  | J-014     |      |
| MTE230      | Tapered Square                  | $\varphi 0.2 \times \text{taper angle} 30^\circ \sim \varphi 10 \times \text{taper angle} 5^\circ$                                  |  |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  | J-004     |      |

| Model   | Shape  | Size       | Material Coating |   | Number of Flute                                                                     | Side Milling                                                                        | Slot Milling                                                                        | Face Milling | Plunging | 3D Milling                                                                          | Work Material                                                                       |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Page  |  |
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|         |        |            |                  |   |                                                                                     |                                                                                     |                                                                                     |              |          |                                                                                     | P                                                                                   | P                                                                                   | M                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | S                                                                                     | H                                                                                     |                                                                                       |                                                                                       |                                                                                       |       |  |
|         |        |            |                  |   |                                                                                     |                                                                                     |                                                                                     |              |          |                                                                                     | Carbon Steel                                                                        | Alloy Steel                                                                         | Prehardened Steel                                                                     | Stainless Steel                                                                       | Aluminum Alloy                                                                        | Copper                                                                                | Copper Tungsten                                                                       | Resin                                                                                 | Graphite                                                                              | Hard Brittle Material                                                                 | Heat Resistant Alloy etc                                                              | Hardened Steel                                                                        |                                                                                       |       |  |
|         |        |            |                  |   |                                                                                     |                                                                                     |                                                                                     |              |          |                                                                                     |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |       |  |
| MX225   | Square | φ0.3 ~ φ12 | ∞                | 2 |    |    |    | -            | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-006 |  |
| MX230   | Square | φ0.1 ~ φ12 | ∞                | 2 |    |    |    | -            | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-008 |  |
| MX235   | Square | φ0.1 ~ φ12 | ∞                | 2 |    |    |    | -            | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-010 |  |
| MX240   | Square | φ0.3 ~ φ12 | ∞                | 2 |    | -                                                                                   |    | -            | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-012 |  |
| MX245   | Square | φ0.3 ~ φ12 | ∞                | 2 |    | -                                                                                   |    | -            | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-014 |  |
| MX425   | Square | φ1 ~ φ12   | ∞                | 4 |    | -                                                                                   |    | -            | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    | H-016 |  |
| MX430   | Square | φ1 ~ φ12   | ∞                | 4 |   | -                                                                                   |   | -            | -        |   |   |   |   |   |   |   |   |   |   |   |   |   |   | H-018 |  |
| MX435   | Square | φ1 ~ φ12   | ∞                | 4 |  | -                                                                                   |  | -            | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  | H-020 |  |
| MX440   | Square | φ1 ~ φ12   | ∞                | 4 |  | -                                                                                   |  | -            | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  | H-022 |  |
| MX445   | Square | φ1 ~ φ12   | ∞                | 4 |  | -                                                                                   |  | -            | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  | H-024 |  |
| MXH225  | Square | φ0.1 ~ φ6  | ∞ Premium        | 2 |  |  |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-004 |  |
| MXH225P | Square | φ0.1 ~ φ6  | ∞ Premium        | 2 |  | -                                                                                   |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-014 |  |
| MXH230  | Square | φ0.1 ~ φ6  | ∞ Premium        | 2 |  |  |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-006 |  |
| MXH230P | Square | φ0.1 ~ φ6  | ∞ Premium        | 2 |  | -                                                                                   |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-016 |  |
| MXH235  | Square | φ0.1 ~ φ6  | ∞ Premium        | 2 |  |  |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-008 |  |
| MXH235P | Square | φ0.1 ~ φ6  | ∞ Premium        | 2 |  | -                                                                                   |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-018 |  |
| MXH240  | Square | φ0.3 ~ φ6  | ∞ Premium        | 2 |  | -                                                                                   |  | -            | -        | -                                                                                   | -                                                                                   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  | F-010 |  |

| Model   | Shape      | Size        | Material Coating                                                                      | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                          | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                            |                                                                                     |                                                                                     |        |        | Page  |
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|         |            |             |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                     | P<br>Carbon Steel                                                                     | P<br>Alloy Steel                                                                      | M<br>Stainless Steel<br>Prehardened Steel                                             | N<br>Aluminum Alloy                                                                   | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                          | N<br>Graphite                                                                         | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc                                                       | H                                                                                   |        |        |       |
|         |            |             |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                            |                                                                                     | Hardened Steel                                                                      |        |        |       |
|         |            |             |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                       |                            |                                                                                     | 55 HRC                                                                              | 65 HRC | 70 HRC |       |
| MXH245  | Square     | φ0.3 ~ φ6   |    |    |    | -                                                                                     |    | -        | -                                                                                   | -                                                                                     | -                                                                                     |    |    | -                                                                                     | -                                                                                     | -                                                                                   | -                                                                                     | -                          |  |  | -      | -      | F-012 |
| NC-2    | Square     | φ0.5 ~ φ20  |    |    |    |    |    | -        | -                                                                                   |    |    |    |    |    |    | -                                                                                   |    | -                          | -                                                                                   | -                                                                                   | -      | -      | T-026 |
| NC-4    | Square     | φ1 ~ φ20    |    |    |    | -                                                                                     |    | -        | -                                                                                   |    |    |    |    |    | -                                                                                     |  | -                                                                                     | -                          | -                                                                                   | -                                                                                   | -      | -      | T-034 |
| NC-LS-2 | Square     | φ1 ~ φ12    |    |    |    | -                                                                                     |    | -        | -                                                                                   |    |    |    |    |    | -                                                                                     |  | -                                                                                     | -                          | -                                                                                   | -                                                                                   | -      | -      | T-032 |
| NCB-2   | Ball       | R0.2 ~ R0.9 |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -        |  |    |    |    |    |    |    | -                                                                                   |    | -                          | -                                                                                   | -                                                                                   | -      | -      | T-086 |
| NCB-2X  | Ball       | R0.2 ~ R0.9 |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -        |  |    |    |    |    |    |    | -                                                                                   |    | -                          | -                                                                                   | -                                                                                   | -      | -      | U-024 |
| NCL-2   | Square     | φ1 ~ φ12    |   |   |   | -                                                                                     |   | -        | -                                                                                   |   |   |   |   |   |   | -                                                                                   |   | -                          | -                                                                                   | -                                                                                   | -      | -      | T-030 |
| NCL-4   | Square     | φ2 ~ φ12    |  |  |  | -                                                                                     |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-040 |
| NCM-2   | Square     | φ0.5 ~ φ20  |  |  |  |  |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-028 |
| NCM-4   | Square     | φ1 ~ φ20    |  |  |  | -                                                                                     |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-038 |
| NCR-2   | Chamfering | R0.5 ~ R5   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-108 |
| NCR-2X  | Chamfering | R0.5 ~ R3   |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | U-036 |
| NE-2    | Square     | φ1 ~ φ20    |  |  |  |  |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-042 |
| NE-3    | Square     | φ3 ~ φ20    |  |  |  |  |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-044 |
| NE-4    | Square     | φ3 ~ φ20    |  |  |  | -                                                                                     |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-048 |
| NEA-2   | Square     | φ3 ~ φ25    |  |  |  |  |  | -        | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-058 |
| NEL-3   | Square     | φ6 ~ φ20    |  |  |  | -                                                                                     |  | -        | -                                                                                   |  |  |  |  |  |  | -                                                                                   |  | -                          | -                                                                                   | -                                                                                   | -      | -      | T-046 |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Model   | Shape                 | Size                                                                                                | Material Coating                                                                    | Number of Flute | Side Milling                                                                      | Slot Milling                                                                        | Face Milling                                                                      | Plunging | 3D Milling                                                                          | Work Material                                                                       |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Page                                                                                  |                                                                                       |                                                                                     |       |
|---------|-----------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|
|         |                       |                                                                                                     |                                                                                     |                 |                                                                                   |                                                                                     |                                                                                   |          |                                                                                     | P<br>Carbon Steel                                                                   | P<br>Alloy Steel                                                                    | P<br>Prehardened Steel                                                              | M<br>Stainless Steel                                                                  | N<br>Aluminum Alloy                                                                   | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material                                                            | S<br>Heat Resistant Alloy etc                                                         | Hardened Steel                                                                        |                                                                                       |                                                                                       |                                                                                       |                                                                                     |       |
|         |                       |                                                                                                     |                                                                                     |                 |                                                                                   |                                                                                     |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | H                                                                                     | 55 HRC                                                                                |                                                                                       | 65 HRC                                                                                |                                                                                     |       |
|         |                       |                                                                                                     |                                                                                     |                 |                                                                                   |                                                                                     |                                                                                   |          |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | 70 HRC                                                                              |       |
| NER-2   | Tapered Square        | $\varphi 2 \times$ taper angle 7°<br>~ $\varphi 6 \times$ taper angle 15°                           | MG                                                                                  | 2               |  |    | -                                                                                 | -        | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  | T-084 |
| NERB-2  | Tapered Corner Radius | R1 $\times$ taper angle 10°<br>~ R3 $\times$ taper angle 20°                                        | MG                                                                                  | 2               |  |    | -                                                                                 | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | T-104                                                                               |       |
| NERR-2X | Tapered Corner Radius | $\varphi 2 \times$ taper angle 7° $\times$ R0.3<br>~ $\varphi 6 \times$ taper angle 15° $\times$ R2 | X                                                                                   | 2               |  |    |  | -        | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | U-034                                                                               |       |
| NHB-2   | Long Neck Ball        | R0.4 ~ R5                                                                                           | MG                                                                                  | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | T-098                                                                               |       |
| NHR-2   | Long Neck Square      | $\varphi 0.5 \sim \varphi 5$                                                                        | MG                                                                                  | 2               |  |    |  | -        | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | T-062                                                                               |       |
| NHR-2X  | Long Neck Square      | $\varphi 0.5 \sim \varphi 5$                                                                        | X                                                                                   | 2               |  |    |  | -        | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | U-010                                                                               |       |
| NLBL-2  | Ball                  | R0.5 ~ R10                                                                                          | MG                                                                                  | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | T-092                                                                               |       |
| NRF-4   | Tapered Square        | $\varphi 0.5 \times$ taper angle 30°<br>~ $\varphi 2 \times$ taper angle 3°                         | MG                                                                                  | 4               | -                                                                                 |  | -                                                                                 | -        | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | U-020                                                                               |       |
| NSB-2   | Ball                  | R1 ~ R10                                                                                            | MG                                                                                  | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T-088                                                                               |       |
| NSB-2X  | Ball                  | R1 ~ R10                                                                                            | X                                                                                   | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | U-026                                                                               |       |
| NSBL-2  | Ball                  | R3 ~ R10                                                                                            | MG                                                                                  | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T-090                                                                               |       |
| NSCV    | Chamfering            | $\varphi 4$<br>$\varphi 6$                                                                          | MG                                                                                  | 3               | -                                                                                 | -                                                                                   | -                                                                                 | -        | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | S-006                                                                               |       |
| NSCV-M  | Chamfering            | $\varphi 4$<br>$\varphi 6$                                                                          |  | 3               | -                                                                                 | -                                                                                   | -                                                                                 | -        | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | S-008                                                                               |       |
| NSL-2   | Square                | $\varphi 1 \sim \varphi 12$                                                                         | MG                                                                                  | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | T-050                                                                               |       |
| NSMB100 | Ball                  | R0.005 ~ R0.05                                                                                      | SMG                                                                                 | 1               | -                                                                                 | -                                                                                   | -                                                                                 | -        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | D-012                                                                               |       |
| NSMD    | Micro Drill           | $\varphi 0.01 \sim \varphi 0.1$                                                                     | SMG                                                                                 | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Q-014                                                                               |       |
| NSMD-M  | Micro Drill           | $\varphi 0.01 \sim \varphi 0.1$                                                                     |  | 2               | -                                                                                 | -                                                                                   | -                                                                                 | -        | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Q-012                                                                               |       |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Model   | Shape                 | Size                                                                                                                      | Material Coating                                                                      | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                            | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                               |                |        |        |        | Page |
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|         |                       |                                                                                                                           |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       | P<br>Carbon Steel                                                                     | P<br>Alloy Steel                                                                      | M<br>Stainless Steel                                                                  | N<br>Aluminum Alloy                                                                   | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material                                                          | S<br>Heat Resistant Alloy etc | Hardened Steel |        |        |        |      |
|         |                       |                                                                                                                           |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                               | H              | 55 HRC | 65 HRC |        |      |
|         |                       |                                                                                                                           |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |          |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                               |                |        |        | 70 HRC |      |
| NSMD-MS | Micro Drill           | $\varphi 0.01 \sim \varphi 0.05$                                                                                          |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     |    |    |    |    |    |    |    |    |  | -                             | -              | -      | Q-008  |        |      |
| NSMD-S  | Micro Drill           | $\varphi 0.01 \sim \varphi 0.05$                                                                                          |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    |    |    |    | -                                                                                   | -                             | -              | -      | Q-010  |        |      |
| NSME100 | Square                | $\varphi 0.01 \sim \varphi 0.05$                                                                                          |    |    | -                                                                                     |    |    | -        | -                                                                                     |    |    |    |    |    |    |    |    | -                                                                                   | -                             | -              | -      | D-006  |        |      |
| NSME230 | Square                | $\varphi 0.03 \sim \varphi 0.09$                                                                                          |    |    | -                                                                                     |    |    | -        | -                                                                                     |    |    |    |    |    |    |    |    | -                                                                                   | -                             | -              | -      | D-008  |        |      |
| NSPD    | Micro Drill           | $\varphi 0.01 \sim \varphi 0.1$                                                                                           |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    |    |    |    | -                                                                                   | -                             | -              | -      | Q-018  |        |      |
| NSPD-M  | Micro Drill           | $\varphi 0.01 \sim \varphi 0.1$                                                                                           |    |    | -                                                                                     | -                                                                                     | -                                                                                     | -        | -                                                                                     |    |    |    |    |    |    |    |    |  | -                             | -              | -      | Q-016  |        |      |
| NSR-2   | Corner Radius         | $\varphi 1 \times R0.2$<br>$\sim \varphi 20 \times R5$                                                                    |   |   |   |   |   | -        | -                                                                                     |   |   |   |   |   |   |   |   | -                                                                                   | -                             | -              | -      | T-106  |        |      |
| NTB-2   | Tapered Ball          | $R0.5 \times$ taper angle $30^\circ$<br>$\sim R5 \times$ taper angle $10^\circ$                                           |  |  |  |  | -                                                                                     | -        |  |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | T-102  |        |      |
| NTE-2   | Tapered Square        | $\varphi 0.5 \times$ taper angle $30^\circ$<br>$\sim \varphi 10 \times$ taper angle $10^\circ$                            |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | T-066  |        |      |
| NTE-2X  | Tapered Square        | $\varphi 0.5 \times$ taper angle $30^\circ$<br>$\sim \varphi 2.5 \times$ taper angle $5^\circ$                            |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | U-014  |        |      |
| NTE-4   | Tapered Square        | $\varphi 3 \times$ taper angle $30^\circ$<br>$\sim \varphi 16 \times$ taper angle $10^\circ$                              |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | T-074  |        |      |
| NTE-4X  | Tapered Square        | $\varphi 3 \times$ taper angle $30^\circ$<br>$\sim \varphi 10 \times$ taper angle $5^\circ$                               |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | U-016  |        |      |
| NTEL-2  | Tapered Square        | $\varphi 1 \times$ taper angle $30^\circ$<br>$\sim \varphi 3 \times$ taper angle $20^\circ$                               |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | T-072  |        |      |
| NTEL-4  | Tapered Square        | $\varphi 3 \times$ taper angle $30^\circ$<br>$\sim \varphi 6 \times$ taper angle $5^\circ$                                |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | T-078  |        |      |
| NTEM-2  | Tapered Square        | $\varphi 1 \times$ taper angle $4^\circ$<br>$\sim \varphi 4 \times$ taper angle $20^\circ$                                |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | T-070  |        |      |
| NTEM-2X | Tapered Square        | $\varphi 0.5 \times$ taper angle $30^\circ$<br>$\sim \varphi 6 \times$ taper angle $15^\circ$                             |  |  |  |  | -                                                                                     | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | U-018  |        |      |
| NTER-2X | Tapered Corner Radius | $\varphi 1 \times$ taper angle $30^\circ$ $\times$ $R0.2$<br>$\sim \varphi 6 \times$ taper angle $10^\circ$ $\times$ $R2$ |  |  |  |  |  | -        | -                                                                                     |  |  |  |  |  |  |  |  | -                                                                                   | -                             | -              | -      | U-030  |        |      |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Model   | Shape                     | Size                     | Material Coating                                                                    | Number of Flute                                                                     | Side Milling                                                                        | Slot Milling                                                                        | Face Milling                                                                        | Plunging | 3D Milling                                                                          | Work Material                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                            |                                                                                       |                                                                                       |                                                                                       | Page           |        |
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|         |                           |                          |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |          |                                                                                     | P<br>Carbon Steel                                                                 | P<br>Alloy Steel                                                                    | M<br>Prehardened Steel                                                              | N<br>Stainless Steel                                                                | N<br>Aluminum Alloy                                                                   | N<br>Copper                                                                           | N<br>Copper Tungsten                                                                  | N<br>Resin                                                                            | N<br>Graphite                                                                         | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc                                                         | H                                                                                     |                                                                                       |                |        |
|         |                           |                          |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |          |                                                                                     |                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                            |                                                                                       | Hardened Steel                                                                        |                                                                                       |                |        |
|         |                           |                          |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |          |                                                                                     |                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                            |                                                                                       | 55 HRC                                                                                | 65 HRC                                                                                |                | 70 HRC |
| NX-25   | Square                    | φ0.5 ~ φ12               |    |    |    |    |    | -        | -                                                                                   |  |    |  |  |    |    |    |    |    | -                          | -                                                                                     | -                                                                                     | -                                                                                     | T-006          |        |
| NX-30   | Square                    | φ0.5 ~ φ12               |    |    |    |    |    | -        | -                                                                                   |  |    |  |  |    |    |    |    |    | -                          | -                                                                                     | -                                                                                     | -                                                                                     | T-010          |        |
| NX-30X  | Square                    | φ1 ~ φ12                 |    |    |    |    |    | -        | -                                                                                   |  |    |  |  |    |    |    |    |    | -                          | -                                                                                     | -                                                                                     | -                                                                                     | U-004          |        |
| NX-35   | Square                    | φ0.5 ~ φ12               |    |    |    |    |    | -        | -                                                                                   |  |    |  |  |    |    |    |    |    | -                          | -                                                                                     | -                                                                                     | -                                                                                     | T-014          |        |
| NX-40   | Square                    | φ0.5 ~ φ12               |    |    |    | -                                                                                   |    | -        | -                                                                                   |  |    |  |  |    |    |    |    |    | -                          | -                                                                                     | -                                                                                     | -                                                                                     | T-018          |        |
| NX-45   | Square                    | φ0.5 ~ φ12               |    |    |    | -                                                                                   |    | -        | -                                                                                   |  |    |  |  |    |    |    |    |    | -                          | -                                                                                     | -                                                                                     | -                                                                                     | T-022          |        |
| PCDRB   | Long Neck Ball            | R0.05 ~ R1               |   | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                   | -        |   | -                                                                                 |   | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |   | -                          |   |   |   | C-006          |        |
| PCDRS   | Long Neck Corner Radius   | φ0.3 × R0.05 ~ φ1 × R0.1 |  |  | -                                                                                   | -                                                                                   |  | -        |  | -                                                                                 | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  | -                          | -                                                                                     | -                                                                                     | -                                                                                     | C-008          |        |
| PCDSE   | Long Neck Square          | φ0.1 ~ φ1                |  |  | -                                                                                   | -                                                                                   |  | -        | -                                                                                   | -                                                                                 | -                                                                                   | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     |  | -                          | -                                                                                     | -                                                                                     | -                                                                                     | C-004          |        |
| RSB230  | Ball / Long Neck Ball     | R0.1 ~ R3                |  |  | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -                                                                                 | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  | -                          | -                                                                                     | -                                                                                     | -                                                                                     | N-020          |        |
| RSE230  | Square / Long Neck Square | φ0.1 ~ φ6                |  |  |  |  |  | -        | -                                                                                   | -                                                                                 | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  | -                          | -                                                                                     | -                                                                                     | -                                                                                     | N-012          |        |
| RSES230 | Square / Long Neck Square | φ0.1 ~ φ6                |  |  |  |  |  | -        | -                                                                                   | -                                                                                 | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  | -                          | -                                                                                     | -                                                                                     | -                                                                                     | N-004          |        |
| SFB200  | Long Neck Ball            | R0.1 ~ R1                |  |  | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -                                                                                 |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                          |  |  |  | B-012          |        |
| SHPR400 | Long Neck Corner Radius   | φ0.1 × R0.01 ~ φ3 × R0.2 |  |  | -                                                                                   |  |  | -        | -                                                                                   | -                                                                                 |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                          |  |  |  | B-034          |        |
| SHR320  | Long Neck Corner Radius   | φ0.5 × R0.1 ~ φ2 × R0.3  |  |  | -                                                                                   |  |  | -        | -                                                                                   | -                                                                                 |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                          |  |  |  | B-032          |        |
| SMB120  | Ball                      | R0.01 ~ R0.05            |  |  | -                                                                                   | -                                                                                   | -                                                                                   | -        |  | -                                                                                 |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                          |  |  |  | B-010<br>D-010 |        |
| SMEZ120 | Square                    | φ0.03 ~ φ0.1             |  |  | -                                                                                   |  | -                                                                                   | -        | -                                                                                   | -                                                                                 |  | -                                                                                   | -                                                                                   | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                                                                                     | -                          |  |  |  | B-004<br>D-004 |        |

※ 1 Positioned as a semi-standard products and original products(distributor stock)

| Model     | Shape                   | Size                                                  | Material Coating                                                                        | Number of Flute | Side Milling                                                                          | Slot Milling                                                                          | Face Milling | Plunging | 3D Milling                                                                            | Work Material     |                  |                                           |                     |             |                      |            |               |                            |                               |                |   |   | Page  |
|-----------|-------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------|----------|---------------------------------------------------------------------------------------|-------------------|------------------|-------------------------------------------|---------------------|-------------|----------------------|------------|---------------|----------------------------|-------------------------------|----------------|---|---|-------|
|           |                         |                                                       |                                                                                         |                 |                                                                                       |                                                                                       |              |          |                                                                                       | P<br>Carbon Steel | P<br>Alloy Steel | M<br>Stainless Steel<br>Prehardened Steel | N<br>Aluminum Alloy | N<br>Copper | N<br>Copper Tungsten | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H              |   |   |       |
|           |                         |                                                       |                                                                                         |                 |                                                                                       |                                                                                       |              |          |                                                                                       |                   |                  |                                           |                     |             |                      |            |               |                            |                               | Hardened Steel |   |   |       |
|           |                         |                                                       |                                                                                         |                 |                                                                                       |                                                                                       |              |          |                                                                                       |                   |                  |                                           |                     |             |                      |            |               |                            |                               |                |   |   |       |
| SSB200    | Long Neck Ball          | R0.1 ~ R1                                             |  2   | -               | -                                                                                     | -                                                                                     | -            | -        |    | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-016 |
| SSBL200   | Long Neck Ball          | R0.05 ~ R1                                            |  2   | -               | -                                                                                     | -                                                                                     | -            | -        |    | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-020 |
| SSE400    | Long Neck Square        | φ0.1                                                  |  4   | -               |    |    | -            | -        | -                                                                                     | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-006 |
| SSE600    | Long Neck Square        | φ0.2 ~ φ1                                             |  6   | -               |    |    | -            | -        | -                                                                                     | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-008 |
| SSF120    | Long Neck Corner Radius | φ0.2 × R0.05 ~ φ2 × R0.1                              |  1   | -               | -                                                                                     |    | -            | -        | -                                                                                     | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-040 |
| SSPB220   | Long Neck Ball          | R0.1 ~ R3                                             |  2   | -               | -                                                                                     | -                                                                                     | -            | -        |    | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-014 |
| SSPBL220  | Long Neck Ball          | R0.1 ~ R1                                             |  2   | -               | -                                                                                     | -                                                                                     | -            | -        |    | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-018 |
| SSPBTN220 | Long Neck Tapered Ball  | R0.1 × neck taper angle30' ~ R1 × neck taper angle 2° |  2 | -               | -                                                                                     | -                                                                                     | -            | -        |  | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-022 |
| SSR200    | Long Neck Corner Radius | φ0.1 × R0.02 ~ φ2 × R0.5                              |  2 | -               |  |  | -            | -        | -                                                                                     | -                 | -                | ○                                         | -                   | -           | -                    | -          | -             | -                          | -                             | ○              | ○ | ○ | B-026 |

| Code No. | Model   | Size           | Shape             | Material Coating                                                                    | Number of Flute                                                                     | Side Milling                                                                         | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                          | Page  |
|----------|---------|----------------|-------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|-------|
| 01-00001 | NSME100 | φ0.01 ~ φ0.05  | Micro Edge Square |    |    | -                                                                                    |    |    | -        | -                                                                                   | D-006 |
| 01-00002 | NSME230 | φ0.03 ~ φ0.09  | Micro Edge Square |    |    | -                                                                                    |    |    | -        | -                                                                                   | D-008 |
| 01-00003 | NSMB100 | R0.005 ~ R0.05 | Micro Edge Ball   |    |    | -                                                                                    | -                                                                                     | -                                                                                     | -        |  | D-012 |
| 01-00025 | NX-25   | φ0.5 ~ φ12     | Square            |    |    |    |    |    | -        | -                                                                                   | T-006 |
| 01-00030 | NX-30   | φ0.5 ~ φ12     | Square            |    |    |    |    |    | -        | -                                                                                   | T-010 |
| 01-00031 | NX-30X  | φ1 ~ φ12       | Square            |    |    |    |    |    | -        | -                                                                                   | U-004 |
| 01-00035 | NX-35   | φ0.5 ~ φ12     | Square            |  |  |  |  |  | -        | -                                                                                   | T-014 |
| 01-00040 | NX-40   | φ0.5 ~ φ12     | Square            |  |  |  | -                                                                                     |  | -        | -                                                                                   | T-018 |
| 01-00045 | NX-45   | φ0.5 ~ φ12     | Square            |  |  |  | -                                                                                     |  | -        | -                                                                                   | T-022 |
| 01-00112 | NE-2    | φ1 ~ φ20       | Square            |  |  |  |  |  | -        | -                                                                                   | T-042 |
| 01-00113 | NE-3    | φ3 ~ φ20       | Square            |  |  |  |  |  | -        | -                                                                                   | T-044 |
| 01-00114 | NE-4    | φ3 ~ φ20       | Square            |  |  |  | -                                                                                     |  | -        | -                                                                                   | T-048 |
| 01-00116 | NEL-3   | φ6 ~ φ20       | Square            |  |  |  | -                                                                                     |  | -        | -                                                                                   | T-046 |
| 01-00212 | NC-2    | φ0.5 ~ φ20     | Square            |  |  |  |  |  | -        | -                                                                                   | T-026 |
| 01-00222 | NCL-2   | φ1 ~ φ12       | Square            |  |  |  | -                                                                                     |  | -        | -                                                                                   | T-030 |
| 01-00224 | NCL-4   | φ2 ~ φ12       | Square            |  |  |  | -                                                                                     |  | -        | -                                                                                   | T-040 |
| 01-00232 | NCM-2   | φ0.5 ~ φ20     | Square            |  |  |  |  |  | -        | -                                                                                   | T-028 |

| Code No.             | Model   | Size                                            | Shape                 | Material Coating                                                                      | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                            | Page  |
|----------------------|---------|-------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|-------|
| 01-00234             | NCM-4   | φ1 ~ φ20                                        | Square                |    |    |    | -                                                                                     |    | -        | -                                                                                     | T-038 |
| 01-00242             | NC-LS-2 | φ1 ~ φ12                                        | Square                |    |    |    | -                                                                                     |    | -        | -                                                                                     | T-032 |
| 01-00244             | NC-4    | φ1 ~ φ20                                        | Square                |    |    |    | -                                                                                     |    | -        | -                                                                                     | T-034 |
| 01-00312<br>01-00313 | NTE-2   | φ0.5×taper angle30'<br>~φ10×taper angle10°      | Tapered Square        |    |    |    |    | -                                                                                     | -        | -                                                                                     | T-066 |
| 01-00314<br>01-00315 | NTE-4   | φ3×taper angle30'<br>~φ16×taper angle10°        | Tapered Square        |    |    |    |    | -                                                                                     | -        | -                                                                                     | T-074 |
| 01-00316             | NTE-2X  | φ0.5×taper angle30'<br>~φ2.5×taper angle5°      | Tapered Square        |    |    |    |    | -                                                                                     | -        | -                                                                                     | U-014 |
| 01-00317             | NTE-4X  | φ3×taper angle30'<br>~φ10×taper angle5°         | Tapered Square        |  |  |  |  | -                                                                                     | -        | -                                                                                     | U-016 |
| 01-00322<br>01-00323 | NTEL-2  | φ1×taper angle30'<br>~φ3×taper angle20°         | Tapered Square        |  |  |  |  | -                                                                                     | -        | -                                                                                     | T-072 |
| 01-00324<br>01-00325 | NTEL-4  | φ3×taper angle30'<br>~φ6×taper angle5°          | Tapered Square        |  |  |  |  | -                                                                                     | -        | -                                                                                     | T-078 |
| 01-00332             | NTEM-2  | φ1×taper angle4°<br>~φ4×taper angle20°          | Tapered Square        |  |  |  |  | -                                                                                     | -        | -                                                                                     | T-070 |
| 01-00336             | NTEM-2X | φ0.5×taper angle30'<br>~φ6×taper angle15°       | Tapered Square        |  |  |  |  | -                                                                                     | -        | -                                                                                     | U-018 |
| 01-00352             | NTB-2   | R0.5×taper angle30'<br>~R5×taper angle10°       | Tapered Square        |  |  |  |  | -                                                                                     | -        |  | T-102 |
| 01-00362             | NTER-2X | φ1×taper angle30°×R0.2<br>~φ6×taper angle10°×R2 | Tapered Corner Radius |  |  |  |  |  | -        | -                                                                                     | U-030 |
| 01-00412             | NHR-2   | φ0.5 ~ φ5                                       | Long Neck Square      |  |  |  |  |  | -        | -                                                                                     | T-062 |
| 01-00413             | NHR-2X  | φ0.5 ~ φ5                                       | Long Neck Square      |  |  |  |  |  | -        | -                                                                                     | U-010 |
| 01-00425             | NRF-4   | φ0.5×taper angle30'<br>~φ2×taper angle3°        | Tapered Square        |  |  | -                                                                                     |  | -                                                                                     | -        | -                                                                                     | U-020 |
| 01-00432             | NHB-2   | R0.4 ~ R5                                       | Long Neck Ball        |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -        |  | T-098 |



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| Code No. | Model     | Size                                             | Shape                       | Material Coating | Number of Flute | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Page           |
|----------|-----------|--------------------------------------------------|-----------------------------|------------------|-----------------|--------------|--------------|--------------|----------|------------|----------------|
| 01-00440 | SSE400    | φ0.1                                             | CBN Long Neck Square        | CBN              | 4               | -            | Slot         | Face         | -        | -          | B-006          |
| 01-00450 | SSE600    | φ0.2 ~ φ1                                        | CBN Long Neck Square        | CBN              | 6               | -            | Slot         | Face         | -        | -          | B-008          |
| 01-00460 | SMB120    | R0.01 ~ R0.05                                    | CBN Micro Edge Ball         | CBN              | 1               | -            | -            | -            | -        | 3D         | B-010<br>D-010 |
| 01-00470 | SSF120    | φ0.2 × R0.05 ~ φ2 × R0.1                         | CBN Long Neck Corner Radius | CBN              | 1               | -            | -            | Face         | -        | -          | B-040          |
| 01-00480 | SMEZ120   | φ0.03 ~ φ0.1                                     | CBN Micro Edge Square       | CBN              | 1               | -            | Slot         | -            | -        | -          | B-004<br>D-004 |
| 01-00485 | SHPR400   | φ0.1 × R0.01 ~ φ3 × R0.2                         | CBN Long Neck Corner Radius | CBN              | 4               | -            | Slot         | Face         | -        | -          | B-034          |
| 01-00490 | SSR200    | φ0.1 × R0.02 ~ φ2 × R0.5                         | CBN Long Neck Corner Radius | CBN              | 2               | -            | Slot         | Face         | -        | -          | B-026          |
| 01-00495 | SHR320    | φ0.5 × R0.1 ~ φ2 × R0.3                          | CBN Long Neck Corner Radius | CBN              | 3               | -            | Slot         | Face         | -        | -          | B-032          |
| 01-00500 | SFB200    | R0.1 ~ R1                                        | CBN Long Neck Ball          | CBN              | 2               | -            | -            | -            | -        | 3D         | B-012          |
| 01-00505 | SSPB220   | R0.1 ~ R3                                        | CBN Long Neck Ball          | CBN              | 2               | -            | -            | -            | -        | 3D         | B-014          |
| 01-00506 | SSPBL220  | R0.1 ~ R1                                        | CBN Long Neck Ball          | CBN              | 2               | -            | -            | -            | -        | 3D         | B-018          |
| 01-00507 | SSPBTN220 | R0.1×neck taper angle30' ~ R1×neck taper angle2° | CBN Long Neck Tapered Ball  | CBN              | 2               | -            | -            | -            | -        | 3D         | B-022          |
| 01-00510 | SSB200    | R0.1 ~ R1                                        | CBN Long Neck Ball          | CBN              | 2               | -            | -            | -            | -        | 3D         | B-016          |
| 01-00511 | SSBL200   | R0.05 ~ R1                                       | CBN Long Neck Ball          | CBN              | 2               | -            | -            | -            | -        | 3D         | B-020          |
| 01-00512 | NCB-2     | R0.2 ~ R0.9                                      | Ball                        | MG               | 2               | -            | -            | -            | -        | 3D         | T-086          |
| 01-00513 | NCB-2X    | R0.2 ~ R0.9                                      | Ball                        | X                | 2               | -            | -            | -            | -        | 3D         | U-024          |
| 01-00522 | NSB-2     | R1 ~ R10                                         | Ball                        | MG               | 2               | -            | -            | -            | -        | 3D         | T-088          |

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| Code No. | Model     | Size       | Shape                     | Material Coating | Number of Flute | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Page           |
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| 01-00523 | NSB-2X    | R1 ~ R10   | Ball                      | X                | 2               | -            | -            | -            | -        | 3D         | U-026          |
| 01-00528 | NLBL-2    | R0.5 ~ R10 | Ball                      | MG               | 2               | -            | -            | -            | -        | 3D         | T-092          |
| 01-00530 | NSBL-2    | R3 ~ R10   | Ball                      | MG               | 2               | -            | -            | -            | -        | 3D         | T-090          |
| 01-00622 | NEA-2     | φ3 ~ φ25   | Square                    | WC               | 2               | Side         | Slot         | Face         | -        | -          | T-058          |
| 01-00631 | AL2D-2    | φ0.5 ~ φ12 | Square                    | WC               | 2               | Side         | Slot         | Face         | -        | -          | L-004          |
| 01-00632 | AL3D-2    | φ1 ~ φ12   | Square                    | WC               | 2               | Side         | Slot         | Face         | -        | -          | L-008          |
| 01-00633 | AL4D-2    | φ1 ~ φ12   | Square                    | WC               | 2               | Side         | -            | Face         | -        | -          | L-012          |
| 01-00634 | AL5D-2    | φ1 ~ φ12   | Square                    | WC               | 2               | Side         | -            | Face         | -        | -          | L-016          |
| 01-00635 | AL3D-2DLC | φ1 ~ φ12   | Square                    | DLC              | 2               | Side         | Slot         | Face         | -        | -          | L-010          |
| 01-00636 | ALZ345    | φ1 ~ φ12   | Square / Long Neck Square | WC               | 3               | Side         | Slot         | Face         | Plunge   | -          | K-020<br>L-024 |
| 01-00637 | AL-3LS    | φ5 ~ φ12   | Square                    | WC               | 3               | Side         | Slot         | Face         | -        | -          | L-022          |
| 01-00638 | ALB225    | R0.3 ~ R6  | Ball / Long Neck Ball     | WC               | 2               | -            | -            | -            | -        | 3D         | L-030          |
| 01-00639 | AL3D-345  | φ1 ~ φ12   | Square                    | WC               | 3               | Side         | Slot         | Face         | Plunge   | -          | K-012<br>L-020 |
| 01-00640 | RSES230   | φ0.1 ~ φ6  | Square / Long Neck Square | MG               | 2               | Side         | Slot         | Face         | -        | -          | N-004          |
| 01-00644 | RSE230    | φ0.1 ~ φ6  | Square / Long Neck Square | MG               | 2               | Side         | Slot         | Face         | -        | -          | N-012          |
| 01-00654 | RSB230    | R0.1 ~ R3  | Ball / Long Neck Ball     | MG               | 2               | -            | -            | -            | -        | 3D         | N-020          |
| 01-00661 | AL2D-2DLC | φ0.5 ~ φ12 | Square                    | DLC              | 2               | Side         | Slot         | Face         | -        | -          | L-006          |

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| Code No. | Model      | Size                                                                                                           | Shape                 | Material Coating | Number of Flute | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Page           |
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| 01-00663 | AL4D-2DLC  | $\phi 1 \sim \phi 12$                                                                                          | Square                | DLC              | 2               | Side         | -            | Face         | -        | -          | L-014          |
| 01-00664 | AL5D-2DLC  | $\phi 1 \sim \phi 12$                                                                                          | Square                | DLC              | 2               | Side         | -            | Face         | -        | -          | L-018          |
| 01-00666 | ALZ345-DLC | $\phi 1 \sim \phi 12$                                                                                          | Long Neck Square      | DLC              | 3               | Side         | Slot         | Face         | Plunge   | -          | K-018<br>L-028 |
| 01-00668 | ALB225-DLC | R0.3 $\sim$ R6                                                                                                 | Ball / Long Neck Ball | DLC              | 2               | -            | -            | -            | -        | 3D         | L-032          |
| 01-00712 | NER-2      | $\phi 2 \times$ taper angle $7^{\circ}$<br>$\sim \phi 6 \times$ taper angle $15^{\circ}$                       | Tapered Square        | MG               | 2               | Side         | Slot         | -            | -        | -          | T-084          |
| 01-00722 | NERB-2     | R1 $\times$ taper angle $10^{\circ}$<br>$\sim$ R3 $\times$ taper angle $20^{\circ}$                            | Tapered Ball          | MG               | 2               | Side         | Slot         | -            | -        | 3D         | T-104          |
| 01-00732 | NERR-2X    | $\phi 2 \times$ taper angle $7^{\circ} \times$ R0.3<br>$\sim \phi 6 \times$ taper angle $15^{\circ} \times$ R2 | Tapered Corner Radius | X                | 2               | Side         | Slot         | Face         | -        | -          | U-034          |
| 01-00772 | NSR-2      | $\phi 1 \times$ R0.2<br>$\sim \phi 20 \times$ R5                                                               | Corner Radius         | MG               | 2               | Side         | Slot         | Face         | -        | -          | T-106          |
| 01-00812 | NSL-2      | $\phi 1 \sim \phi 12$                                                                                          | Square                | MG               | 2               | -            | -            | -            | -        | -          | T-050          |
| 01-00912 | NCR-2      | R0.5 $\sim$ R5                                                                                                 | Chamfering            | MG               | 2               | -            | -            | -            | -        | -          | T-108          |
| 01-00913 | NCR-2X     | R0.5 $\sim$ R3                                                                                                 | Chamfering            | X                | 2               | -            | -            | -            | -        | -          | U-036          |
| 04-00001 | NSMD       | $\phi 0.01 \sim \phi 0.1$                                                                                      | Micro Drill           | SMG              | 2               | -            | -            | -            | -        | -          | Q-014          |
| 04-00002 | NSMD-M     | $\phi 0.01 \sim \phi 0.1$                                                                                      | Micro Drill           | Micro            | 2               | -            | -            | -            | -        | -          | Q-012          |
| 04-00005 | NSMD-S     | $\phi 0.01 \sim \phi 0.05$                                                                                     | Micro Drill           | SMG              | 2               | -            | -            | -            | -        | -          | Q-010          |
| 04-00006 | NSMD-MS    | $\phi 0.01 \sim \phi 0.05$                                                                                     | Micro Drill           | Micro            | 2               | -            | -            | -            | -        | -          | Q-008          |
| 04-00010 | NSPD       | $\phi 0.01 \sim \phi 0.1$                                                                                      | Micro Drill           | SMG              | 2               | -            | -            | -            | -        | -          | Q-018          |
| 04-00012 | NSPD-M     | $\phi 0.01 \sim \phi 0.1$                                                                                      | Micro Drill           | Micro            | 2               | -            | -            | -            | -        | -          | Q-016          |

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| Code No. | Model   | Size                                                 | Shape                       | Material Coating | Number of Flute | Side Milling | Slot Milling | Face Milling | Plunging | 3D Milling | Page  |
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| 04-00050 | MSDH    | $\phi 0.1 \sim \phi 1$                               | Drill                       | Premium          | 2               | -            | -            | -            | -        | -          | Q-026 |
| 04-00100 | CED100  | $\phi 0.1 \sim \phi 2$                               | Long Neck Square            | SCD              | 1               | -            | -            | Face         | -        | -          | U-008 |
| 04-00200 | MDR-R   | $\phi 0.1 \sim \phi 1$                               | Drill                       | Micro            | 2               | -            | -            | -            | -        | -          | Q-020 |
| 04-00210 | MDR-PD  | $\phi 0.1 \sim \phi 1$                               | Drill                       | Micro            | 2               | -            | -            | -            | -        | -          | Q-024 |
| 04-00230 | MFD     | $\phi 0.1 \sim \phi 6$                               | Flat Drill                  | Micro            | 2               | -            | -            | -            | -        | -          | Q-004 |
| 04-00250 | NSCV    | $\phi 4$<br>$\phi 6$                                 | Chamfering                  | MG               | 3               | -            | -            | -            | -        | -          | S-006 |
| 04-00260 | NSCV-M  | $\phi 4$<br>$\phi 6$                                 | Chamfering                  | Micro            | 3               | -            | -            | -            | -        | -          | S-008 |
| 04-00300 | PCDSE   | $\phi 0.1 \sim \phi 1$                               | PCD Long Neck Square        | PCD              | 2<br>6          | -            | -            | Face         | -        | -          | C-004 |
| 04-00500 | PCDRB   | R0.05 $\sim$ R1                                      | PCD Long Neck Ball          | PCD              | -               | -            | -            | -            | -        | 3D         | C-006 |
| 04-00700 | PCDRS   | $\phi 0.3 \times$ R0.05<br>$\sim \phi 1 \times$ R0.1 | PCD Long Neck Corner Radius | PCD              | 4<br>6          | -            | -            | Face         | -        | 3D         | C-008 |
| 05-00035 | DCSE235 | $\phi 0.5 \sim \phi 6$                               | Square                      | DIA              | 2               | Side         | Slot         | Face         | -        | -          | P-004 |
| 05-00100 | DCMS    | $\phi 0.3 \sim \phi 2$                               | Long Neck Square            | DIA              | 8<br>10         | -            | -            | Face         | -        | -          | O-004 |
| 05-00200 | DCHR230 | $\phi 0.5 \sim \phi 6$                               | Long Neck Square            | DIA              | 2               | Side         | Slot         | Face         | -        | -          | P-006 |
| 05-00500 | DCMB    | R0.1 $\sim$ R1                                       | Ball / Long Neck Ball       | DIA              | 2               | -            | -            | -            | -        | 3D         | O-006 |
| 05-00520 | DCRB230 | R0.2 $\sim$ R3                                       | Long Neck Ball              | DIA              | 2               | -            | -            | -            | -        | 3D         | P-008 |
| 06-00001 | MMTS    | S0.1 $\sim$ S1.4                                     | Thread Mill                 | Micro            | 2               | -            | -            | -            | -        | -          | R-008 |
| 06-00002 | MMTM    | M1 $\sim$ M6                                         | Thread Mill                 | Micro            | 4<br>6          | -            | -            | -            | -        | -          | R-004 |

| Code No. | Model   | Size                                      | Shape                      | Material Coating                                                                    | Number of Flute                                                                     | Side Milling                                                                        | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                            | Page  |
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| 06-00003 | MMTU    | No.0-80UNF<br>~ 1/4-28UNF                 | Thread Mill                |    |    | -                                                                                   | -                                                                                     | -                                                                                     | -        | -                                                                                     | R-006 |
| 07-00001 | DSF     | φ 1 ~ φ 20                                | Long Neck Square           |    |    | -                                                                                   | -                                                                                     |    | -        | -                                                                                     | T-060 |
| 07-00036 | DX      | φ 0.5 ~ φ 20                              | Square                     |    |    |    |    |    | -        | -                                                                                     | T-052 |
| 07-00040 | DXM     | φ 3 ~ φ 20                                | Square                     |    |    |    | -                                                                                     |    | -        | -                                                                                     | T-054 |
| 07-00045 | DXL     | φ 3 ~ φ 20                                | Square                     |    |    |    | -                                                                                     |    | -        | -                                                                                     | T-056 |
| 07-00100 | DHR237  | φ 0.1 ~ φ 6                               | Long Neck Square           |    |    |    |    |    | -        | -                                                                                     | M-004 |
| 07-00110 | DHR237R | φ 0.2 × R0.02<br>~ φ 6 × R1               | Long Neck<br>Corner Radius |   |   |   |   |   | -        | -                                                                                     | M-014 |
| 07-00313 | DTE     | φ 1×taper angle30'<br>~φ 10×taper angle5° | Tapered Square             |  |  |  |  | -                                                                                     | -        | -                                                                                     | T-080 |
| 07-00322 | DTL     | φ 1×taper angle30'<br>~φ 8×taper angle5°  | Tapered Square             |  |  |  |  | -                                                                                     | -        | -                                                                                     | T-082 |
| 07-00333 | DHS     | φ 6 ~ φ 20                                | Square                     |  |  |  |  |  | -        | -                                                                                     | U-006 |
| 07-00432 | DHB     | R0.5 ~ R6                                 | Long Neck Ball             |  |  | -                                                                                   | -                                                                                     | -                                                                                     | -        |  | T-096 |
| 07-00523 | DB      | R0.5 ~ R10                                | Ball                       |  |  | -                                                                                   | -                                                                                     | -                                                                                     | -        |  | T-094 |
| 07-00530 | DRB230  | R0.05 ~ R3                                | Long Neck Ball             |  |  | -                                                                                   | -                                                                                     | -                                                                                     | -        |  | M-008 |
| 07-00913 | DIR     | R0.1 ~ R5                                 | Chamfering                 |  |  | -                                                                                   | -                                                                                     | -                                                                                     | -        | -                                                                                     | T-110 |
| 08-00005 | MXH225  | φ 0.1 ~ φ 6                               | Square                     |  |  |  |  |  | -        | -                                                                                     | F-004 |
| 08-00006 | MXH230  | φ 0.1 ~ φ 6                               | Square                     |  |  |  |  |  | -        | -                                                                                     | F-006 |
| 08-00007 | MXH235  | φ 0.1 ~ φ 6                               | Square                     |  |  |  |  |  | -        | -                                                                                     | F-008 |

| Code No. | Model   | Size         | Shape  | Material Coating                                                                      | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling | Page  |
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| 08-00008 | MXH240  | φ 0.3 ~ φ 6  | Square |    |    |    | -                                                                                     |    | -        | -          | F-010 |
| 08-00009 | MXH245  | φ 0.3 ~ φ 6  | Square |    |    |    | -                                                                                     |    | -        | -          | F-012 |
| 08-00015 | MXH225P | φ 0.1 ~ φ 6  | Square |    |    |    | -                                                                                     |    | -        | -          | F-014 |
| 08-00016 | MXH230P | φ 0.1 ~ φ 6  | Square |    |    |    | -                                                                                     |    | -        | -          | F-016 |
| 08-00017 | MXH235P | φ 0.1 ~ φ 6  | Square |    |    |    | -                                                                                     |    | -        | -          | F-018 |
| 08-00025 | MX225   | φ 0.3 ~ φ 12 | Square |    |    |    |    |    | -        | -          | H-006 |
| 08-00030 | MX230   | φ 0.1 ~ φ 12 | Square |   |   |   |   |   | -        | -          | H-008 |
| 08-00035 | MX235   | φ 0.1 ~ φ 12 | Square |  |  |  |  |  | -        | -          | H-010 |
| 08-00040 | MX240   | φ 0.3 ~ φ 12 | Square |  |  |  | -                                                                                     |  | -        | -          | H-012 |
| 08-00045 | MX245   | φ 0.3 ~ φ 12 | Square |  |  |  | -                                                                                     |  | -        | -          | H-014 |
| 08-00075 | MX425   | φ 1 ~ φ 12   | Square |  |  |  | -                                                                                     |  | -        | -          | H-016 |
| 08-00080 | MX430   | φ 1 ~ φ 12   | Square |  |  |  | -                                                                                     |  | -        | -          | H-018 |
| 08-00085 | MX435   | φ 1 ~ φ 12   | Square |  |  |  | -                                                                                     |  | -        | -          | H-020 |
| 08-00090 | MX440   | φ 1 ~ φ 12   | Square |  |  |  | -                                                                                     |  | -        | -          | H-022 |
| 08-00095 | MX445   | φ 1 ~ φ 12   | Square |  |  |  | -                                                                                     |  | -        | -          | H-024 |
| 08-00100 | MSE230  | φ 0.1 ~ φ 12 | Square |  |  |  |  |  | -        | -          | H-032 |
| 08-00101 | MSEM230 | φ 0.5 ~ φ 12 | Square |  |  |  | -                                                                                     |  | -        | -          | H-036 |

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| Code No. | Model       | Size                                             | Shape            | Material Coating                                                                    | Number of Flute                                                                     | Side Milling                                                                        | Slot Milling                                                                          | Face Milling                                                                          | Plunging                                                                              | 3D Milling | Page  |
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| 08-00102 | MSES230P    | $\phi 0.1 \sim \phi 12$                          | Square           |    |    |    |    |    | -                                                                                     | -          | H-030 |
| 08-00103 | MSE230SS    | $\phi 0.1 \sim \phi 6$                           | Square           |    |    |    |    |    | -                                                                                     | -          | H-026 |
| 08-00105 | MSE230M     | $\phi 0.1 \sim \phi 6$                           | Square           |    |    |    |    |    | -                                                                                     | -          | H-038 |
| 08-00110 | MSE430      | $\phi 1 \sim \phi 20$                            | Square           |    |    |    | -                                                                                     |    | -                                                                                     | -          | H-046 |
| 08-00111 | MSEM430     | $\phi 1 \sim \phi 20$                            | Square           |    |    |    | -                                                                                     |    | -                                                                                     | -          | H-050 |
| 08-00112 | MSE430P     | $\phi 1 \sim \phi 12$                            | Square           |    |    |    | -                                                                                     |    | -                                                                                     | -          | H-044 |
| 08-00120 | MSE245      | $\phi 2 \sim \phi 12$                            | Square           |    |    |   |   |   | -                                                                                     | -          | H-040 |
| 08-00130 | MSE345      | $\phi 3 \sim \phi 20$                            | Square           |  |  |  |  |  | -                                                                                     | -          | H-042 |
| 08-00133 | MSZ345      | $\phi 1 \sim \phi 12$                            | Square           |  |  |  |  |  |  | -          | K-008 |
| 08-00135 | MSCZ440     | $\phi 1 \sim \phi 6$                             | Square           |  |  |  |  |  |  | -          | K-006 |
| 08-00136 | MSCZ440-LN  | $\phi 1 \sim \phi 6$                             | Long Neck Square |  |  |  |  |  |  | -          | K-016 |
| 08-00140 | MSE445      | $\phi 2 \sim \phi 20$                            | Square           |  |  |  | -                                                                                     |  | -                                                                                     | -          | H-048 |
| 08-00144 | MSX440      | $\phi 3 \times R0.2$<br>$\sim \phi 20 \times R1$ | Corner Radius    |  |  |  |  |  | -                                                                                     | -          | K-026 |
| 08-00150 | MSXH440R    | $\phi 3 \times R0.3$<br>$\sim \phi 12 \times R2$ | Corner Radius    |  |  |  |  |  | -                                                                                     | -          | K-024 |
| 08-00152 | MSUSZ440    | $\phi 1 \sim \phi 6$                             | Square           |  |  |  |  |  |  | -          | K-004 |
| 08-00153 | MSUSZ440-LN | $\phi 1 \sim \phi 6$                             | Long Neck Square |  |  |  |  |  |  | -          | K-014 |
| 08-00200 | MHR230      | $\phi 0.1 \sim \phi 6$                           | Long Neck Square |  |  |  |  |  | -                                                                                     | -          | I-004 |

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| Code No.             | Model      | Size                                                                                    | Shape                      | Material Coating                                                                      | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | Plunging | 3D Milling                                                                            | Page  |
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| 08-00202             | MHRLN230-6 | $\phi 0.3 \sim \phi 2$                                                                  | Long Neck Square           |    |    |    |    |    | -        | -                                                                                     | I-024 |
| 08-00207             | MHRH230    | $\phi 0.1 \sim \phi 3$                                                                  | Long Neck Square           |    |    |    |    |    | -        | -                                                                                     | G-004 |
| 08-00210             | MHR430     | $\phi 1 \sim \phi 10$                                                                   | Long Neck Square           |    |    |    |    |    | -        | -                                                                                     | I-016 |
| 08-00217             | MHRH430    | $\phi 1 \sim \phi 6$                                                                    | Long Neck Square           |    |    |    |    |    | -        | -                                                                                     | G-010 |
| 08-00220<br>08-00221 | MHR230R    | $\phi 0.2 \times R0.05$<br>$\sim \phi 6 \times R1$                                      | Long Neck<br>Corner Radius |    |    |    |    |    | -        | -                                                                                     | I-058 |
| 08-00227             | MHRH230R   | $\phi 0.2 \times R0.02$<br>$\sim \phi 0.9 \times R0.1$                                  | Long Neck<br>Corner Radius |    |    |    |    |    | -        | -                                                                                     | G-040 |
| 08-00230             | MHR430R    | $\phi 1 \times R0.05$<br>$\sim \phi 6 \times R1$                                        | Long Neck<br>Corner Radius |    |    |   |   |   | -        | -                                                                                     | I-072 |
| 08-00237             | MHRH430R   | $\phi 0.1 \times R0.01$<br>$\sim \phi 6 \times R1$                                      | Long Neck<br>Corner Radius |  |  |  |  |  | -        | -                                                                                     | G-044 |
| 08-00300             | MTE230     | $\phi 0.2 \times \text{taper angle} 30'$<br>$\sim \phi 10 \times \text{taper angle} 5'$ | Tapered Square             |  |  |  |  | -                                                                                     | -        | -                                                                                     | J-004 |
| 08-00310             | MRT425     | $\phi 0.2 \times \text{taper angle} 30'$<br>$\sim \phi 3 \times \text{taper angle} 2'$  | Tapered Square             |  |  | -                                                                                     |  | -                                                                                     | -        | -                                                                                     | J-010 |
| 08-00400             | MHD445     | $\phi 1 \sim \phi 4$                                                                    | Square                     |  |  |  |  |  | -        | -                                                                                     | H-052 |
| 08-00410             | MHD645     | $\phi 5 \sim \phi 12$                                                                   | Square                     |  |  |  |  |  | -        | -                                                                                     | H-054 |
| 08-00427             | MHDH445    | $\phi 1 \sim \phi 4$                                                                    | Square                     |  |  |  |  |  | -        | -                                                                                     | F-020 |
| 08-00428             | MHDH645    | $\phi 5 \sim \phi 12$                                                                   | Square                     |  |  |  |  |  | -        | -                                                                                     | F-022 |
| 08-00437             | MHDH445R   | $\phi 3 \times R0.2$<br>$\sim \phi 4 \times R0.5$                                       | Corner Radius              |  |  |  |  |  | -        | -                                                                                     | F-028 |
| 08-00438             | MHDH645R   | $\phi 5 \times R0.2$<br>$\sim \phi 12 \times R2$                                        | Corner Radius              |  |  |  |  |  | -        | -                                                                                     | F-030 |
| 08-00500<br>08-00501 | MSB230     | R0.05 $\sim$ R10                                                                        | Ball                       |  |  | -                                                                                     | -                                                                                     | -                                                                                     | -        |  | H-056 |

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| Code No.             | Model      | Size                                                    | Shape                  | Material Coating                                                                      | Number of Flute                                                                      | Side Milling                                                                          | Slot Milling | Face Milling | Plunging | 3D Milling                                                                            | Page  |
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| 08-00504             | MSB230SF   | R0.1 ~ R6                                               | Ball                   |  2   | -                                                                                    | -                                                                                     | -            | -            | -        |    | H-068 |
| 08-00505             | MSB230G2   | R0.05 ~ R3                                              | Ball                   |  2   | -                                                                                    | -                                                                                     | -            | -            | -        |    | H-062 |
| 08-00507             | MSBH230    | R0.05 ~ R6                                              | Ball                   |  2   | -                                                                                    | -                                                                                     | -            | -            | -        |    | F-024 |
| 08-00510             | MSBL230    | R0.1 ~ R5                                               | Ball                   |  2   | -                                                                                    | -                                                                                     | -            | -            | -        |    | H-072 |
| 08-00511             | MSBXL230   | R0.5 ~ R5                                               | Ball                   |  2   | -                                                                                    | -                                                                                     | -            | -            | -        |    | H-073 |
| 08-00520<br>08-00521 | MRB230     | R0.05 ~ R3                                              | Long Neck Ball         |  2   | -                                                                                    | -                                                                                     | -            | -            | -        |    | I-026 |
| 08-00522             | MRBLN230-6 | R0.15 ~ R1                                              | Long Neck Ball         |  2  | -                                                                                    | -                                                                                     | -            | -            | -        |   | I-042 |
| 08-00525             | MRB230SF   | R0.1 ~ R1.5                                             | Long Neck Ball         |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | I-038 |
| 08-00527<br>08-00528 | MRBH230    | R0.05 ~ R3                                              | Long Neck Ball         |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | G-014 |
| 08-00530             | MSB230S    | R0.1 ~ R6                                               | Ball                   |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | H-064 |
| 08-00537             | MRBSH230SF | R0.05 ~ R3                                              | Long Neck Ball         |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | E-006 |
| 08-00540             | MTB230     | R0.1×taper angle1°<br>~ R2×taper angle15°               | Tapered Ball           |  2 |  |  | -            | -            | -        |  | J-014 |
| 08-00554             | MACH225SF  | R0.1 ~ R3                                               | Long Neck Ball         |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | G-024 |
| 08-00555             | MACH225    | R0.1 ~ R3                                               | Long Neck Ball         |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | G-026 |
| 08-00570             | MRBTN230   | R0.1×neck taper angle30°<br>~ R2×neck taper angle1°     | Long Neck Tapered Ball |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | I-044 |
| 08-00580             | MRBTN230L  | R0.1×neck taper angle30°<br>~ R5×neck taper angle1° 30° | Long Neck Tapered Ball |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | I-054 |
| 08-00588             | MRBTNH230  | R0.05×neck taper angle3°<br>~ R2×neck taper angle1°     | Long Neck Tapered Ball |  2 | -                                                                                    | -                                                                                     | -            | -            | -        |  | G-028 |

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| Code No. | Model       | Size                                                            | Shape                           | Material Coating                                                                        | Number of Flute                                                                       | Side Milling                                                                          | Slot Milling                                                                          | Face Milling | Plunging | 3D Milling                                                                          | Page  |
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| 08-00590 | MRBTNH345   | R0.5×neck taper angle30°<br>~ R2×neck taper angle1°             | Long Neck Tapered Ball          |  3   | -                                                                                     | -                                                                                     | -                                                                                     | -            | -        |  | G-036 |
| 08-00600 | MSB345      | R0.5 ~ R6                                                       | Ball                            |  3   | -                                                                                     | -                                                                                     | -                                                                                     | -            | -        |  | H-060 |
| 08-00607 | MSBH345     | R0.5 ~ R3                                                       | Ball                            |  3   | -                                                                                     | -                                                                                     | -                                                                                     | -            | -        |  | F-026 |
| 08-00610 | MSBSH330-5X | R0.1 ~ R1                                                       | Ball                            |  3   | -                                                                                     | -                                                                                     | -                                                                                     | -            | -        |  | E-004 |
| 08-00634 | MRBSH330    | R0.1 ~ R1                                                       | Long Neck Ball                  |  3   | -                                                                                     | -                                                                                     | -                                                                                     | -            | -        |  | E-010 |
| 08-00700 | MSRS230     | φ 1 × R0.1<br>~ φ 6 × R2                                        | Corner Radius                   |  2   |    |    |    | -            | -        | -                                                                                   | H-074 |
| 08-00710 | MSRS430     | φ 1 × R0.1<br>~ φ 12 × R3                                       | Corner Radius                   |  4  |   |   |   | -            | -        | -                                                                                   | H-076 |
| 08-00770 | MSTNR230    | φ 0.2×R0.05×neck taper angle1°<br>~ φ 3×R0.5×neck taper angle1° | Long Neck Tapered Corner Radius |  2 |  |  |  | -            | -        | -                                                                                   | I-078 |
| 08-00900 | MIR200      | R0.1 ~ R5                                                       | Chamfering                      |  2 | -                                                                                     | -                                                                                     | -                                                                                     | -            | -        | -                                                                                   | S-004 |

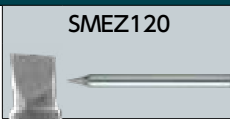
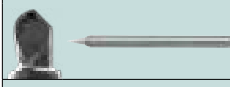


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| <div></div> Micro Edge                                 | D - 002                                                    |
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| <div></div> Regular Line<br>MUGEN COATING PREMIUM      | Full Cutting Length Type F - 002<br>Long Neck Type G - 002 |
| <div></div> Regular Line<br>MUGEN COATING              | Full Cutting Length Type H - 002<br>Long Neck Type I - 002 |
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| <div></div> Copper Electrode Milling                   | M - 002                                                    |
| <div></div> Resin Milling                              | N - 002                                                    |
| <div></div> Hard Brittle Material Milling              | O - 002                                                    |
| <div></div> Graphite Milling                           | P - 002                                                    |
| Drill                                                  |                                                            |
| <div></div> Drill                                      | Q - 002                                                    |
| Thread Mill                                            |                                                            |
| <div></div> Thread Mill                                | R - 002                                                    |
| Chamfering                                             |                                                            |
| <div></div> Chamfering                                 | S - 002                                                    |

Some semi-standard items are also listed in the standard catalog

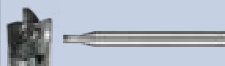
## CBN Core Line

## Various lineup optimize a long time machining on hardened steel

| NEW                                                                                            | Model   | Size          | Maximum Cutting Depth | Length of Cut | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling                                           | Work Material |             |                   |                 |                |        |       |          |                       |                          |        |        |        | Number of Sizes | Page  |
|------------------------------------------------------------------------------------------------|---------|---------------|-----------------------|---------------|-----------------|-------------|--------------|--------------|--------------|------------------------------------------------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|----------|-----------------------|--------------------------|--------|--------|--------|-----------------|-------|
|                                                                                                |         |               |                       |               |                 |             |              |              |              |                                                      | P             | P           | P                 | M               | N              | N      | N     | N        | N                     | S                        | H      |        |        |                 |       |
|                                                                                                |         |               |                       |               |                 |             |              |              |              |                                                      | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC | 65 HRC | 70 HRC |                 |       |
|                                                                                                |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| CBN Micro Edge Square                                                                          |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|               | SMEZ120 | φ0.03 ~ φ0.1  | 1D                    | 1D            | 1               | 20°         | -            | Slot         | -            | -                                                    | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 8               | B-004 |
| CBN micro end mill with standardized of Dia.0.1mm or smaller                                   |         |               |                       |               |                 |             |              |              |              | ※ Listed at "Micro Edge" as well (Page D-004)        |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| CBN Long Neck Square                                                                           |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|               | SSE400  | φ0.1          | 5D                    | 0.4D          | 4               | 0°          | -            | Slot Face    | -            | -                                                    | -             | ○           | -                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 2               | B-006 |
| Best applicable for precise machining on minute corners of the narrow pitch connectors and etc |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|              | SSE600  | φ0.2 ~ φ1     | 5D                    | 0.4D          | 6               | 0°          | -            | Slot Face    | -            | -                                                    | -             | ○           | -                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 14              | B-008 |
| Best applicable for precise machining on minute corners of the narrow pitch connectors and etc |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| CBN Micro Edge Ball                                                                            |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|             | SMB120  | R0.01 ~ R0.05 | 1D                    | 1D            | 1               | 20°         | -            | -            | -            | 3D                                                   | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 7               | B-010 |
| Realized micro milling by size line up R0.01 - R0.05                                           |         |               |                       |               |                 |             |              |              |              | ※ Listed at "Micro Edge Series" as well (Page D-010) |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| CBN Long Neck Ball                                                                             |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|             | SFB200  | R0.1 ~ R1     | 2.5D                  | 0.8D          | 2               | 0°          | -            | -            | -            | 3D                                                   | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 12              | B-012 |
| Realized nano level surface roughness even for milling with its R-center                       |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|             | SSPB220 | R0.1 ~ R3     | 3D                    | 0.8D          | 2               | 20°         | -            | -            | -            | 3D                                                   | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 30              | B-014 |
| Realized glossy finished surface                                                               |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
|             | SSB200  | R0.1 ~ R1     | 2.5D                  | 0.8D          | 2               | 0°          | -            | -            | -            | 3D                                                   | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                        | ○      | ○      | ○      | 15              | B-016 |
| Capable to machine with the same depth of cut as carbide tool finishing                        |         |               |                       |               |                 |             |              |              |              |                                                      |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |

## CBN Core Line

Various lineup optimize a long time machining on hardened steel

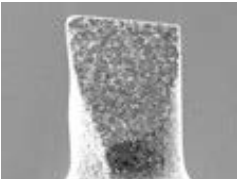
| NEW                                                                                                                      | Model     | Size                                             | Maximum Cutting Depth | Length of Cut    | Number of Flute | Helix Angle | Side Milling | Slot Milling                                                                          | Face Milling                                                                          | 3D Milling                                                                           | Work Material |             |                    |                 |                |        |       |          |                       |                          |                                              | Number of Sizes | Page |       |
|--------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------|-----------------------|------------------|-----------------|-------------|--------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------|-------------|--------------------|-----------------|----------------|--------|-------|----------|-----------------------|--------------------------|----------------------------------------------|-----------------|------|-------|
|                                                                                                                          |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      | P             | P           | P                  | M               | N              | N      | N     | N        | S                     | H                        |                                              |                 |      |       |
|                                                                                                                          |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      | Carbon Steel  | Alloy Steel | Pre-hardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel<br>55 HRC<br>65 HRC<br>70 HRC |                 |      |       |
| CBN Long Neck Ball                                                                                                       |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                       | SSPBL220  | R0.1 ~ R1                                        | 10D                   | $\frac{\pi}{8}D$ | 2               | 20°         | -            | -                                                                                     | -                                                                                     |   | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 27   | B-018 |
| Realized glossy finished surface by maximum L/D=10                                                                       |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                       | SSBL200   | R0.05 ~ R1                                       | 10D                   | $\frac{\pi}{8}D$ | 2               | 0°          | -            | -                                                                                     | -                                                                                     |   | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 25   | B-020 |
| Capable to machine at deep area finishing by maximum L/D=10                                                              |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
| CBN Long Neck Tapered Ball                                                                                               |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                      | SSPBTN220 | R0.1×neck taper angle30' ~ R1×neck taper angle2" | 10D                   | $\frac{\pi}{8}D$ | 2               | 20°         | -            | -                                                                                     | -                                                                                     |  | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 64   | B-022 |
| Taper neck design for high rigidity. Suitable for deep and high accurate finishing                                       |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
| CBN Long Neck Corner Radius                                                                                              |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                     | SSR200    | φ0.1× R0.02 ~ φ2× R0.5                           | 6D                    | $\frac{\pi}{8}D$ | 2               | 0°          | -            |  |  | -                                                                                    | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 172  | B-026 |
| Corner radius end mill with CBN material at the cutting edge. Total 172 sizes. Applicable for various machining profiles |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                     | SHR320    | φ0.5× R0.1 ~ φ2× R0.3                            | 5D                    | 0.5D             | 3               | 20°         | -            |  |  | -                                                                                    | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 14   | B-032 |
| 3-flute CBN corner radius end mill. Realized high efficient and high accurate machining                                  |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                     | SHPR400   | φ0.1× R0.01 ~ φ3× R0.2                           | 6D                    | $\frac{\pi}{8}D$ | 4               | 0°          | -            |  |  | -                                                                                    | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 142  | B-034 |
| 4-flute corner radius end mill from Dia.0.1mm. High precise type to pursue machining accuracy                            |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |
|                                     | SSF120    | φ0.2× R0.05 ~ φ2× R0.1                           | 2.5D                  | 0.5D             | 1               | -20°        | -            | -                                                                                     |  | -                                                                                    | -             | -           | ○                  | -               | -              | -      | -     | -        | -                     | ○                        | ○                                            | ○               | 9    | B-040 |
| Single flute end mill for hardened steels. Specialized for accurate finishing on flat surface                            |           |                                                  |                       |                  |                 |             |              |                                                                                       |                                                                                       |                                                                                      |               |             |                    |                 |                |        |       |          |                       |                          |                                              |                 |      |       |

CBN micro end mill with standardized of Dia.0.1mm or smaller

**PATENTED** PAT. No. 5177982



- NS TOOL engineering technology and selected CBN material realize sharp edge.
- Tolerance of flute diameter is  $\pm 2\mu\text{m}$ .
- Tolerance of shank diameter is h3 (0~-0.0025).



Cutting edge shape

| Work Material | Prehardened Steels•Hardened Steels<br>NAK•STAVAX•SKD11•PD613<br>(~62HRC)                                                                                                                                                                                                                                                                                                                 |          |        |                   |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|-------------------|
| Dia.          | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                             |          | Feed   | Spindle Speed     |
|               | $a_p$ mm                                                                                                                                                                                                                                                                                                                                                                                 | $a_e$ mm | mm/min | $\text{min}^{-1}$ |
| 0.03          | 0.0005                                                                                                                                                                                                                                                                                                                                                                                   | 0.003    | 10     | 60,000            |
| 0.04          | 0.001                                                                                                                                                                                                                                                                                                                                                                                    | 0.003    | 20     | 60,000            |
| 0.05          | 0.001                                                                                                                                                                                                                                                                                                                                                                                    | 0.005    | 30     | 60,000            |
| 0.06          | 0.002                                                                                                                                                                                                                                                                                                                                                                                    | 0.005    | 40     | 60,000            |
| 0.07          | 0.002                                                                                                                                                                                                                                                                                                                                                                                    | 0.01     | 50     | 60,000            |
| 0.08          | 0.003                                                                                                                                                                                                                                                                                                                                                                                    | 0.015    | 65     | 60,000            |
| 0.09          | 0.003                                                                                                                                                                                                                                                                                                                                                                                    | 0.02     | 80     | 60,000            |
| 0.1           | 0.003                                                                                                                                                                                                                                                                                                                                                                                    | 0.025    | 100    | 60,000            |
| Notes         | ※1 Depth of Cut : $a_p$ = Axial Depth of Cut / $a_e$ = Radial Depth of Cut.<br>※2 Handle with care when exchanging and presetting tool.<br>※3 We recommend using oil mist coolant.<br>※4 Minimize chucking runout. (Recommend to measure actual runout at activated spindle speed.)<br>※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut. |          |        |                   |



Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>( $\ell$ ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|-----------------------------|----------------------------------|-------------------|-----------------------|
| 01-00480-00030 | 0.03        | 0.03                        | 15°                              | 4                 | 50                    |
| 01-00480-00040 | 0.04        | 0.04                        | 15°                              | 4                 | 50                    |
| 01-00480-00050 | 0.05        | 0.05                        | 15°                              | 4                 | 50                    |
| 01-00480-00060 | 0.06        | 0.06                        | 15°                              | 4                 | 50                    |
| 01-00480-00070 | 0.07        | 0.07                        | 15°                              | 4                 | 50                    |
| 01-00480-00080 | 0.08        | 0.08                        | 15°                              | 4                 | 50                    |
| 01-00480-00090 | 0.09        | 0.09                        | 15°                              | 4                 | 50                    |
| 01-00480-00100 | 0.1         | 0.1                         | 15°                              | 4                 | 50                    |

How to Order

When you order, indicate SMEZ120 (D). ※( $\gamma$ ) is reference value.

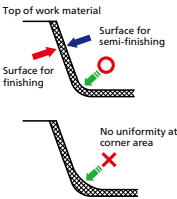
Points in Use

Advice on Cutting Environment

- ④ Minimize the deflection of cutting edge.
- ④ To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

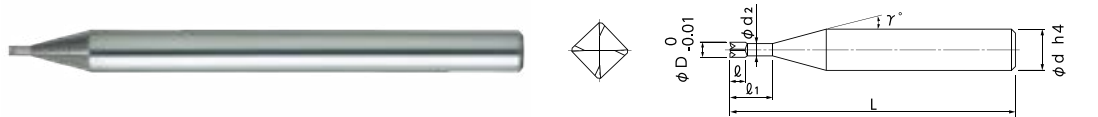
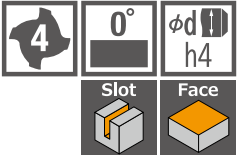
- ④ When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- ④ When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



CBN Square End Mill

Recommended Milling Conditions

Best applicable for precise machining on minute corners of the narrow pitch connectors and etc



- Possible to machine the corner edge of hardened steels.
- Intensified wear resistance by NS TOOL original design of cutting edge.



Cutting edge shape

| Work Material |                   | Hardened Steels<br>HPM-38・STAVAX・SKD61<br>(~55HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |                   | Hardened Steels<br>SKD11<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH<br>(~65HRC) |       |        |                   |
|---------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|
| Dia.          | Under Neck Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     |
|               |                   | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> |
| 0.1           | 0.2               | 0.001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.002 | 250    | 40,000            | 0.001                                | 0.002 | 200    | 40,000            | 0.001                                | 0.002 | 150    | 40,000            |
|               | 0.5               | 0.001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.002 | 200    | 40,000            | 0.001                                | 0.002 | 150    | 40,000            | 0.001                                | 0.001 | 100    | 40,000            |
| Notes         |                   | ※1 Depth of Cut is the maximum effective value for the contour line tool path.<br>※2 ap: Axial Depth of Cut, ae: Radial Depth of Cut.<br>※3 Recommended oil mist coolant.<br>※4 Minimize a possible tool overhang length.<br>※5 Minimize chucking runout. (Recommend to measure actual runout of activated spindle speed.)<br>※6 For the reference value, when finishing process of bottom surface, reduce the feed approx. 50% of the recommended milling conditions and Depth of Cut (ap): 0.001mm for Dia. 0.1mm, (ae): Dia. x 0.05mm. |       |        |                   |                                      |       |        |                   |                                      |       |        |                   |

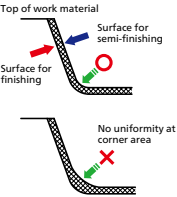
Points in Use

Advice on Cutting Environment

- ⚙ Minimize the deflection of cutting edge.
- ⚙ To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

- ⚙ When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- ⚙ When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



| Code No.       | Dia.<br>(D) | Under Neck Length<br>( $\phi$ 1) | Length of Cut<br>( $\phi$ ) | Neck Dia.<br>(d2) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------------------|-----------------------------|-------------------|----------------------------------|-------------------|-----------------------|
| 01-00440-01002 | 0.1         | 0.2                              | 0.04                        | 0.075             | 15°                              | 4                 | 53                    |
| 01-00440-01005 |             | 0.5                              | 0.04                        | 0.08              | 15°                              | 4                 | 53                    |

Unit : mm

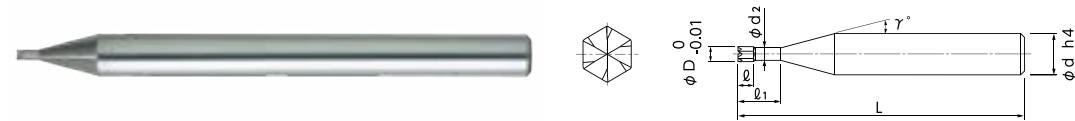
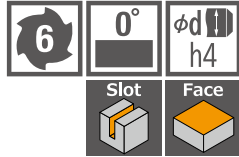
How to Order

When you order, indicate SSE400 (D)x( $\phi$ 1).    ※( $\gamma$ ) is reference value.

CBN Square End Mill

Recommended Milling Conditions

Best applicable for precise machining on minute corners of the narrow pitch connectors and etc



- Possible to machine the corner edge of hardened steels.
- Intensified wear resistance by NS TOOL original design of cutting edge.



Cutting edge shape

Unit : mm

| Code No.       | Dia. (D) | Under Neck Length (L1) | Length of Cut (L) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| 01-00450-02004 | 0.2      | 0.4                    | 0.08              | 0.175          | 15°                  | 4              | 53                 |
| 01-00450-02010 |          | 1                      | 0.08              | 0.175          | 15°                  | 4              | 53                 |
| 01-00450-03005 | 0.3      | 0.5                    | 0.12              | 0.275          | 15°                  | 4              | 49                 |
| 01-00450-03015 |          | 1.5                    | 0.12              | 0.275          | 15°                  | 4              | 50                 |
| 01-00450-04008 | 0.4      | 0.8                    | 0.16              | 0.37           | 15°                  | 4              | 49                 |
| 01-00450-04020 |          | 2                      | 0.16              | 0.37           | 15°                  | 4              | 50                 |
| 01-00450-05010 | 0.5      | 1                      | 0.2               | 0.46           | 15°                  | 4              | 49                 |
| 01-00450-05025 |          | 2.5                    | 0.2               | 0.46           | 15°                  | 4              | 50                 |
| 01-00450-06012 | 0.6      | 1.2                    | 0.24              | 0.56           | 15°                  | 4              | 49                 |
| 01-00450-06030 |          | 3                      | 0.24              | 0.56           | 15°                  | 4              | 50                 |
| 01-00450-08015 | 0.8      | 1.5                    | 0.32              | 0.76           | 15°                  | 4              | 49                 |
| 01-00450-08040 |          | 4                      | 0.32              | 0.76           | 15°                  | 4              | 52                 |
| 01-00450-10020 | 1        | 2                      | 0.4               | 0.95           | 15°                  | 4              | 49                 |
| 01-00450-10050 |          | 5                      | 0.4               | 0.95           | 15°                  | 4              | 52                 |

How to Order

When you order, indicate SSE600 (D)×(L1). ※(γ) is reference value.

Machining Case 1

Flow Channel Model



Work Size : 40x20mm Cutting depth : 0.5mm

- Work Material : HAP40 64HRC
- Coolant : Oil mist
- Total machining time : 7hr 30min

| Process                            | Pre-roughing       | Roughing (2 pcs) | Semi-finishing        | Contour line finishing | Bottom finishing |
|------------------------------------|--------------------|------------------|-----------------------|------------------------|------------------|
| Tool                               | MHRH430<br>φ 2.5x8 | MHRH430<br>φ 1x4 | SSR200<br>φ 1xR0.02x1 | SSE600                 | φ 1x2            |
| Spindle speed [min <sup>-1</sup> ] | 8,000              | 20,000           | 30,000                |                        |                  |
| Feed [mm/min]                      | 1,000              |                  | 600                   | 300                    | 90               |
| Depth of cut ap×ae[mm]             | 0.03×0.75          | 0.02×0.3         | 0.005×0.01~0.05       | 0.005×0.005            | 0.001×0.5        |
| Machining time                     | 13min              | 1hr44min         | 1hr18min              | 4hr15min               |                  |

Machining case

W-002

| Work Material |                   | Hardened Steels<br>HPM-38・STAVAX・SKD61<br>(~55HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |        |                   | Hardened Steels<br>SKD11<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH<br>(~65HRC) |       |        |                   |
|---------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|
| Dia.          | Under Neck Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     |
|               |                   | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> |
| 0.2           | 0.4               | 0.003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.002 | 400    | 40,000            | 0.002                                | 0.002 | 300    | 40,000            | 0.002                                | 0.002 | 200    | 40,000            |
|               | 1                 | 0.003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.002 | 300    | 40,000            | 0.002                                | 0.002 | 200    | 40,000            | 0.002                                | 0.002 | 100    | 40,000            |
| 0.3           | 0.5               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.003 | 600    | 40,000            | 0.004                                | 0.003 | 400    | 40,000            | 0.003                                | 0.003 | 400    | 40,000            |
|               | 1.5               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.002 | 500    | 40,000            | 0.004                                | 0.002 | 300    | 40,000            | 0.003                                | 0.002 | 200    | 40,000            |
| 0.4           | 0.8               | 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.004 | 700    | 40,000            | 0.005                                | 0.003 | 600    | 40,000            | 0.003                                | 0.003 | 600    | 40,000            |
|               | 2                 | 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.003 | 600    | 40,000            | 0.005                                | 0.002 | 400    | 40,000            | 0.003                                | 0.002 | 400    | 40,000            |
| 0.5           | 1                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.005 | 800    | 40,000            | 0.007                                | 0.003 | 700    | 40,000            | 0.005                                | 0.003 | 600    | 40,000            |
|               | 2.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.004 | 800    | 40,000            | 0.007                                | 0.002 | 500    | 40,000            | 0.005                                | 0.002 | 400    | 40,000            |
| 0.6           | 1.2               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.005 | 800    | 40,000            | 0.007                                | 0.003 | 700    | 40,000            | 0.005                                | 0.003 | 600    | 40,000            |
|               | 3                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.004 | 800    | 40,000            | 0.007                                | 0.002 | 500    | 40,000            | 0.005                                | 0.002 | 400    | 40,000            |
| 0.8           | 1.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.005 | 800    | 40,000            | 0.007                                | 0.004 | 800    | 40,000            | 0.005                                | 0.004 | 700    | 40,000            |
|               | 3.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.004 | 800    | 40,000            | 0.007                                | 0.003 | 600    | 40,000            | 0.005                                | 0.003 | 500    | 40,000            |
| 1             | 2                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.006 | 800    | 40,000            | 0.007                                | 0.006 | 800    | 40,000            | 0.005                                | 0.006 | 800    | 40,000            |
|               | 5                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.005 | 800    | 40,000            | 0.007                                | 0.005 | 600    | 40,000            | 0.005                                | 0.005 | 600    | 40,000            |
| Notes         |                   | ※1 Depth of Cut is the maximum effective value for the contour line tool path.<br>※2 ap: Axial Depth of Cut, ae: Radial Depth of Cut.<br>※3 Recommended oil mist coolant.<br>※4 Minimize a possible tool overhang length.<br>※5 Minimize chucking runout. (Recommend to measure actual runout of activated spindle speed.)<br>※6 For the reference value, when finishing process of bottom surface, reduce the feed approx. 50% of the recommended milling conditions and Depth of Cut (ap): 0.002mm for Dia. 0.2mm and 0.3mm, for Dia. 0.4 to 1mm, up to 0.003mm, (ae): Dia. x 0.05mm. |       |        |                   |                                      |       |        |                   |                                      |       |        |                   |

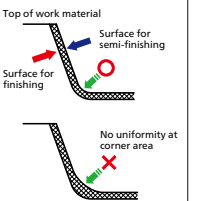
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**

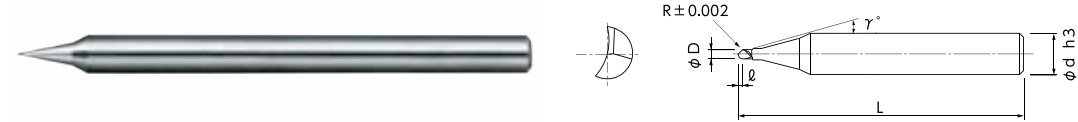
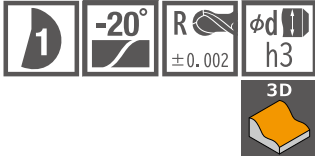




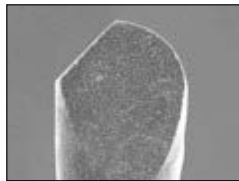
CBN Ball End Mill for precision machining “CBN Micro Ball” ※ Listed at “Micro Edge” as well (Page D-010)

Recommended Milling Conditions

Realized micro milling by size line up R0.01 - R0.05



- The world's first CBN Micro Ball End Mill.
- CBN Micro Ball develops new machining capability in high-precision technology.
- Standarized sizes from R0.01.
- Long machining on pre-hardened to high-hardened steels.

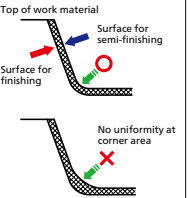


Cutting edge shape

| Work Material | Prehardened Steels・Hardened Steels<br>NAK・STAVAX・SKD11・PD613<br>(~62HRC)                                                                                                                                                                                                                                                                                                                                                                                |       |        |                  |                   |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|------------------|-------------------|
|               | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                            |       | Feed   | Approaching Feed | Spindle Speed     |
| Radius        | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ae mm | mm/min | mm/min           | min <sup>-1</sup> |
| 0.01          | 0.0005                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.001 | 5      | 3                | 80,000            |
| 0.02          | 0.001                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.001 | 30     | 5                | 80,000            |
| 0.03          | 0.001                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.002 | 70     | 10               | 80,000            |
| 0.04          | 0.002                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.003 | 100    | 30               | 80,000            |
| 0.05          | 0.002                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.005 | 200    | 30               | 80,000            |
| Notes         | <p>※1 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br/>※2 Handle with care when exchanging and presetting tool.<br/>※3 We recommend using oil mist coolant.<br/>※4 Minimize chucking runout.<br/>(Recommend to measure actual runout at activated spindle speed.)<br/>※5 Tool approaching angle must be 3 degrees or below.<br/>※6 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.</p> |       |        |                  |                   |

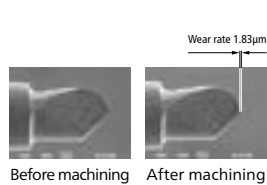
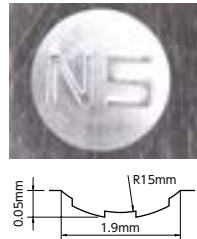
## Points in Use

| Advice on Cutting Environment                                                                                                                                                                                                          | Advice on Finishing Allowance (stock amount)                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>⚙ Minimize the deflection of cutting edge.</li><li>⚙ To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.</li></ul> | <ul style="list-style-type: none"><li>⚙ When using small CBN End Mill, <b>uniform finishing allowance (stock amount) is important.</b></li><li>⚙ When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. <b>Therefore, it is important to get uniform stock amount in the pre-stage cutting.</b></li></ul> |



### Machining Case 1

R0.05 NS Logo

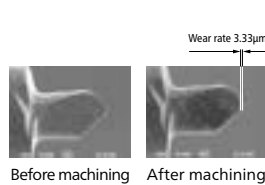
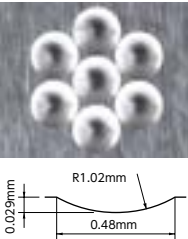


|                  |                            |                             |
|------------------|----------------------------|-----------------------------|
| Work Material    | STAVAX 52HRC               |                             |
| Spindle speed    | 80,000min <sup>-1</sup>    |                             |
| Feed             | Roughing : 200mm/min       | Finishing : 50mm/min        |
| Depth of cut ※   | Roughing : 2μm×5μm (ap×ae) | Finishing : 2μm×2μm (ap×ae) |
| Machining time   | 1hr 50min                  |                             |
| Machining length | 7.7m                       |                             |
| Coolant          | Oil mist                   |                             |

- Full process done by one tool.
- ※ ap: Axial Depth of Cut, ae: Radial Depth of Cut.

### Machining Case 2

R0.03 Lens Array Model



|                  |                            |                             |
|------------------|----------------------------|-----------------------------|
| Work Material    | PD613 60HRC                |                             |
| Spindle speed    | 80,000min <sup>-1</sup>    |                             |
| Feed             | Roughing : 50mm/min        | Finishing : 30mm/min        |
| Depth of cut ※   | Roughing : 1μm×2μm (ap×ae) | Finishing : 1μm×1μm (ap×ae) |
| Machining time   | 4hr                        |                             |
| Machining length | 10.4m                      |                             |
| Coolant          | Oil mist                   |                             |

- Full process done by one tool.
- ※ ap: Axial Depth of Cut, ae: Radial Depth of Cut.

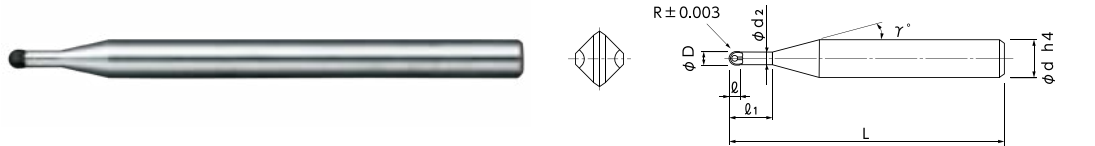
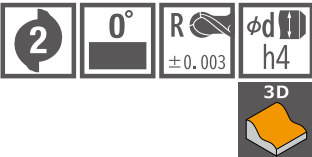
Machining case W-003

CBN Super Finish Ball End Mill

Recommended Milling Conditions

Realized nano level surface roughness even for milling with its R-center

**PATENTED** PAT. No. 3759098



- Sharpened edge at R-center improves shearing ability.
- Continuous 10 hours machining on hardened steel of 60HRC.
- Long-lasting high surface accuracy Rz1.0μm.
- Save significant time at polishing process.



Cutting edge shape

Sharp tooth edge guarantees long and consistent accuracy.

| Work Material | Prehardened Steels・Hardened Steels・High Speed Steels<br>NAK・SKD・SKH・HAP<br>(～68HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |              |                   |            |                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|-------------------|------------|-------------------|
| Radius        | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       | Normal Speed |                   | High Speed |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       | Feed         | Spindle Speed     | Feed       | Spindle Speed     |
|               | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ae mm | mm/min       | min <sup>-1</sup> | mm/min     | min <sup>-1</sup> |
| 0.1 ～0.2      | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.01  | 600          | 20,000            | 1,500      | 50,000            |
| 0.25～0.3      | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.01  | 800          |                   | 2,000      |                   |
| 0.4 ～0.6      | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.02  | 1,200        |                   | 3,000      |                   |
| 0.7 ～0.8      | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.02  | 1,600        |                   | 4,000      |                   |
| 0.9 ～1        | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.05  | 2,000        |                   | 5,000      |                   |
| Notes         | ※ 1 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※ 2 SFB200 is a Super-Finish Ball End Mill recommended to use after the finish process of carbide end mill.<br>※ 3 Cutting depth must be fixed all through the milling process according to the recommended milling conditions.<br>※ 4 Pay a special attention when choosing tool path and deciding a milling condition for corner milling.<br>※ 5 We recommend using oil mist coolant.<br>※ 6 Machine, tool chuck must be sufficiently accurate. |       |              |                   |            |                   |

Machining Case 1

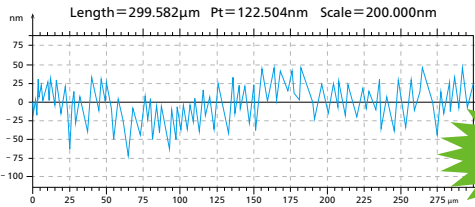
Reflector

- Work Material : ELMAX 60HRC
- Coolant : Oil mist
- Total machining time : 19hr 10min

| Process                            | Roughing     | Semi-finishing   | Finishing   |
|------------------------------------|--------------|------------------|-------------|
| Tool                               | MSBH230 R0.2 | SSBL200 R0.2x1.2 | SFB200 R0.2 |
| Spindle speed [min <sup>-1</sup> ] | 40,000       |                  |             |
| Feed [mm/min]                      | 800          | 700              | 400         |
| Depth of cut apxae[mm]             | 0.015x0.05   | 0.005x0.01       | 0.004x0.002 |
| Machining time                     | 3hr 23min    | 2hr 10min        | 13hr 37min  |



Work size : 20x20mm



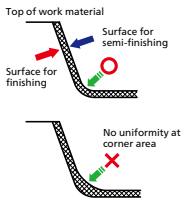
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



Long Neck  
Ball

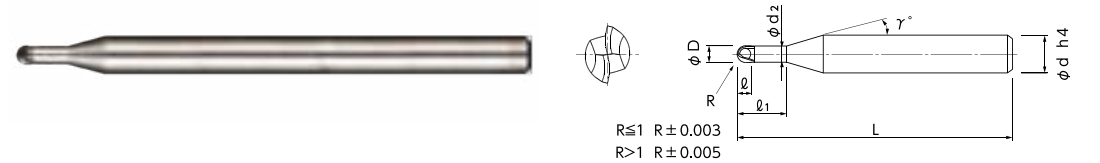
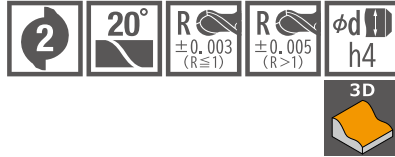


Long Neck  
Ball

CBN Super Spiral Ball End Mill

Recommended Milling Conditions

Realized glossy finished surface



- Adopted spiral ball shape to improve sharpness of cutting edge.
- Adopted cutting edge shape to improve the chipping resistance of cutting edge.
- When peripheral cutting edge makes contact with cutting surface, vibration occurs by an increase in cutting resistance and it affects tool life and cutting surface quality. The influence can be reduced by adoption of the strong back taper shape.
- Enlarged standard tool size up to R3 to extend application range.



Cutting edge shape

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| 01-00505-00101 | R0.1       | 0.3                    | 0.15              | 0.2      | 0.19           | 15°                  | 4              | 50                 |
| 01-00505-00100 |            | 0.6                    | 0.15              | 0.2      | 0.19           | 15°                  | 4              | 50                 |
| 01-00505-00150 | R0.15      | 0.3                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00505-00151 |            | 0.5                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00505-00152 | R0.2       | 0.75                   | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00505-00201 |            | 0.5                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00505-00202 |            | 0.75                   | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00505-00203 |            | 1                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00505-00200 | R0.25      | 1.2                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00505-00251 |            | 1                      | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 50                 |
| 01-00505-00301 | R0.3       | 1.2                    | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 50                 |
| 01-00505-00300 |            | 1.5                    | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 50                 |
| 01-00505-00401 | R0.4       | 1.6                    | 0.6               | 0.8      | 0.76           | 15°                  | 4              | 50                 |
| 01-00505-00400 |            | 2                      | 0.6               | 0.8      | 0.76           | 15°                  | 4              | 50                 |
| 01-00505-00501 | R0.5       | 2                      | 0.7               | 1        | 0.95           | 15°                  | 4              | 50                 |
| 01-00505-00500 |            | 2.5                    | 0.7               | 1        | 0.95           | 15°                  | 4              | 50                 |
| 01-00505-00601 | R0.6       | 2.4                    | 0.8               | 1.2      | 1.15           | 15°                  | 4              | 50                 |
| 01-00505-00600 |            | 3                      | 0.8               | 1.2      | 1.15           | 15°                  | 4              | 50                 |
| 01-00505-00751 | R0.75      | 3                      | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00505-00750 |            | 3.8                    | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00505-01000 | R1         | 4                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |
| 01-00505-01001 |            | 5                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |
| 01-00505-01506 | R1.5       | 6                      | 1.8               | 3        | 2.85           | 12°                  | 6              | 50                 |
| 01-00505-01509 |            | 9                      | 1.8               | 3        | 2.85           | 12°                  | 6              | 70                 |
| 01-00505-02008 | R2         | 8                      | 2.4               | 4        | 3.8            | 12°                  | 6              | 50                 |
| 01-00505-02012 |            | 12                     | 2.4               | 4        | 3.8            | 12°                  | 6              | 70                 |
| 01-00505-02510 | R2.5       | 10                     | 3                 | 5        | 4.8            | 12°                  | 6              | 60                 |
| 01-00505-02515 |            | 15                     | 3                 | 5        | 4.8            | 12°                  | 6              | 80                 |
| 01-00505-03012 | R3         | 12                     | 3.6               | 6        | 5.8            | —                    | 6              | 60                 |
| 01-00505-03018 |            | 18                     | 3.6               | 6        | 5.8            | —                    | 6              | 80                 |

How to Order

When you order, indicate SSPB220 (R)×(ℓ1).   ※(γ) is reference value.

Machining case

W-004

| Work Material |                   | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(~52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |        |                   | Hardened Steels<br>SKD11・ELMAX<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH・HAP<br>(~68HRC) |       |        |                   |
|---------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
|               |                   | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       | Feed   | Spindle Speed     | Depth of Cut                               |       | Feed   | Spindle Speed     | Depth of Cut                             |       | Feed   | Spindle Speed     |
| Radius        | Under Neck Length | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> | ap mms                                   | ae mm | mm/min | min <sup>-1</sup> |
| 0.1           | 0.3               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005 | 600    | 40,000            | 0.005                                      | 0.005 | 450    | 40,000            | 0.003                                    | 0.003 | 300    | 40,000            |
|               | 0.6               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005 | 500    | 40,000            | 0.005                                      | 0.005 | 350    | 40,000            | 0.003                                    | 0.003 | 250    | 40,000            |
| 0.15          | 0.3               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005 | 800    | 40,000            | 0.005                                      | 0.005 | 600    | 40,000            | 0.003                                    | 0.003 | 450    | 40,000            |
|               | 0.5               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005 | 750    | 40,000            | 0.005                                      | 0.005 | 550    | 40,000            | 0.003                                    | 0.003 | 400    | 40,000            |
| 0.2           | 0.75              | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005 | 700    | 40,000            | 0.005                                      | 0.005 | 500    | 40,000            | 0.003                                    | 0.003 | 400    | 40,000            |
|               | 0.5               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 1,200  | 40,000            | 0.005                                      | 0.01  | 900    | 40,000            | 0.005                                    | 0.005 | 600    | 40,000            |
|               | 0.75              | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 1,100  | 40,000            | 0.005                                      | 0.01  | 850    | 40,000            | 0.005                                    | 0.005 | 550    | 40,000            |
| 0.25          | 1                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 1,000  | 40,000            | 0.005                                      | 0.01  | 800    | 40,000            | 0.005                                    | 0.005 | 500    | 40,000            |
|               | 1.2               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 1,000  | 40,000            | 0.005                                      | 0.01  | 800    | 40,000            | 0.005                                    | 0.005 | 500    | 40,000            |
|               | 1                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.01  | 1,200  | 40,000            | 0.01                                       | 0.01  | 1,000  | 40,000            | 0.005                                    | 0.005 | 700    | 40,000            |
| 0.3           | 1.2               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.02  | 1,800  | 40,000            | 0.01                                       | 0.02  | 1,500  | 40,000            | 0.005                                    | 0.01  | 1,000  | 40,000            |
|               | 1.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.02  | 1,500  | 40,000            | 0.01                                       | 0.02  | 1,200  | 40,000            | 0.005                                    | 0.01  | 800    | 40,000            |
| 0.4           | 1.6               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.02  | 1,800  | 40,000            | 0.01                                       | 0.02  | 1,500  | 40,000            | 0.005                                    | 0.01  | 1,000  | 40,000            |
|               | 2                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.02  | 1,500  | 40,000            | 0.01                                       | 0.02  | 1,200  | 40,000            | 0.005                                    | 0.01  | 800    | 40,000            |
| 0.5           | 2                 | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.04  | 2,500  | 40,000            | 0.02                                       | 0.03  | 1,800  | 40,000            | 0.01                                     | 0.02  | 1,200  | 40,000            |
|               | 2.5               | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.04  | 2,000  | 40,000            | 0.02                                       | 0.03  | 1,500  | 40,000            | 0.01                                     | 0.02  | 1,000  | 40,000            |
| 0.6           | 2.4               | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.04  | 2,500  | 40,000            | 0.02                                       | 0.03  | 2,000  | 40,000            | 0.01                                     | 0.02  | 1,500  | 40,000            |
|               | 3                 | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.04  | 2,500  | 40,000            | 0.02                                       | 0.03  | 2,000  | 40,000            | 0.01                                     | 0.02  | 1,500  | 40,000            |
| 0.75          | 3                 | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.05  | 3,000  | 40,000            | 0.03                                       | 0.05  | 3,000  | 40,000            | 0.02                                     | 0.03  | 2,000  | 30,000            |
|               | 3.8               | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.05  | 3,000  | 40,000            | 0.03                                       | 0.05  | 3,000  | 40,000            | 0.02                                     | 0.03  | 2,000  | 30,000            |
| 1             | 4                 | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.1   | 3,000  | 30,000            | 0.03                                       | 0.05  | 3,000  | 30,000            | 0.03                                     | 0.03  | 2,000  | 25,000            |
|               | 5                 | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.1   | 3,000  | 30,000            | 0.03                                       | 0.05  | 3,000  | 30,000            | 0.03                                     | 0.03  | 2,000  | 25,000            |
| 1.5           | 6                 | 0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.15  | 2,300  | 20,000            | 0.05                                       | 0.075 | 2,100  | 20,000            | 0.04                                     | 0.06  | 1,300  | 15,000            |
|               | 9                 | 0.06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.12  | 2,200  | 20,000            | 0.04                                       | 0.06  | 2,000  | 20,000            | 0.04                                     | 0.05  | 1,200  | 15,000            |
| 2             | 8                 | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.18  | 2,300  | 17,000            | 0.06                                       | 0.09  | 2,100  | 15,000            | 0.05                                     | 0.07  | 1,300  | 12,000            |
|               | 12                | 0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.15  | 2,000  | 17,000            | 0.05                                       | 0.08  | 1,700  | 15,000            | 0.04                                     | 0.06  | 1,200  | 12,000            |
| 2.5           | 10                | 0.11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.21  | 2,200  | 13,000            | 0.08                                       | 0.12  | 1,800  | 12,000            | 0.07                                     | 0.1   | 1,300  | 11,000            |
|               | 15                | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.18  | 1,900  | 13,000            | 0.06                                       | 0.1   | 1,500  | 12,000            | 0.06                                     | 0.08  | 1,100  | 11,000            |
| 3             | 12                | 0.13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.24  | 2,000  | 10,000            | 0.09                                       | 0.15  | 1,600  | 10,000            | 0.08                                     | 0.12  | 1,200  | 10,000            |
|               | 18                | 0.11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.21  | 1,700  | 10,000            | 0.08                                       | 0.12  | 1,400  | 10,000            | 0.07                                     | 0.1   | 1,000  | 10,000            |
| Notes         |                   | ※1 Max. Depth of Cut for semi-finishing and finishing. Adjust milling conditions depending on the rigidity of the machine and desired accuracy.<br>※2 Obtain uniform stock amount on the cutting surface in the pre-stage cutting (semi-finishing).<br>※3 Required careful set up of milling conditions, tool path and etc. at cutting parts, such as corners where will become overloaded.<br>※4 Adjust both Depth of Cut and feed rate at 70% of the recommended milling conditions for high quality milling surface.<br>※5 Oil mist coolant is recommended.<br>※6 Adjust feed rate at same rate as spindle speed if necessary to adjust spindle speed from recommended milling conditions. |       |        |                   |                                            |       |        |                   |                                          |       |        |                   |

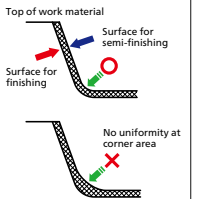
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

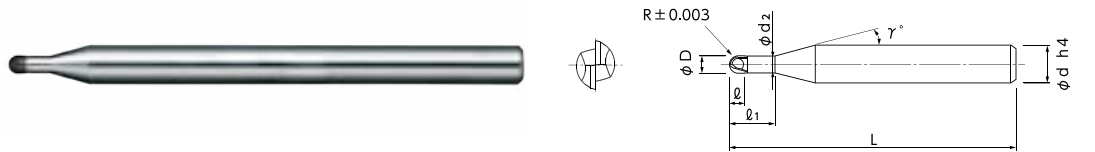
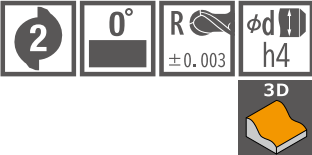
- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



CBN Super Speed Ball End Mill

Recommended Milling Conditions

Capable to machine with the same depth of cut as carbide tool finishing



- This CBN Ball End Mill has realized both advantages of CBN and Carbide.
- Depth of Cut can be increased at the equivalent level to Carbide.
- Unique flute design with R-accuracy ±0.003 prevents chipping!
- Flute is smoothly tangent from straight line to R-curve.
- Applicable for hardened materials up to 70HRC!



Cutting edge shape

| Work Material |                   | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(～52HRC)                                                                                                                                                                                                                                                                                                                                                  |       |        |                   | Hardened Steels<br>SKD11<br>(～62HRC) |       |        |                   | High Speed Steels<br>SKH・HAP<br>(～68HRC) |       |        |                   |
|---------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
| Radius        | Under Neck Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                          |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     | Depth of Cut                             |       | Feed   | Spindle Speed     |
|               |                   | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                 | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.1           | 0.3               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.005 | 720    | 50,000            | 0.005                                | 0.005 | 540    | 50,000            | 0.003                                    | 0.003 | 360    | 50,000            |
| 0.15          | 0.3               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.01  | 1,400  |                   | 0.005                                | 0.01  | 800    |                   | 0.005                                    | 0.005 | 500    |                   |
|               | 0.5               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.005 | 1,200  |                   | 0.005                                | 0.005 | 640    |                   | 0.003                                    | 0.005 | 460    |                   |
|               | 0.75              | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.005 | 1,000  |                   | 0.005                                | 0.005 | 540    |                   | 0.003                                    | 0.005 | 400    |                   |
| 0.2           | 0.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.01  | 1,800  |                   | 0.01                                 | 0.01  | 1,200  |                   | 0.005                                    | 0.01  | 640    |                   |
|               | 0.75              | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.01  | 1,600  |                   | 0.005                                | 0.01  | 1,000  |                   | 0.005                                    | 0.01  | 540    |                   |
|               | 1                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.01  | 1,400  |                   | 0.005                                | 0.01  | 900    |                   | 0.005                                    | 0.005 | 460    |                   |
| 0.25          | 1                 | 0.015                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.015 | 1,800  |                   | 0.01                                 | 0.015 | 1,500  |                   | 0.01                                     | 0.01  | 1,100  |                   |
| 0.3           | 1.5               | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.03  | 2,000  |                   | 0.01                                 | 0.02  | 2,000  |                   | 0.01                                     | 0.02  | 1,500  |                   |
| 0.4           | 2                 | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.05  | 2,000  |                   | 0.02                                 | 0.03  | 2,000  |                   | 0.01                                     | 0.03  | 1,500  |                   |
| 0.5           | 2.5               | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.05  | 3,000  |                   | 0.03                                 | 0.05  | 3,000  |                   | 0.02                                     | 0.03  | 2,000  |                   |
| 0.6           | 3                 | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.05  | 3,000  |                   | 0.03                                 | 0.05  | 3,000  |                   | 0.02                                     | 0.03  | 2,000  |                   |
| 0.75          | 3.8               | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.1   | 4,000  |                   | 0.05                                 | 0.05  | 4,000  |                   | 0.02                                     | 0.05  | 3,000  |                   |
| 1             | 4                 | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1   | 5,000  |                   | 0.05                                 | 0.05  | 5,000  |                   | 0.03                                     | 0.05  | 3,000  |                   |
|               | 5                 | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1   | 5,000  |                   | 0.05                                 | 0.05  | 5,000  |                   | 0.03                                     | 0.05  | 3,000  |                   |
| Notes         |                   | ※1 Depth of Cut shows the maximum value for semi-finishing and finishing.<br>※2 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br>※3 We recommend using oil mist coolant.<br>※4 Adjust both spindle speed and feed at the same rate.<br>※5 Adjust milling conditions according to the volume of Depth of Cut and rigidity of machine.<br>※6 Length of tool overhang must be as short as possible. |       |        |                   |                                      |       |        |                   |                                          |       |        |                   |



| Unit : mm      |            |                        |                   |          |                |                      |                |                    |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00510-00100 | R0.1       | 0.3                    | 0.15              | 0.2      | 0.19           | 15°                  | 4              | 50                 |
| 01-00510-00150 | R0.15      | 0.3                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00510-00151 |            | 0.5                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00510-00152 |            | 0.75                   | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00510-00200 | R0.2       | 0.5                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00510-00201 |            | 0.75                   | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00510-00202 |            | 1                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00510-00250 | R0.25      | 1                      | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 50                 |
| 01-00510-00300 | R0.3       | 1.5                    | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 50                 |
| 01-00510-00400 | R0.4       | 2                      | 0.6               | 0.8      | 0.76           | 15°                  | 4              | 50                 |
| 01-00510-00500 | R0.5       | 2.5                    | 0.7               | 1        | 0.95           | 15°                  | 4              | 50                 |
| 01-00510-00600 | R0.6       | 3                      | 0.8               | 1.2      | 1.15           | 15°                  | 4              | 50                 |
| 01-00510-00750 | R0.75      | 3.8                    | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00510-01001 | R1         | 4                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |
| 01-00510-01000 |            | 5                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |

How to Order

When you order, indicate SSB200 (R)×(ℓ1). ※(γ) is reference value.

Machining case

W-005

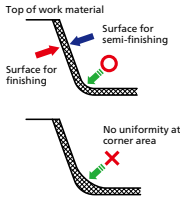
Points in Use

Advice on Cutting Environment

- ➊ Minimize the deflection of cutting edge.
- ➋ To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

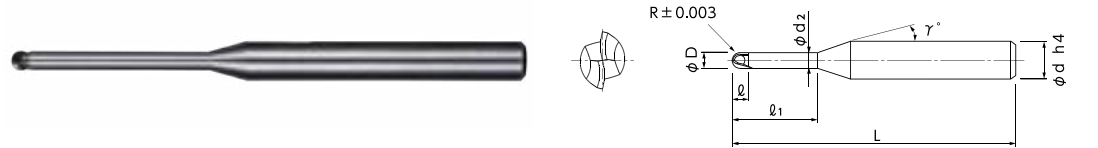
- ➊ When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- ➋ When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



CBN Super Spiral Long Neck Ball End Mill

Recommended Milling Conditions

Realized glossy finished surface by maximum L/D=10



- Added longer under neck length type to SSPB220 series.
- Realized deeper milling by adoption of spiral ball shape and strong back taper shape to improve both sharpness and the chipping resistance of cutting edges.



Cutting edge shape

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| 01-00506-00101 | R0.1       | 1                      | 0.15              | 0.2      | 0.19           | 15°                  | 4              | 50                 |
| 01-00506-00151 | R0.15      | 0.9                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00506-00152 |            | 1.5                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00506-00201 | R0.2       | 2                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00506-00202 |            | 3                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 52                 |
| 01-00506-00251 | R0.25      | 1.5                    | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 50                 |
| 01-00506-00252 |            | 2.5                    | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 50                 |
| 01-00506-00253 |            | 3.5                    | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 52                 |
| 01-00506-00301 | R0.3       | 3                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 50                 |
| 01-00506-00302 |            | 4                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 53                 |
| 01-00506-00303 |            | 5                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 53                 |
| 01-00506-00304 |            | 6                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 53                 |
| 01-00506-00401 | R0.4       | 4                      | 0.6               | 0.8      | 0.76           | 15°                  | 4              | 53                 |
| 01-00506-00402 |            | 6                      | 0.6               | 0.8      | 0.76           | 15°                  | 4              | 53                 |
| 01-00506-00501 | R0.5       | 4                      | 0.7               | 1        | 0.95           | 15°                  | 4              | 51                 |
| 01-00506-00502 |            | 6                      | 0.7               | 1        | 0.95           | 15°                  | 4              | 53                 |
| 01-00506-00503 |            | 8                      | 0.7               | 1        | 0.95           | 15°                  | 4              | 53                 |
| 01-00506-00504 |            | 10                     | 0.7               | 1        | 0.95           | 15°                  | 4              | 53                 |
| 01-00506-00601 | R0.6       | 6                      | 0.8               | 1.2      | 1.15           | 15°                  | 4              | 53                 |
| 01-00506-00751 | R0.75      | 7.5                    | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00506-00752 |            | 10                     | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00506-00753 |            | 15                     | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00506-01001 | R1         | 6                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 53                 |
| 01-00506-01002 |            | 8                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 53                 |
| 01-00506-01003 |            | 10                     | 1.2               | 2        | 1.94           | 15°                  | 4              | 53                 |
| 01-00506-01004 |            | 14                     | 1.2               | 2        | 1.94           | 15°                  | 4              | 53                 |
| 01-00506-01005 |            | 20                     | 1.2               | 2        | 1.94           | 15°                  | 4              | 53                 |

How to Order

When you order, indicate SSPBL220 (R)×(ℓ1). ※(γ) is reference value.

| Work Material |                   | Prehardened Steels•Hardened Steels<br>NAK80•STAVAX•SKD61<br>(~52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       |        |                   | Hardened Steels<br>SKD11•ELMAX<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH•HAP<br>(~68HRC) |       |        |                   |
|---------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
|               |                   | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       | Feed   | Spindle Speed     | Depth of Cut                               |       | Feed   | Spindle Speed     | Depth of Cut                             |       | Feed   | Spindle Speed     |
| Radius        | Under Neck Length | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.1           | 1                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.005 | 200    | 40,000            | 0.005                                      | 0.005 | 150    | 40,000            | 0.003                                    | 0.003 | 100    | 40,000            |
|               | 0.9               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.005 | 600    | 40,000            | 0.005                                      | 0.005 | 400    | 40,000            | 0.003                                    | 0.005 | 300    | 40,000            |
| 0.15          | 1.5               | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.005 | 320    | 40,000            | 0.005                                      | 0.005 | 240    | 40,000            | 0.003                                    | 0.005 | 160    | 40,000            |
|               | 2                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.01  | 500    | 40,000            | 0.005                                      | 0.01  | 400    | 40,000            | 0.005                                    | 0.005 | 320    | 40,000            |
| 0.2           | 3                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.005 | 250    | 40,000            | 0.005                                      | 0.005 | 200    | 40,000            | 0.003                                    | 0.005 | 120    | 40,000            |
|               | 1.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 1,200  | 40,000            | 0.01                                       | 0.01  | 1,000  | 40,000            | 0.005                                    | 0.01  | 600    | 40,000            |
| 0.25          | 2.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 720    | 40,000            | 0.01                                       | 0.01  | 600    | 40,000            | 0.005                                    | 0.01  | 480    | 40,000            |
|               | 3.5               | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 400    | 36,000            | 0.005                                      | 0.01  | 320    | 36,000            | 0.005                                    | 0.005 | 240    | 36,000            |
| 0.3           | 3                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,200  | 40,000            | 0.01                                       | 0.02  | 800    | 40,000            | 0.01                                     | 0.01  | 600    | 40,000            |
|               | 4                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 540    | 36,000            | 0.01                                       | 0.01  | 400    | 36,000            | 0.005                                    | 0.01  | 320    | 36,000            |
|               | 5                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 360    | 30,000            | 0.005                                      | 0.01  | 320    | 30,000            | 0.005                                    | 0.005 | 240    | 30,000            |
|               | 6                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.005 | 240    | 24,000            | 0.005                                      | 0.005 | 200    | 24,000            | 0.003                                    | 0.003 | 160    | 24,000            |
| 0.4           | 4                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.015 | 1,000  | 40,000            | 0.01                                       | 0.015 | 800    | 40,000            | 0.005                                    | 0.01  | 600    | 40,000            |
|               | 6                 | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.01  | 720    | 30,000            | 0.005                                      | 0.01  | 540    | 30,000            | 0.005                                    | 0.005 | 400    | 30,000            |
| 0.5           | 4                 | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 1,600  | 40,000            | 0.02                                       | 0.02  | 1,200  | 40,000            | 0.01                                     | 0.015 | 800    | 40,000            |
|               | 6                 | 0.015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.02  | 1,200  | 30,000            | 0.015                                      | 0.015 | 900    | 30,000            | 0.01                                     | 0.01  | 600    | 30,000            |
|               | 8                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.015 | 720    | 20,000            | 0.01                                       | 0.01  | 540    | 20,000            | 0.005                                    | 0.01  | 400    | 20,000            |
|               | 10                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.01  | 540    | 16,000            | 0.005                                      | 0.01  | 400    | 16,000            | 0.005                                    | 0.005 | 300    | 16,000            |
| 0.6           | 6                 | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,400  | 32,000            | 0.015                                      | 0.02  | 1,000  | 32,000            | 0.01                                     | 0.015 | 720    | 32,000            |
|               | 7.5               | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 1,600  | 32,000            | 0.015                                      | 0.03  | 1,400  | 32,000            | 0.01                                     | 0.01  | 1,000  | 32,000            |
| 0.75          | 10                | 0.015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.02  | 900    | 20,000            | 0.01                                       | 0.02  | 720    | 20,000            | 0.01                                     | 0.01  | 540    | 20,000            |
|               | 15                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 480    | 12,000            | 0.01                                       | 0.01  | 400    | 12,000            | 0.005                                    | 0.01  | 300    | 12,000            |
| 1             | 6                 | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.05  | 2,400  | 40,000            | 0.03                                       | 0.03  | 2,000  | 40,000            | 0.02                                     | 0.02  | 1,600  | 40,000            |
|               | 8                 | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 2,000  | 36,000            | 0.02                                       | 0.03  | 1,400  | 36,000            | 0.01                                     | 0.02  | 1,000  | 36,000            |
|               | 10                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 1,600  | 32,000            | 0.015                                      | 0.03  | 800    | 32,000            | 0.01                                     | 0.015 | 600    | 32,000            |
|               | 14                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 900    | 20,000            | 0.01                                       | 0.02  | 720    | 20,000            | 0.01                                     | 0.01  | 540    | 20,000            |
|               | 20                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 360    | 8,000             | 0.01                                       | 0.02  | 320    | 8,000             | 0.01                                     | 0.01  | 240    | 8,000             |
| Notes         |                   | ※1 Max. Depth of Cut for semi-finishing and finishing. Adjust milling conditions depending on the rigidity of the machine and desired accuracy.<br>※2 Obtain uniform stock amount on the cutting surface in the pre-stage cutting (semi-finishing).<br>※3 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※4 Required careful set up of milling conditions, tool path and etc. at cutting parts, such as corners where will become overloaded.<br>※5 Coolant supply and chip disposal in the deep portion are very important.<br>※6 Oil mist coolant is recommended. |       |        |                   |                                            |       |        |                   |                                          |       |        |                   |

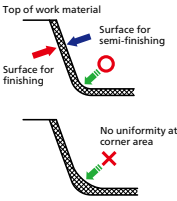
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**

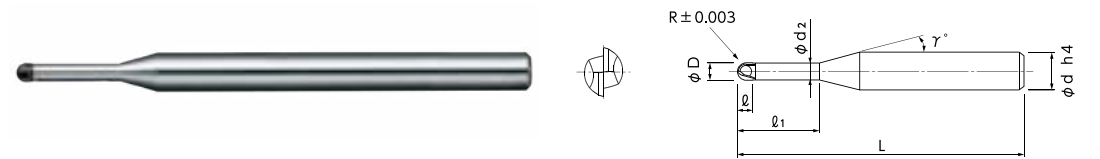




## CBN Super Speed Long Neck Ball End Mill

## Recommended Milling Conditions

Capable to machine at deep area finishing by maximum L/D=10



- Lineup of CBN tool with long neck applicable to deep milling, available 25 sizes in total.
- Enables milling more deeply by long under neck length up to 10mm.
- Enables wider application for milling by long neck in addition to long life and accurate finishing.
- Standardized in R0.05 at smallest.
- Unique flute design with R-accuracy ±0.003 prevents chipping!



Cutting edge shape

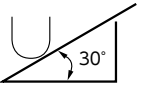
Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| 01-00511-00051 | R0.05      | 0.3                    | 0.08              | 0.1      | 0.09           | 15°                  | 4              | 50                 |
| 01-00511-00052 |            | 0.5                    | 0.08              | 0.1      | 0.09           | 15°                  | 4              | 50                 |
| 01-00511-00075 | R0.075     | 0.45                   | 0.12              | 0.15     | 0.14           | 15°                  | 4              | 50                 |
| 01-00511-00076 |            | 0.75                   | 0.12              | 0.15     | 0.14           | 15°                  | 4              | 50                 |
| 01-00511-00101 | R0.1       | 0.6                    | 0.15              | 0.2      | 0.19           | 15°                  | 4              | 50                 |
| 01-00511-00102 |            | 1                      | 0.15              | 0.2      | 0.19           | 15°                  | 4              | 50                 |
| 01-00511-00151 | R0.15      | 0.9                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00511-00152 |            | 1.5                    | 0.23              | 0.3      | 0.28           | 15°                  | 4              | 50                 |
| 01-00511-00201 | R0.2       | 1.2                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00511-00202 |            | 2                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 50                 |
| 01-00511-00251 | R0.25      | 1.5                    | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 50                 |
| 01-00511-00252 |            | 2.5                    | 0.38              | 0.5      | 0.46           | 15°                  | 4              | 50                 |
| 01-00511-00301 | R0.3       | 3                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 50                 |
| 01-00511-00302 |            | 4                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 52                 |
| 01-00511-00303 |            | 5                      | 0.5               | 0.6      | 0.56           | 15°                  | 4              | 52                 |
| 01-00511-00401 | R0.4       | 4                      | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 53                 |
| 01-00511-00501 | R0.5       | 4                      | 0.7               | 1        | 0.95           | 12°                  | 4              | 53                 |
| 01-00511-00502 |            | 5                      | 0.7               | 1        | 0.95           | 12°                  | 4              | 53                 |
| 01-00511-00504 |            | 6                      | 0.7               | 1        | 0.95           | 15°                  | 4              | 53                 |
| 01-00511-00506 |            | 8                      | 0.7               | 1        | 0.95           | 15°                  | 4              | 53                 |
| 01-00511-00508 |            | 10                     | 0.7               | 1        | 0.95           | 15°                  | 4              | 53                 |
| 01-00511-00751 | R0.75      | 7.5                    | 1                 | 1.5      | 1.45           | 15°                  | 4              | 52                 |
| 01-00511-01001 | R1         | 6                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |
| 01-00511-01003 |            | 8                      | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |
| 01-00511-01005 |            | 10                     | 1.2               | 2        | 1.94           | 15°                  | 4              | 52                 |

### How to Order

When you order, indicate SSBL200 (R)×(ℓ1). ※(γ) is reference value.

| Work Material |                   |     | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(~52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |        |                   | Hardened Steels<br>SKD11<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH<br>(~68HRC) |       |        |                   |
|---------------|-------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|
| Radius        | Under Neck Length | L/D | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     | Depth of Cut                         |       | Feed   | Spindle Speed     |
|               |                   |     | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> |
| 0.05          | 0.3               | 3   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 200    | 50,000            | 0.003                                | 0.005 | 150    | 50,000            | 0.002                                | 0.003 | 120    | 50,000            |
|               | 0.5               | 5   | 0.003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.003 | 120    | 50,000            | 0.003                                | 0.003 | 100    | 50,000            | 0.002                                | 0.003 | 80     | 50,000            |
| 0.075         | 0.45              | 3   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 300    | 50,000            | 0.003                                | 0.005 | 200    | 50,000            | 0.002                                | 0.003 | 150    | 50,000            |
|               | 0.75              | 5   | 0.003                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.003 | 200    | 50,000            | 0.003                                | 0.003 | 150    | 50,000            | 0.002                                | 0.003 | 100    | 50,000            |
| 0.1           | 0.6               | 3   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 500    | 50,000            | 0.005                                | 0.005 | 380    | 50,000            | 0.003                                | 0.003 | 280    | 50,000            |
|               | 1                 | 5   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 300    | 50,000            | 0.005                                | 0.005 | 260    | 50,000            | 0.003                                | 0.003 | 120    | 50,000            |
| 0.15          | 0.9               | 3   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 800    | 50,000            | 0.005                                | 0.005 | 460    | 50,000            | 0.003                                | 0.005 | 360    | 50,000            |
|               | 1.5               | 5   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 480    | 50,000            | 0.005                                | 0.005 | 320    | 50,000            | 0.003                                | 0.005 | 280    | 50,000            |
| 0.2           | 1.2               | 3   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.01  | 1,200  | 50,000            | 0.005                                | 0.01  | 820    | 50,000            | 0.005                                | 0.005 | 580    | 50,000            |
|               | 2                 | 5   | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.01  | 620    | 50,000            | 0.005                                | 0.01  | 580    | 50,000            | 0.005                                | 0.005 | 380    | 50,000            |
| 0.25          | 1.5               | 3   | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 1,500  | 50,000            | 0.01                                 | 0.01  | 1,200  | 50,000            | 0.005                                | 0.01  | 860    | 50,000            |
|               | 2.5               | 5   | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 800    | 50,000            | 0.01                                 | 0.01  | 680    | 50,000            | 0.005                                | 0.01  | 540    | 50,000            |
| 0.3           | 3                 | 5   | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.02  | 1,600  | 40,000            | 0.01                                 | 0.02  | 1,200  | 40,000            | 0.01                                 | 0.01  | 920    | 40,000            |
|               | 4                 | 6.7 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 1,200  | 30,000            | 0.01                                 | 0.01  | 960    | 30,000            | 0.005                                | 0.01  | 640    | 30,000            |
| 0.4           | 5                 | 8.3 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 800    | 30,000            | 0.005                                | 0.01  | 680    | 30,000            | 0.005                                | 0.005 | 480    | 30,000            |
|               | 4                 | 5   | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 1,500  | 30,000            | 0.01                                 | 0.02  | 1,200  | 30,000            | 0.01                                 | 0.01  | 920    | 30,000            |
| 0.5           | 4                 | 4   | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.05  | 2,400  | 40,000            | 0.02                                 | 0.03  | 2,400  | 40,000            | 0.02                                 | 0.02  | 1,500  | 40,000            |
|               | 5                 | 5   | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.05  | 2,000  | 32,000            | 0.02                                 | 0.03  | 2,000  | 32,000            | 0.01                                 | 0.02  | 1,200  | 32,000            |
|               | 6                 | 6   | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 1,500  | 25,000            | 0.01                                 | 0.02  | 1,500  | 25,000            | 0.01                                 | 0.01  | 1,000  | 25,000            |
|               | 8                 | 8   | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 1,200  | 16,000            | 0.01                                 | 0.02  | 1,000  | 16,000            | 0.01                                 | 0.01  | 840    | 16,000            |
|               | 10                | 10  | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.02  | 800    | 12,000            | 0.005                                | 0.01  | 720    | 12,000            | 0.005                                | 0.005 | 620    | 12,000            |
| 0.75          | 7.5               | 5   | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 2,000  | 32,000            | 0.01                                 | 0.03  | 1,800  | 32,000            | 0.01                                 | 0.01  | 1,200  | 32,000            |
| 1             | 6                 | 3   | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.05  | 4,000  | 40,000            | 0.03                                 | 0.03  | 4,000  | 40,000            | 0.02                                 | 0.03  | 2,600  | 40,000            |
|               | 8                 | 4   | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.05  | 3,000  | 32,000            | 0.02                                 | 0.03  | 2,600  | 32,000            | 0.01                                 | 0.02  | 1,800  | 32,000            |
|               | 10                | 5   | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 2,000  | 24,000            | 0.01                                 | 0.03  | 1,600  | 24,000            | 0.01                                 | 0.02  | 1,200  | 24,000            |
| Notes         |                   |     | <p>※1 Depth of Cut shows the maximum value for semi-finishing and finishing.<br/>※2 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br/>※3 We recommend using oil mist coolant.<br/>※4 Adjust both spindle speed and feed at the same rate.<br/>※5 Adjust milling conditions according to the volume of Depth of Cut and rigidity of machine.<br/>※6 Length of tool overhang must be as short as possible.</p> <p>※7 Recommended milling conditions for the sizes L/D (Effective length / Diameter) = 5 or longer are based on machining inclined angle 30 deg. or lower.</p> |       |        |                   |                                      |       |        |                   |                                      |       |        |                   |



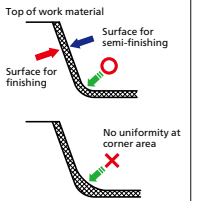
## Points in Use

### Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

### Advice on Finishing Allowance (stock amount)

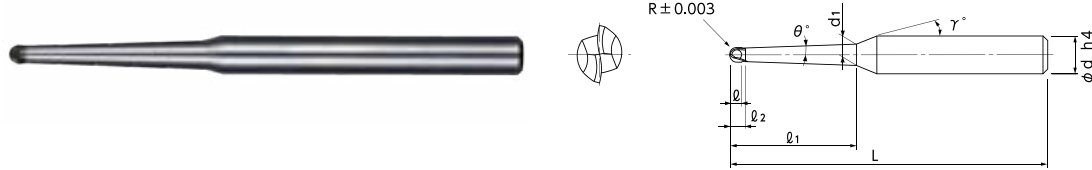
- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



## CBN Super Spiral Long Taper Neck Ball End Mill

## CBN Super Spiral Long Taper Neck Ball End Mill

Taper neck design for high rigidity.  
Suitable for deep and high accurate finishing

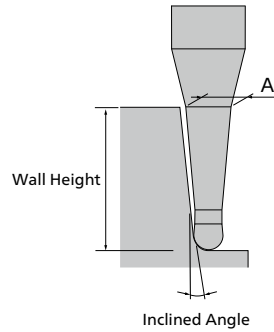


- To realize more rigid, CBN long neck ball end mill with taper neck are adopted.
- Both efficiency and accuracy are increasing by taper neck design and spiral ball shape with improved sharpness in finish machining on deep milling.

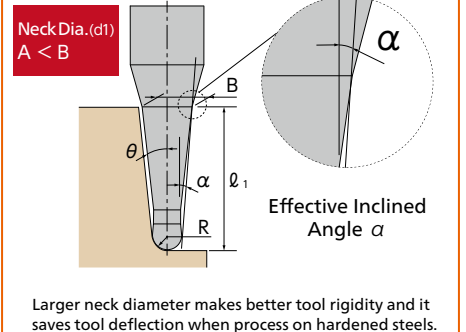


Cutting edge shape

### General Taper Neck Design



### SSPBTN220 Taper Neck Design



Unit : mm

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Effective Inclined Angle (α) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length2 (ℓ2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------------------|------------------------|------------------------------|----------------|-------------------|-------------------------|----------------------|----------------|--------------------|
| 01-00507-02520 | R0.25      | 30°                  | 4                      | 0°18′                        | 0.54           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02521 |            |                      | 5                      | 0°18′                        | 0.55           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02530 |            | 1°                   | 4                      | 0°48′                        | 0.61           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02531 |            |                      | 5                      | 0°48′                        | 0.64           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02540 |            | 1°30′                | 4                      | 1°18′                        | 0.67           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02541 |            |                      | 5                      | 1°18′                        | 0.72           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02550 | R0.3       | 2°                   | 4                      | 1°48′                        | 0.74           | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-02551 |            |                      | 5                      | 1°48′                        | 0.8            | 0.38              | 0.62                    | 15°                  | 4              | 52                 |
| 01-00507-03020 |            | 30°                  | 5                      | 0°18′                        | 0.65           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03021 |            |                      | 6                      | 0°18′                        | 0.66           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03030 |            | 1°                   | 5                      | 0°48′                        | 0.74           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03031 |            |                      | 6                      | 0°48′                        | 0.76           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03040 | R0.5       | 1°30′                | 5                      | 1°18′                        | 0.82           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03041 |            |                      | 6                      | 1°18′                        | 0.86           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03050 |            | 2°                   | 5                      | 1°48′                        | 0.9            | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-03051 |            |                      | 6                      | 1°48′                        | 0.96           | 0.5               | 0.75                    | 15°                  | 4              | 53                 |
| 01-00507-05020 |            | 30°                  | 8                      | 0°21′                        | 1.1            | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05021 |            |                      | 10                     | 0°21′                        | 1.12           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05030 | R0.75      | 1°                   | 8                      | 0°51′                        | 1.23           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05031 |            |                      | 10                     | 0°51′                        | 1.29           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05040 |            | 1°30′                | 8                      | 1°21′                        | 1.36           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05041 |            |                      | 10                     | 1°21′                        | 1.45           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05050 |            | 2°                   | 8                      | 1°51′                        | 1.49           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-05051 |            |                      | 10                     | 1°51′                        | 1.62           | 0.7               | 1.25                    | 15°                  | 4              | 53                 |
| 01-00507-07520 | R1         | 30°                  | 10                     | 0°22′                        | 1.62           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07521 |            |                      | 15                     | 0°22′                        | 1.69           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07530 |            | 1°                   | 10                     | 0°52′                        | 1.78           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07531 |            |                      | 15                     | 0°52′                        | 1.94           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07540 |            | 1°30′                | 10                     | 1°22′                        | 1.95           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07541 |            |                      | 15                     | 1°22′                        | 2.18           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07550 | R1         | 2°                   | 10                     | 1°52′                        | 2.11           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-07551 |            |                      | 15                     | 1°52′                        | 2.43           | 1                 | 1.9                     | 15°                  | 4              | 52                 |
| 01-00507-10020 |            | 30°                  | 16                     | 0°24′                        | 2.21           | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10021 |            |                      | 20                     | 0°24′                        | 2.27           | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10030 |            | 1°                   | 16                     | 0°54′                        | 2.48           | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10031 |            |                      | 20                     | 0°54′                        | 2.6            | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10040 | R1         | 1°30′                | 16                     | 1°24′                        | 2.74           | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10041 |            |                      | 20                     | 1°24′                        | 2.93           | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10050 |            | 2°                   | 16                     | 1°54′                        | 3              | 1.2               | 2.5                     | 15°                  | 4              | 53                 |
| 01-00507-10051 |            |                      | 20                     | 1°54′                        | 3.26           | 1.2               | 2.5                     | 15°                  | 4              | 53                 |

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Effective Inclined Angle (α) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length2 (ℓ2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------------------|------------------------|------------------------------|----------------|-------------------|-------------------------|----------------------|----------------|--------------------|
| 01-00507-01020 | R0.1       | 30°                  | 1.5                    | 0°15′                        | 0.22           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01021 |            |                      | 2                      | 0°15′                        | 0.22           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01030 |            | 1°                   | 1.5                    | 0°45′                        | 0.24           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01031 |            |                      | 2                      | 0°45′                        | 0.25           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01040 |            | 1°30′                | 1.5                    | 1°15′                        | 0.27           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01041 |            |                      | 2                      | 1°15′                        | 0.29           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01050 | R0.15      | 2°                   | 1.5                    | 1°45′                        | 0.29           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01051 |            |                      | 2                      | 1°45′                        | 0.32           | 0.15              | 0.25                    | 15°                  | 4              | 50                 |
| 01-00507-01520 |            | 30°                  | 2                      | 0°16′                        | 0.32           | 0.23              | 0.38                    | 15°                  | 4              | 50                 |
| 01-00507-01521 |            |                      | 3                      | 0°16′                        | 0.33           | 0.23              | 0.38                    | 15°                  | 4              | 52                 |
| 01-00507-01530 |            | 1°                   | 2                      | 0°46′                        | 0.35           | 0.23              | 0.38                    | 15°                  | 4              | 50                 |
| 01-00507-01531 |            |                      | 3                      | 0°46′                        | 0.38           | 0.23              | 0.38                    | 15°                  | 4              | 52                 |
| 01-00507-01540 | R0.2       | 1°30′                | 2                      | 1°16′                        | 0.39           | 0.23              | 0.38                    | 15°                  | 4              | 50                 |
| 01-00507-01541 |            |                      | 3                      | 1°16′                        | 0.43           | 0.23              | 0.38                    | 15°                  | 4              | 52                 |
| 01-00507-01550 |            | 2°                   | 2                      | 1°46′                        | 0.42           | 0.23              | 0.38                    | 15°                  | 4              | 50                 |
| 01-00507-01551 |            |                      | 3                      | 1°46′                        | 0.48           | 0.23              | 0.38                    | 15°                  | 4              | 52                 |
| 01-00507-02020 |            | 30°                  | 3                      | 0°18′                        | 0.43           | 0.3               | 0.5                     | 15°                  | 4              | 50                 |
| 01-00507-02021 |            |                      | 4                      | 0°18′                        | 0.44           | 0.3               | 0.5                     | 15°                  | 4              | 52                 |
| 01-00507-02030 | R0.2       | 1°                   | 3                      | 0°48′                        | 0.48           | 0.3               | 0.5                     | 15°                  | 4              | 50                 |
| 01-00507-02031 |            |                      | 4                      | 0°48′                        | 0.51           | 0.3               | 0.5                     | 15°                  | 4              | 52                 |
| 01-00507-02040 |            | 1°30′                | 3                      | 1°18′                        | 0.53           | 0.3               | 0.5                     | 15°                  | 4              | 50                 |
| 01-00507-02041 |            |                      | 4                      | 1°18′                        | 0.58           | 0.3               | 0.5                     | 15°                  | 4              | 52                 |
| 01-00507-02050 |            | 2°                   | 3                      | 1°48′                        | 0.58           | 0.3               | 0.5                     | 15°                  | 4              | 50                 |
| 01-00507-02051 |            |                      | 4                      | 1°48′                        | 0.64           | 0.3               | 0.5                     | 15°                  | 4              | 52                 |

### How to Order

When you order, indicate SSPBTN220 (R)×(θ)×(ℓ1).

※(γ) is reference value.

| Work Material |                  |                   | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(~52HRC) |       |        |                   | Hardened Steels<br>SKD11・ELMAX<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH・HAP<br>(~68HRC) |       |        |                   |
|---------------|------------------|-------------------|----------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
| Radius        | Neck Taper Angle | Under Neck Length | Depth of Cut                                                         |       | Feed   | Spindle Speed     | Depth of Cut                               |       | Feed   | Spindle Speed     | Depth of Cut                             |       | Feed   | Spindle Speed     |
|               |                  |                   | ap mm                                                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.1           | 30′              | 1.5               | 0.003                                                                | 0.005 | 140    | 40,000            | 0.003                                      | 0.003 | 120    | 40,000            | 0.002                                    | 0.003 | 100    | 40,000            |
|               |                  | 2                 | 0.003                                                                | 0.003 | 120    | 40,000            | 0.002                                      | 0.003 | 100    | 40,000            | 0.002                                    | 0.002 | 80     | 40,000            |
|               | 1°               | 1.5               | 0.003                                                                | 0.005 | 160    | 40,000            | 0.003                                      | 0.003 | 140    | 40,000            | 0.002                                    | 0.003 | 120    | 40,000            |
|               |                  | 2                 | 0.003                                                                | 0.003 | 140    | 40,000            | 0.002                                      | 0.003 | 120    | 40,000            | 0.002                                    | 0.002 | 90     | 40,000            |
|               | 1°30′            | 1.5               | 0.003                                                                | 0.005 | 200    | 40,000            | 0.003                                      | 0.003 | 160    | 40,000            | 0.002                                    | 0.003 | 140    | 40,000            |
|               |                  | 2                 | 0.003                                                                | 0.003 | 160    | 40,000            | 0.002                                      | 0.003 | 140    | 40,000            | 0.002                                    | 0.002 | 100    | 40,000            |
|               | 2°               | 1.5               | 0.003                                                                | 0.005 | 240    | 40,000            | 0.003                                      | 0.003 | 200    | 40,000            | 0.002                                    | 0.003 | 160    | 40,000            |
|               |                  | 2                 | 0.003                                                                | 0.003 | 200    | 40,000            | 0.002                                      | 0.003 | 160    | 40,000            | 0.002                                    | 0.002 | 120    | 40,000            |
| 0.15          | 30′              | 2                 | 0.005                                                                | 0.005 | 200    | 40,000            | 0.005                                      | 0.005 | 160    | 40,000            | 0.003                                    | 0.005 | 120    | 40,000            |
|               |                  | 3                 | 0.003                                                                | 0.005 | 160    | 40,000            | 0.003                                      | 0.003 | 120    | 40,000            | 0.002                                    | 0.003 | 100    | 40,000            |
|               | 1°               | 2                 | 0.005                                                                | 0.005 | 240    | 40,000            | 0.005                                      | 0.005 | 200    | 40,000            | 0.003                                    | 0.005 | 160    | 40,000            |
|               |                  | 3                 | 0.003                                                                | 0.005 | 200    | 40,000            | 0.003                                      | 0.003 | 160    | 40,000            | 0.002                                    | 0.003 | 120    | 40,000            |
|               | 1°30′            | 2                 | 0.005                                                                | 0.005 | 320    | 40,000            | 0.005                                      | 0.005 | 240    | 40,000            | 0.003                                    | 0.005 | 200    | 40,000            |
|               |                  | 3                 | 0.003                                                                | 0.005 | 240    | 40,000            | 0.003                                      | 0.003 | 200    | 40,000            | 0.002                                    | 0.003 | 160    | 40,000            |
|               | 2°               | 2                 | 0.005                                                                | 0.005 | 400    | 40,000            | 0.005                                      | 0.005 | 300    | 40,000            | 0.003                                    | 0.005 | 240    | 40,000            |
|               |                  | 3                 | 0.003                                                                | 0.005 | 300    | 40,000            | 0.003                                      | 0.003 | 240    | 40,000            | 0.002                                    | 0.003 | 180    | 40,000            |
| 0.2           | 30′              | 3                 | 0.007                                                                | 0.01  | 320    | 40,000            | 0.005                                      | 0.01  | 240    | 40,000            | 0.005                                    | 0.005 | 160    | 40,000            |
|               |                  | 4                 | 0.005                                                                | 0.005 | 240    | 36,000            | 0.005                                      | 0.005 | 180    | 36,000            | 0.003                                    | 0.005 | 120    | 36,000            |
|               | 1°               | 3                 | 0.007                                                                | 0.01  | 400    | 40,000            | 0.005                                      | 0.01  | 300    | 40,000            | 0.005                                    | 0.005 | 200    | 40,000            |
|               |                  | 4                 | 0.005                                                                | 0.005 | 320    | 36,000            | 0.005                                      | 0.005 | 240    | 36,000            | 0.003                                    | 0.005 | 160    | 36,000            |
|               | 1°30′            | 3                 | 0.007                                                                | 0.01  | 480    | 40,000            | 0.005                                      | 0.01  | 360    | 40,000            | 0.005                                    | 0.005 | 240    | 40,000            |
|               |                  | 4                 | 0.005                                                                | 0.005 | 400    | 36,000            | 0.005                                      | 0.005 | 320    | 36,000            | 0.003                                    | 0.005 | 200    | 36,000            |
|               | 2°               | 3                 | 0.007                                                                | 0.01  | 540    | 40,000            | 0.005                                      | 0.01  | 400    | 40,000            | 0.005                                    | 0.005 | 300    | 40,000            |
|               |                  | 4                 | 0.005                                                                | 0.005 | 480    | 36,000            | 0.005                                      | 0.005 | 360    | 36,000            | 0.003                                    | 0.005 | 240    | 36,000            |
| 0.25          | 30′              | 4                 | 0.01                                                                 | 0.01  | 400    | 36,000            | 0.005                                      | 0.01  | 320    | 36,000            | 0.005                                    | 0.005 | 240    | 36,000            |
|               |                  | 5                 | 0.005                                                                | 0.01  | 320    | 32,000            | 0.005                                      | 0.005 | 240    | 32,000            | 0.003                                    | 0.005 | 160    | 32,000            |
|               | 1°               | 4                 | 0.01                                                                 | 0.01  | 480    | 36,000            | 0.005                                      | 0.01  | 400    | 36,000            | 0.005                                    | 0.005 | 300    | 36,000            |
|               |                  | 5                 | 0.005                                                                | 0.01  | 400    | 32,000            | 0.005                                      | 0.005 | 320    | 32,000            | 0.003                                    | 0.005 | 240    | 32,000            |
|               | 1°30′            | 4                 | 0.01                                                                 | 0.01  | 640    | 36,000            | 0.005                                      | 0.01  | 480    | 36,000            | 0.005                                    | 0.005 | 360    | 36,000            |
|               |                  | 5                 | 0.005                                                                | 0.01  | 540    | 32,000            | 0.005                                      | 0.005 | 400    | 32,000            | 0.003                                    | 0.005 | 300    | 32,000            |
|               | 2°               | 4                 | 0.01                                                                 | 0.01  | 720    | 36,000            | 0.005                                      | 0.01  | 540    | 36,000            | 0.005                                    | 0.005 | 400    | 36,000            |
|               |                  | 5                 | 0.005                                                                | 0.01  | 640    | 32,000            | 0.005                                      | 0.005 | 480    | 32,000            | 0.003                                    | 0.005 | 360    | 32,000            |
| 0.3           | 30′              | 5                 | 0.01                                                                 | 0.01  | 480    | 36,000            | 0.005                                      | 0.01  | 400    | 36,000            | 0.005                                    | 0.005 | 300    | 36,000            |
|               |                  | 6                 | 0.005                                                                | 0.01  | 400    | 32,000            | 0.005                                      | 0.005 | 360    | 32,000            | 0.003                                    | 0.005 | 240    | 32,000            |
|               | 1°               | 5                 | 0.01                                                                 | 0.01  | 640    | 36,000            | 0.005                                      | 0.01  | 480    | 36,000            | 0.005                                    | 0.005 | 400    | 36,000            |
|               |                  | 6                 | 0.005                                                                | 0.01  | 540    | 32,000            | 0.005                                      | 0.005 | 400    | 32,000            | 0.003                                    | 0.005 | 300    | 32,000            |
|               | 1°30′            | 5                 | 0.01                                                                 | 0.01  | 800    | 36,000            | 0.005                                      | 0.01  | 640    | 36,000            | 0.005                                    | 0.005 | 480    | 36,000            |
|               |                  | 6                 | 0.005                                                                | 0.01  | 720    | 32,000            | 0.005                                      | 0.005 | 540    | 32,000            | 0.003                                    | 0.005 | 400    | 32,000            |
|               | 2°               | 5                 | 0.01                                                                 | 0.01  | 900    | 36,000            | 0.005                                      | 0.01  | 720    | 36,000            | 0.005                                    | 0.005 | 540    | 36,000            |
|               |                  | 6                 | 0.005                                                                | 0.01  | 800    | 32,000            | 0.005                                      | 0.005 | 640    | 32,000            | 0.003                                    | 0.005 | 480    | 32,000            |

~ 55 HRC

~ 65 HRC

~ 70 HRC

Hardened Steel

Long Neck Tapered Ball

| Work Material |                  |                   | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(~52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       |        |                   | Hardened Steels<br>SKD11・ELMAX<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH・HAP<br>(~68HRC) |       |        |                   |
|---------------|------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
| Radius        | Neck Taper Angle | Under Neck Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       | Feed   | Spindle Speed     | Depth of Cut                               |       | Feed   | Spindle Speed     | Depth of Cut                             |       | Feed   | Spindle Speed     |
|               |                  |                   | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.5           | 30′              | 8                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 900    | 20,000            | 0.01                                       | 0.02  | 800    | 20,000            | 0.01                                     | 0.01  | 640    | 20,000            |
|               |                  | 10                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 720    | 16,000            | 0.005                                      | 0.01  | 640    | 16,000            | 0.005                                    | 0.005 | 480    | 16,000            |
|               | 1°               | 8                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,000  | 20,000            | 0.01                                       | 0.02  | 900    | 20,000            | 0.01                                     | 0.01  | 800    | 20,000            |
|               |                  | 10                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 800    | 16,000            | 0.005                                      | 0.01  | 720    | 16,000            | 0.005                                    | 0.005 | 640    | 16,000            |
|               | 1° 30′           | 8                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,200  | 20,000            | 0.01                                       | 0.02  | 1,000  | 20,000            | 0.01                                     | 0.01  | 900    | 20,000            |
|               |                  | 10                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 900    | 16,000            | 0.005                                      | 0.01  | 800    | 16,000            | 0.005                                    | 0.005 | 720    | 16,000            |
|               | 2°               | 8                 | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,400  | 20,000            | 0.01                                       | 0.02  | 1,200  | 20,000            | 0.01                                     | 0.01  | 1,000  | 20,000            |
|               |                  | 10                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,000  | 16,000            | 0.005                                      | 0.01  | 900    | 16,000            | 0.005                                    | 0.005 | 800    | 16,000            |
| 0.75          | 30′              | 10                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 800    | 16,000            | 0.015                                      | 0.02  | 900    | 16,000            | 0.01                                     | 0.015 | 600    | 16,000            |
|               |                  | 15                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 540    | 12,000            | 0.01                                       | 0.01  | 480    | 12,000            | 0.005                                    | 0.01  | 400    | 12,000            |
|               | 1°               | 10                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 900    | 16,000            | 0.015                                      | 0.02  | 1,000  | 16,000            | 0.01                                     | 0.015 | 720    | 16,000            |
|               |                  | 15                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 680    | 12,000            | 0.01                                       | 0.01  | 600    | 12,000            | 0.005                                    | 0.01  | 540    | 12,000            |
|               | 1° 30′           | 10                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,200  | 20,000            | 0.015                                      | 0.02  | 1,000  | 20,000            | 0.01                                     | 0.015 | 900    | 20,000            |
|               |                  | 15                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 900    | 16,000            | 0.01                                       | 0.01  | 800    | 16,000            | 0.005                                    | 0.01  | 720    | 16,000            |
|               | 2°               | 10                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,400  | 20,000            | 0.015                                      | 0.02  | 1,200  | 20,000            | 0.01                                     | 0.015 | 1,000  | 20,000            |
|               |                  | 15                | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,000  | 16,000            | 0.01                                       | 0.01  | 900    | 16,000            | 0.005                                    | 0.01  | 800    | 16,000            |
| 1             | 30′              | 16                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 720    | 12,000            | 0.015                                      | 0.03  | 540    | 12,000            | 0.01                                     | 0.02  | 400    | 12,000            |
|               |                  | 20                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 400    | 8,000             | 0.01                                       | 0.02  | 360    | 8,000             | 0.01                                     | 0.01  | 240    | 8,000             |
|               | 1°               | 16                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 1,000  | 16,000            | 0.015                                      | 0.03  | 800    | 16,000            | 0.01                                     | 0.02  | 600    | 16,000            |
|               |                  | 20                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 600    | 12,000            | 0.01                                       | 0.02  | 540    | 12,000            | 0.01                                     | 0.01  | 400    | 12,000            |
|               | 1° 30′           | 16                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 1,200  | 20,000            | 0.015                                      | 0.03  | 1,000  | 20,000            | 0.01                                     | 0.02  | 800    | 20,000            |
|               |                  | 20                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 900    | 16,000            | 0.01                                       | 0.02  | 800    | 16,000            | 0.01                                     | 0.01  | 600    | 16,000            |
|               | 2°               | 16                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03  | 1,400  | 20,000            | 0.015                                      | 0.03  | 1,200  | 20,000            | 0.01                                     | 0.02  | 1,000  | 20,000            |
|               |                  | 20                | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.02  | 1,000  | 16,000            | 0.01                                       | 0.02  | 900    | 16,000            | 0.01                                     | 0.01  | 800    | 16,000            |
| Notes         |                  |                   | ※1 Max. Depth of Cut for semi-finishing and finishing. Adjust milling conditions depending on the rigidity of the machine and desired accuracy.<br>※2 Obtain uniform stock amount on the cutting surface in the pre-stage cutting (semi-finishing).<br>※3 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※4 Required careful set up of milling conditions, tool path and etc. at cutting parts, such as corners where will become overloaded.<br>※5 Coolant supply and chip disposal in the deep portion are very important.<br>※6 Oil mist coolant is recommended. |       |        |                   |                                            |       |        |                   |                                          |       |        |                   |

### Points in Use

Advice on Cutting Environment

Minimize the deflection of cutting edge.

To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**

When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy.**Therefore, it is important to get uniform stock amount in the pre-stage cutting.**

Top of work material

Surface for semi-finishing

Surface for finishing

No uniformity at corner area

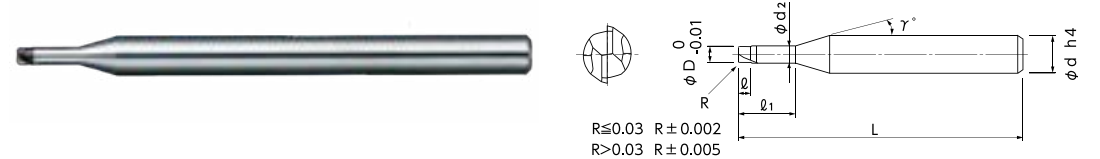
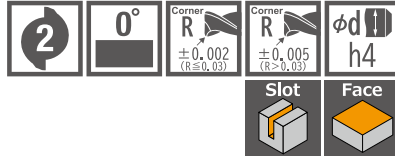
B-024

B-025

CBN Super Speed Radius End Mill

CBN Super Speed Radius End Mill

Corner radius end mill with CBN material at the cutting edge.  
Total 172 sizes. Applicable for various machining profiles



- Realized high efficient machining with radius flute along with excellent wear resistance of CBN.
- Realized excellent surface roughness by introducing smooth tangent on all over flute.
- Applicable for work materials from tempered steel to hardened steel (up to 70 HRC).
- Lineup from Dia.0.1mm. 172 sizes in total.



Cutting edge shape

| Unit : mm      |          |                   |                        |                   |                |                      |                |                    |
|----------------|----------|-------------------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Corner Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00490-01022 | 0.1      | R0.02             | 0.2                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00490-01023 |          |                   | 0.3                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00490-01024 |          |                   | 0.5                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00490-01032 |          | R0.03             | 0.2                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00490-01033 |          |                   | 0.3                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00490-01034 |          |                   | 0.5                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00490-01522 | 0.15     | R0.02             | 0.2                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00490-01523 |          |                   | 0.3                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00490-01524 |          |                   | 0.5                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00490-01532 |          | R0.03             | 0.2                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00490-01533 |          |                   | 0.3                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00490-01534 |          |                   | 0.5                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00490-02020 | 0.2      | R0.02             | 0.3                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02021 |          |                   | 0.5                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02022 |          |                   | 1                      | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02030 |          | R0.03             | 0.3                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02031 |          |                   | 0.5                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02032 |          |                   | 1                      | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02050 | 0.2      | R0.05             | 0.3                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02051 |          |                   | 0.5                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-02052 |          |                   | 1                      | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00490-03021 | 0.3      | R0.02             | 0.5                    | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03020 |          |                   | 0.75                   | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03022 |          |                   | 1                      | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03023 |          |                   | 1.5                    | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03024 |          |                   | 2                      | 0.13              | 0.28           | 15°                  | 4              | 50                 |

How to Order

When you order, indicate SSR200 (D)×(R)×(ℓ1).

※(γ) is reference value.

Machining case

W-006  
W-007

| Unit : mm      |          |                   |                        |                   |                |                      |                |                    |
|----------------|----------|-------------------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Corner Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00490-03031 | 0.3      | R0.03             | 0.5                    | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03030 |          |                   | 0.75                   | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03032 |          |                   | 1                      | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03033 |          |                   | 1.5                    | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03034 |          |                   | 2                      | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03051 |          | R0.05             | 0.5                    | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03050 |          |                   | 0.75                   | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03052 |          |                   | 1                      | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03053 |          |                   | 1.5                    | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-03054 |          |                   | 2                      | 0.13              | 0.28           | 15°                  | 4              | 50                 |
| 01-00490-04021 | 0.4      | R0.02             | 0.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04022 |          |                   | 1                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04023 |          |                   | 1.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04024 |          |                   | 2                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04031 |          | R0.03             | 0.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04032 |          |                   | 1                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04033 |          |                   | 1.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04034 |          |                   | 2                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04051 |          | R0.05             | 0.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04052 |          |                   | 1                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04053 |          |                   | 1.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04054 |          |                   | 2                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04101 |          | R0.1              | 0.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04102 |          |                   | 1                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04103 |          |                   | 1.5                    | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-04104 |          |                   | 2                      | 0.24              | 0.37           | 15°                  | 4              | 50                 |
| 01-00490-05020 |          | R0.02             | 0.5                    | 0.3               | 0.46           | 15°                  | 4              | 48                 |
| 01-00490-05022 |          |                   | 1                      | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05021 |          |                   | 1.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05023 |          |                   | 2.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05030 |          | R0.03             | 0.5                    | 0.3               | 0.46           | 15°                  | 4              | 48                 |
| 01-00490-05032 |          |                   | 1                      | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05031 |          |                   | 1.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05033 |          |                   | 2.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05050 |          | R0.05             | 0.5                    | 0.3               | 0.46           | 15°                  | 4              | 48                 |
| 01-00490-05052 |          |                   | 1                      | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05051 |          |                   | 1.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05053 |          |                   | 2.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05100 |          | R0.1              | 0.5                    | 0.3               | 0.46           | 15°                  | 4              | 48                 |
| 01-00490-05102 |          |                   | 1                      | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05101 |          |                   | 1.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-05103 |          |                   | 2.5                    | 0.3               | 0.46           | 15°                  | 4              | 50                 |
| 01-00490-06021 | 0.6      | R0.02             | 0.5                    | 0.3               | 0.56           | 15°                  | 4              | 48                 |
| 01-00490-06022 |          |                   | 1                      | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06023 |          |                   | 1.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06024 |          |                   | 2.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06031 |          | R0.03             | 0.5                    | 0.3               | 0.56           | 15°                  | 4              | 48                 |
| 01-00490-06032 |          |                   | 1                      | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06033 |          |                   | 1.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06034 |          |                   | 2.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06051 |          | R0.05             | 0.5                    | 0.3               | 0.56           | 15°                  | 4              | 48                 |
| 01-00490-06052 |          |                   | 1                      | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06053 |          |                   | 1.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06054 |          |                   | 2.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06101 |          | R0.1              | 0.5                    | 0.3               | 0.56           | 15°                  | 4              | 48                 |
| 01-00490-06102 |          |                   | 1                      | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06103 |          |                   | 1.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-06104 |          |                   | 2.5                    | 0.3               | 0.56           | 15°                  | 4              | 50                 |
| 01-00490-08021 | 0.8      | R0.02             | 1.5                    | 0.56              | 0.76           | 15°                  | 4              | 50                 |
| 01-00490-08022 |          |                   | 2.5                    | 0.56              | 0.76           | 15°                  | 4              | 50                 |
| 01-00490-08023 |          |                   | 5                      | 0.56              | 0.76           | 15°                  | 4              | 53                 |



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|------------------------------|-------------------------|-------------------|----------------------------|-------------------|--------------------------|
| 01-00490-08031 | 0.8         | R0.03                   | 1.5                          | 0.56                    | 0.76              | 15°                        | 4                 | 50                       |
| 01-00490-08032 |             |                         | 2.5                          | 0.56                    | 0.76              | 15°                        | 4                 | 50                       |
| 01-00490-08033 |             |                         | 5                            | 0.56                    | 0.76              | 15°                        | 4                 | 53                       |
| 01-00490-08051 |             | R0.05                   | 1.5                          | 0.56                    | 0.76              | 15°                        | 4                 | 50                       |
| 01-00490-08052 |             |                         | 2.5                          | 0.56                    | 0.76              | 15°                        | 4                 | 50                       |
| 01-00490-08053 |             |                         | 5                            | 0.56                    | 0.76              | 15°                        | 4                 | 53                       |
| 01-00490-08101 | 1           | R0.1                    | 1.5                          | 0.56                    | 0.76              | 15°                        | 4                 | 50                       |
| 01-00490-08102 |             |                         | 2.5                          | 0.56                    | 0.76              | 15°                        | 4                 | 50                       |
| 01-00490-08103 |             | R0.02                   | 5                            | 0.56                    | 0.76              | 15°                        | 4                 | 53                       |
| 01-00490-10020 |             |                         | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00490-10022 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10021 |             | R0.02                   | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10023 |             |                         | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00490-10030 |             | R0.03                   | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00490-10032 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10031 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10033 |             | R0.03                   | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00490-10050 |             |                         | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00490-10052 |             | R0.05                   | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10051 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10053 |             |                         | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00490-10100 |             | R0.1                    | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00490-10102 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10101 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10103 |             | R0.1                    | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00490-10200 |             |                         | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00490-10202 |             | R0.2                    | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10201 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10203 |             |                         | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00490-10300 |             | R0.3                    | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00490-10302 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10301 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00490-10303 |             | R0.3                    | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00490-15022 | 1.5         | R0.02                   | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15020 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15021 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15023 |             | R0.02                   | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15032 |             |                         | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15030 |             | R0.03                   | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15031 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15033 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15052 |             | R0.05                   | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15050 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15051 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15053 |             | R0.05                   | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15102 |             |                         | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15100 |             | R0.1                    | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15101 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15103 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |

How to Order

When you order, indicate SSR200 (D)×(R)×(ℓ1).      ※(γ) is reference value.

Machining case

W-006  
W-007

Prehardened Steel

H

Hardened Steel

~ 55 HRC  
~ 60 HRC  
~ 70 HRC

Long Neck  
Corner Radius

Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|------------------------------|-------------------------|-------------------|----------------------------|-------------------|--------------------------|
| 01-00490-15202 | 1.5         | R0.2                    | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15200 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15201 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15203 |             | R0.2                    | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15302 |             |                         | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15300 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15301 | 2           | R0.3                    | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-15303 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00490-20022 |             | R0.02                   | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20020 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20021 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20023 |             | R0.02                   | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20032 |             |                         | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20030 |             | R0.03                   | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20031 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20033 |             |                         | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20052 |             | R0.05                   | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20051 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20053 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20102 |             | R0.1                    | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20101 |             |                         | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20103 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20202 |             | R0.1                    | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 52                       |
| 01-00490-20100 |             |                         | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 52                       |
| 01-00490-20201 |             | R0.2                    | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20203 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20302 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 52                       |
| 01-00490-20300 |             | R0.3                    | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 52                       |
| 01-00490-20301 |             |                         | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20303 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20502 |             | R0.5                    | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 52                       |
| 01-00490-20500 |             |                         | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20501 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00490-20503 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 52                       |

Advice on Cutting Environment

Minimize the deflection of cutting edge.

To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**

When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy.**Therefore, it is important to get uniform stock amount in the pre-stage cutting.**

Top of work material

Surface for semi-finishing

Surface for finishing

No uniformity at corner area

B-028

B-029

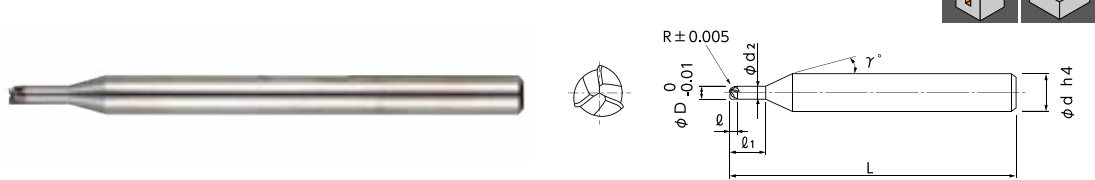


| Work Material |                      |                   | Prehardened Steels•Hardened Steels<br>NAK80•SKD61•STAVAX<br>(~52HRC) |       |       |               | Hardened Steels<br>DC53•ELMAX•PD613<br>(~62HRC) |       |       |               | High Speed Steels<br>DRM3•YXR3<br>(~68HRC) |       |       |               |
|---------------|----------------------|-------------------|----------------------------------------------------------------------|-------|-------|---------------|-------------------------------------------------|-------|-------|---------------|--------------------------------------------|-------|-------|---------------|
| Dia.          | Corner Radius        | Under Neck Length | Depth of Cut                                                         |       | Feed  | Spindle Speed | Depth of Cut                                    |       | Feed  | Spindle Speed | Depth of Cut                               |       | Feed  | Spindle Speed |
|               |                      |                   | ap mm                                                                | ae mm |       |               | ap mm                                           | ae mm |       |               | ap mm                                      | ae mm |       |               |
| 0.1           | 0.02 • 0.03          | 0.2               | 0.002                                                                | 0.015 | 200   | 50,000        | 0.002                                           | 0.01  | 150   | 50,000        | 0.001                                      | 0.01  | 100   | 50,000        |
|               |                      | 0.3               | 0.002                                                                | 0.015 | 150   | 50,000        | 0.001                                           | 0.01  | 100   | 50,000        | 0.001                                      | 0.01  | 50    | 50,000        |
|               |                      | 0.5               | 0.002                                                                | 0.01  | 150   | 50,000        | 0.001                                           | 0.01  | 100   | 50,000        | 0.001                                      | 0.01  | 50    | 50,000        |
| 0.15          | 0.02 • 0.03          | 0.2               | 0.003                                                                | 0.02  | 250   | 50,000        | 0.003                                           | 0.02  | 200   | 50,000        | 0.002                                      | 0.015 | 150   | 50,000        |
|               |                      | 0.3               | 0.003                                                                | 0.02  | 200   | 50,000        | 0.003                                           | 0.02  | 150   | 50,000        | 0.002                                      | 0.015 | 100   | 50,000        |
|               |                      | 0.5               | 0.002                                                                | 0.02  | 200   | 50,000        | 0.002                                           | 0.02  | 150   | 50,000        | 0.001                                      | 0.015 | 100   | 50,000        |
| 0.2           | 0.02•0.03•0.05       | 0.3               | 0.003                                                                | 0.03  | 400   | 50,000        | 0.003                                           | 0.03  | 350   | 50,000        | 0.002                                      | 0.02  | 250   | 50,000        |
|               |                      | 0.5               | 0.003                                                                | 0.03  | 300   | 50,000        | 0.003                                           | 0.03  | 300   | 50,000        | 0.002                                      | 0.02  | 200   | 50,000        |
|               |                      | 1                 | 0.003                                                                | 0.02  | 200   | 50,000        | 0.003                                           | 0.02  | 200   | 50,000        | 0.002                                      | 0.01  | 100   | 50,000        |
| 0.3           | 0.02•0.03•0.05       | 0.5 • 0.75 • 1    | 0.003                                                                | 0.05  | 500   | 50,000        | 0.003                                           | 0.05  | 400   | 50,000        | 0.002                                      | 0.03  | 300   | 50,000        |
|               |                      | 1.5 • 2           | 0.003                                                                | 0.03  | 400   | 50,000        | 0.003                                           | 0.03  | 300   | 50,000        | 0.002                                      | 0.02  | 200   | 50,000        |
| 0.4           | 0.02•0.03•0.05 • 0.1 | 0.5 • 1           | 0.005                                                                | 0.1   | 700   | 50,000        | 0.005                                           | 0.1   | 600   | 50,000        | 0.003                                      | 0.03  | 400   | 50,000        |
|               |                      | 1.5 • 2           | 0.005                                                                | 0.05  | 500   | 50,000        | 0.005                                           | 0.05  | 400   | 50,000        | 0.003                                      | 0.02  | 300   | 50,000        |
| 0.5           | 0.02 • 0.03          | 0.5 • 1 • 1.5     | 0.005                                                                | 0.2   | 600   | 50,000        | 0.005                                           | 0.2   | 600   | 50,000        | 0.003                                      | 0.1   | 500   | 50,000        |
|               |                      | 2.5               | 0.005                                                                | 0.1   | 600   | 50,000        | 0.005                                           | 0.1   | 600   | 50,000        | 0.003                                      | 0.05  | 500   | 50,000        |
|               |                      | 0.5 • 1 • 1.5     | 0.01                                                                 | 0.2   | 600   | 50,000        | 0.01                                            | 0.2   | 600   | 50,000        | 0.005                                      | 0.2   | 500   | 50,000        |
|               | 0.05                 | 2.5               | 0.01                                                                 | 0.1   | 600   | 50,000        | 0.01                                            | 0.1   | 600   | 50,000        | 0.005                                      | 0.1   | 500   | 50,000        |
|               |                      | 0.5 • 1 • 1.5     | 0.02                                                                 | 0.2   | 800   | 50,000        | 0.02                                            | 0.2   | 800   | 50,000        | 0.01                                       | 0.1   | 700   | 50,000        |
|               |                      | 2.5               | 0.01                                                                 | 0.1   | 800   | 50,000        | 0.01                                            | 0.1   | 800   | 50,000        | 0.01                                       | 0.05  | 700   | 50,000        |
| 0.6           | 0.02 • 0.03          | 0.5 • 1 • 1.5     | 0.005                                                                | 0.2   | 600   | 50,000        | 0.005                                           | 0.2   | 600   | 50,000        | 0.003                                      | 0.1   | 500   | 50,000        |
|               |                      | 2.5               | 0.005                                                                | 0.1   | 600   | 50,000        | 0.005                                           | 0.1   | 600   | 50,000        | 0.003                                      | 0.05  | 500   | 50,000        |
|               | 0.05                 | 0.5 • 1 • 1.5     | 0.01                                                                 | 0.2   | 600   | 50,000        | 0.01                                            | 0.2   | 600   | 50,000        | 0.005                                      | 0.2   | 500   | 50,000        |
|               |                      | 2.5               | 0.01                                                                 | 0.1   | 600   | 50,000        | 0.01                                            | 0.1   | 600   | 50,000        | 0.005                                      | 0.1   | 500   | 50,000        |
|               | 0.1                  | 0.5 • 1 • 1.5     | 0.02                                                                 | 0.2   | 1,000 | 50,000        | 0.02                                            | 0.2   | 1,000 | 50,000        | 0.01                                       | 0.1   | 700   | 50,000        |
|               |                      | 2.5               | 0.01                                                                 | 0.1   | 1,000 | 50,000        | 0.01                                            | 0.1   | 1,000 | 50,000        | 0.01                                       | 0.05  | 700   | 50,000        |
| 0.8           | 0.02 • 0.03          | 1.5 • 2.5         | 0.005                                                                | 0.2   | 800   | 50,000        | 0.005                                           | 0.2   | 800   | 50,000        | 0.003                                      | 0.1   | 600   | 40,000        |
|               |                      | 5                 | 0.005                                                                | 0.1   | 800   | 50,000        | 0.005                                           | 0.1   | 800   | 50,000        | 0.003                                      | 0.05  | 600   | 40,000        |
|               | 0.05                 | 1.5 • 2.5         | 0.02                                                                 | 0.3   | 1,000 | 50,000        | 0.02                                            | 0.2   | 1,000 | 50,000        | 0.01                                       | 0.1   | 700   | 40,000        |
|               |                      | 5                 | 0.01                                                                 | 0.2   | 1,000 | 50,000        | 0.01                                            | 0.1   | 1,000 | 50,000        | 0.01                                       | 0.05  | 700   | 40,000        |
|               | 0.1                  | 1.5 • 2.5         | 0.02                                                                 | 0.3   | 1,400 | 50,000        | 0.02                                            | 0.2   | 1,200 | 50,000        | 0.01                                       | 0.1   | 1,000 | 40,000        |
|               |                      | 5                 | 0.01                                                                 | 0.2   | 1,400 | 50,000        | 0.01                                            | 0.1   | 1,200 | 50,000        | 0.01                                       | 0.05  | 1,000 | 40,000        |

| Work Material |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Prehardened Steels・Hardened Steels<br>NAK80・SKD61・STAVAX<br>(~52HRC) |       |        |                   | Hardened Steels<br>DC53・ELMAX・PD613<br>(~62HRC) |       |        |                   | High Speed Steels<br>DRM3・YXR3<br>(~68HRC) |       |        |                   |
|---------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------|--------|-------------------|-------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|
| Dia.          | Corner Radius   | Under Neck Length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Depth of Cut                                                         |       | Feed   | Spindle Speed     | Depth of Cut                                    |       | Feed   | Spindle Speed     | Depth of Cut                               |       | Feed   | Spindle Speed     |
|               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ap mm                                                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> |
| 1             | 0.02・0.03       | 1・2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.005                                                                | 0.4   | 800    | 48,000            | 0.005                                           | 0.3   | 800    | 48,000            | 0.005                                      | 0.2   | 600    | 32,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.01                                                                 | 0.4   | 1,000  | 48,000            | 0.01                                            | 0.3   | 1,000  | 48,000            | 0.01                                       | 0.2   | 800    | 32,000            |
|               | 0.1・0.2・0.3     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.03                                                                 | 0.4   | 1,500  | 48,000            | 0.03                                            | 0.3   | 1,200  | 48,000            | 0.01                                       | 0.2   | 1,000  | 32,000            |
|               | 0.02・0.03       | 3・5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.005                                                                | 0.3   | 800    | 48,000            | 0.005                                           | 0.2   | 800    | 48,000            | 0.005                                      | 0.1   | 600    | 32,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.01                                                                 | 0.3   | 1,000  | 48,000            | 0.01                                            | 0.2   | 1,000  | 48,000            | 0.01                                       | 0.1   | 800    | 32,000            |
|               | 0.1・0.2・0.3     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.3   | 1,500  | 48,000            | 0.02                                            | 0.2   | 1,200  | 48,000            | 0.01                                       | 0.1   | 1,000  | 32,000            |
| 1.5           | 0.02・0.03       | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005                                                                | 0.7   | 1,200  | 32,000            | 0.005                                           | 0.6   | 1,100  | 32,000            | 0.005                                      | 0.3   | 900    | 20,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.7   | 1,200  | 32,000            | 0.01                                            | 0.6   | 1,100  | 32,000            | 0.01                                       | 0.3   | 900    | 20,000            |
|               | 0.1・0.2・0.3     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.04                                                                 | 0.7   | 2,400  | 32,000            | 0.04                                            | 0.6   | 1,800  | 32,000            | 0.01                                       | 0.3   | 1,300  | 20,000            |
|               | 0.02・0.03       | 3・4.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.005                                                                | 0.7   | 1,000  | 32,000            | 0.005                                           | 0.6   | 1,000  | 32,000            | 0.005                                      | 0.3   | 800    | 20,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.7   | 1,000  | 32,000            | 0.01                                            | 0.6   | 1,000  | 32,000            | 0.01                                       | 0.3   | 800    | 20,000            |
|               | 0.1・0.2・0.3     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.04                                                                 | 0.7   | 2,000  | 32,000            | 0.04                                            | 0.6   | 1,500  | 32,000            | 0.01                                       | 0.3   | 1,200  | 20,000            |
|               | 0.02・0.03       | 7.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.005                                                                | 0.5   | 1,000  | 32,000            | 0.005                                           | 0.4   | 1,000  | 32,000            | 0.005                                      | 0.2   | 800    | 20,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.5   | 1,000  | 32,000            | 0.01                                            | 0.4   | 1,000  | 32,000            | 0.01                                       | 0.2   | 800    | 20,000            |
|               | 0.1・0.2・0.3     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.03                                                                 | 0.5   | 2,000  | 32,000            | 0.03                                            | 0.4   | 1,500  | 32,000            | 0.01                                       | 0.2   | 1,200  | 20,000            |
| 2             | 0.02・0.03       | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005                                                                | 0.8   | 1,200  | 24,000            | 0.005                                           | 0.7   | 1,100  | 24,000            | 0.005                                      | 0.5   | 900    | 16,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.8   | 1,200  | 24,000            | 0.01                                            | 0.7   | 1,100  | 24,000            | 0.01                                       | 0.5   | 900    | 16,000            |
|               | 0.1・0.2・0.3・0.5 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.05                                                                 | 0.8   | 2,400  | 24,000            | 0.05                                            | 0.7   | 1,800  | 24,000            | 0.01                                       | 0.5   | 1,300  | 16,000            |
|               | 0.02・0.03       | 4・6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.005                                                                | 0.8   | 1,000  | 24,000            | 0.005                                           | 0.7   | 1,000  | 24,000            | 0.005                                      | 0.5   | 800    | 16,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.8   | 1,000  | 24,000            | 0.01                                            | 0.7   | 1,000  | 24,000            | 0.01                                       | 0.5   | 800    | 16,000            |
|               | 0.1・0.2・0.3・0.5 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.05                                                                 | 0.8   | 2,000  | 24,000            | 0.05                                            | 0.7   | 1,500  | 24,000            | 0.01                                       | 0.5   | 1,200  | 16,000            |
|               | 0.02・0.03       | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.005                                                                | 0.6   | 1,000  | 24,000            | 0.005                                           | 0.5   | 1,000  | 24,000            | 0.005                                      | 0.3   | 800    | 16,000            |
|               | 0.05            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.02                                                                 | 0.6   | 1,000  | 24,000            | 0.01                                            | 0.5   | 1,000  | 24,000            | 0.01                                       | 0.3   | 800    | 16,000            |
|               | 0.1・0.2・0.3・0.5 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.03                                                                 | 0.6   | 2,000  | 24,000            | 0.03                                            | 0.5   | 1,500  | 24,000            | 0.01                                       | 0.3   | 1,200  | 16,000            |
|               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                      |       |        |                   |                                                 |       |        |                   |                                            |       |        |                   |
| Notes         |                 | ※1 Depth of Cut shows the maximum value for semi-finishing and finishing. Adjust milling conditions depending on the rigidity of the machine and desired accuracy.<br>※2 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br>※3 Recommend to apply helical or ramping for approaching into axial direction.<br>※4 We recommend using oil mist coolant.<br>※5 Adjust both spindle speed and feed at the same rate.<br>※6 Adjust milling conditions according to the volume of Depth of Cut and rigidity of machine.<br>※7 Length of tool overhang must be as short as possible.<br>※8 Machine, tool chuck must be sufficiently accurate. |                                                                      |       |        |                   |                                                 |       |        |                   |                                            |       |        |                   |



3-flute CBN corner radius end mill.  
Realized high efficient and high accurate machining



- Realized high accuracy and high efficiency machining by adopting 3 flutes and corner R with spiral shape.

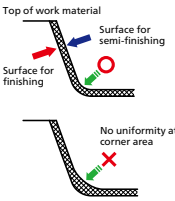


Cutting edge shape

| Work Material |               |                   | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(～52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |        |                   | Hardened Steels<br>SKD11・ELMAX<br>(～62HRC) |       |        |                   | High Speed Steels<br>SKH・HAP<br>(～68HRC) |       |        |                   |
|---------------|---------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
| Dia.          | Corner Radius | Under Neck Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       | Feed   | Spindle Speed     | Depth of Cut                               |       | Feed   | Spindle Speed     | Depth of Cut                             |       | Feed   | Spindle Speed     |
|               |               |                   | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.5           | 0.1           | 1.5               | 0.008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.2   | 1,500  | 50,000            | 0.005                                      | 0.15  | 800    | 50,000            | 0.003                                    | 0.1   | 600    | 50,000            |
|               |               | 2.5               | 0.006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.15  | 1,000  | 40,000            | 0.005                                      | 0.1   | 500    | 40,000            | 0.003                                    | 0.05  | 300    | 40,000            |
| 1             | 0.1<br>0.2    | 3                 | 0.012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.4   | 2,000  | 40,000            | 0.007                                      | 0.25  | 1,000  | 40,000            | 0.006                                    | 0.15  | 800    | 35,000            |
|               |               | 5                 | 0.008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.3   | 1,500  | 30,000            | 0.005                                      | 0.15  | 800    | 30,000            | 0.004                                    | 0.1   | 400    | 25,000            |
| 1.5           | 0.1<br>0.2    | 4.5               | 0.015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.6   | 2,500  | 35,000            | 0.008                                      | 0.4   | 1,200  | 35,000            | 0.007                                    | 0.2   | 1,000  | 30,000            |
|               |               | 7.5               | 0.012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.4   | 1,800  | 25,000            | 0.006                                      | 0.3   | 1,000  | 25,000            | 0.005                                    | 0.15  | 500    | 20,000            |
| 2             | 0.1<br>0.3    | 6                 | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8   | 3,000  | 30,000            | 0.01                                       | 0.6   | 1,500  | 30,000            | 0.008                                    | 0.3   | 1,200  | 25,000            |
|               |               | 10                | 0.015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.6   | 2,000  | 20,000            | 0.008                                      | 0.4   | 1,000  | 20,000            | 0.006                                    | 0.2   | 600    | 18,000            |
| Notes         |               |                   | ※1 Depth of Cut is for contour line milling as the value of reference. Please adjust it depending on machine rigidity and machining method.<br>※2 Ramping approach with angle 3° or smaller is recommended.<br>※3 Recommend leaving uniform finishing allowance on the machined surface in the pre-stage cutting (semi-finishing).<br>※4 When cutting high load sections or complex shapes, it requires attention to condition setting and tool path.<br>※5 Adjust both spindle speed and feed at the same rate.<br>※6 Oil mist coolant is recommended. |       |        |                   |                                            |       |        |                   |                                          |       |        |                   |

Points in Use

| Advice on Cutting Environment                                                                                                                                                                                                      | Advice on Finishing Allowance (stock amount)                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>Minimize the deflection of cutting edge.</li><li>To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.</li></ul> | <ul style="list-style-type: none"><li>When using small CBN End Mill, <b>uniform finishing allowance (stock amount) is important.</b></li><li>When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. <b>Therefore, it is important to get uniform stock amount in the pre-stage cutting.</b></li></ul> |



| Code No.       | Dia. (D) | Corner Radius (R) | Under Neck Length (L1) | Length of Cut (L) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| 01-00495-05011 | 0.5      | R0.1              | 1.5                    | 0.25              | 0.46           | 15°                  | 4              | 50                 |
| 01-00495-05012 |          |                   | 2.5                    | 0.25              | 0.46           | 15°                  | 4              | 50                 |
| 01-00495-10011 | 1        | R0.1              | 3                      | 0.5               | 0.95           | 15°                  | 4              | 50                 |
| 01-00495-10012 |          |                   | 5                      | 0.5               | 0.95           | 15°                  | 4              | 52                 |
| 01-00495-10021 |          | R0.2              | 3                      | 0.5               | 0.95           | 15°                  | 4              | 50                 |
| 01-00495-10022 |          |                   | 5                      | 0.5               | 0.95           | 15°                  | 4              | 52                 |
| 01-00495-15011 | 1.5      | R0.1              | 4.5                    | 0.75              | 1.45           | 15°                  | 4              | 52                 |
| 01-00495-15012 |          |                   | 7.5                    | 0.75              | 1.45           | 15°                  | 4              | 52                 |
| 01-00495-15021 |          | R0.2              | 4.5                    | 0.75              | 1.45           | 15°                  | 4              | 52                 |
| 01-00495-15022 |          |                   | 7.5                    | 0.75              | 1.45           | 15°                  | 4              | 52                 |
| 01-00495-20011 | 2        | R0.1              | 6                      | 1                 | 1.94           | 15°                  | 4              | 52                 |
| 01-00495-20012 |          |                   | 10                     | 1                 | 1.94           | 15°                  | 4              | 52                 |
| 01-00495-20031 |          | R0.3              | 6                      | 1                 | 1.94           | 15°                  | 4              | 52                 |
| 01-00495-20032 |          |                   | 10                     | 1                 | 1.94           | 15°                  | 4              | 52                 |

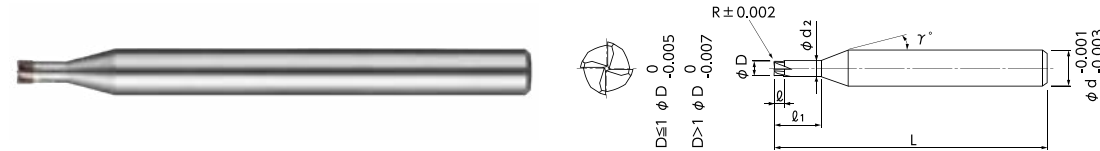
How to Order When you order, indicate SHR320 (D)×(R)×(L1). ※(γ) is reference value.

CBN Super High Precision Radius End Mill

CBN Super High Precision Radius End Mill

4-flute corner radius end mill from Dia.0.1mm.  
High precise type to pursue machining accuracy

Prehardened Steel P



- New tool design has been developed to reduce the cutting resistance and upgrade the finishing accuracy!
- Realized 4-Flute type from  $\phi 0.1$ ! Achieved higher efficient machining and more stable tool life in micro machining!
- The shank diameter accuracy is  $2\mu\text{m}$  ( $-0.001 \sim -0.003$ ), and also supports high precision shrink fit holders.
- Line up from  $\phi 0.1 \sim \phi 3$ , total 142 sizes.



Cutting edge shape

Beware of stocks because there is no blade to the shaft center of endteeth of  $\phi 0.1$  and  $\phi 0.15$ .

◆ New Size

| Code No.       | Dia. (D) | Corner Radius (R) | Under Neck Length (l1) | Length of Cut (l) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| 01-00485-01002 | 0.1      | R0.01             | 0.2                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00485-01003 |          |                   | 0.3                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00485-01005 |          |                   | 0.5                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00485-01022 |          | R0.02             | 0.2                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00485-01023 |          |                   | 0.3                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00485-01025 |          |                   | 0.5                    | 0.04              | 0.09           | 15°                  | 4              | 50                 |
| 01-00485-01522 | 0.15     | R0.02             | 0.2                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00485-01523 |          |                   | 0.3                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00485-01525 |          |                   | 0.5                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00485-01532 |          | R0.03             | 0.2                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00485-01533 |          |                   | 0.3                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00485-01535 |          |                   | 0.5                    | 0.06              | 0.14           | 15°                  | 4              | 50                 |
| 01-00485-02203 | 0.2      | R0.02             | 0.3                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00485-02205 |          |                   | 0.5                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00485-02210 |          |                   | 1                      | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00485-02303 |          | R0.03             | 0.3                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00485-02305 |          |                   | 0.5                    | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00485-02310 |          |                   | 1                      | 0.08              | 0.19           | 15°                  | 4              | 50                 |
| 01-00485-03205 | 0.3      | R0.02             | 0.5                    | 0.13              | 0.285          | 15°                  | 4              | 50                 |
| 01-00485-03207 |          |                   | 0.75                   | 0.13              | 0.285          | 15°                  | 4              | 50                 |
| 01-00485-03210 |          |                   | 1                      | 0.13              | 0.285          | 15°                  | 4              | 50                 |
| 01-00485-03215 |          |                   | 1.5                    | 0.13              | 0.285          | 15°                  | 4              | 50                 |
| 01-00485-03220 |          |                   | 2                      | 0.13              | 0.285          | 15°                  | 4              | 50                 |

How to Order

When you order, indicate SHPR400 (D)×(R)×(l1). ※(γ) is reference value.

Machining case

W-008

Prehardened Steel P

Hardened Steel H  
~ 55 HRC  
~ 65 HRC  
~ 70 HRC

Long Neck  
Corner Radius

Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|------------------------------|-------------------------|-------------------|----------------------------|-------------------|--------------------------|
| 01-00485-10401 | 1           | R0.05                   | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00485-10402 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00485-10403 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00485-10405 |             |                         | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00485-10501 |             | R0.1                    | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00485-10502 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00485-10503 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00485-10505 |             |                         | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00485-10601 |             | R0.2                    | 1                            | 0.7                     | 0.95              | 15°                        | 4                 | 49                       |
| 01-00485-10602 |             |                         | 2                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00485-10603 |             |                         | 3                            | 0.7                     | 0.95              | 15°                        | 4                 | 50                       |
| 01-00485-10605 |             |                         | 5                            | 0.7                     | 0.95              | 15°                        | 4                 | 53                       |
| 01-00485-15202 | 1.5         | R0.02                   | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15203 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15204 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15207 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15402 |             |                         | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15403 |             | R0.05                   | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15404 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15407 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15502 |             | R0.1                    | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15503 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15504 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15507 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15602 |             | R0.2                    | 2                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15603 |             |                         | 3                            | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15604 |             |                         | 4.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-15607 |             |                         | 7.5                          | 1                       | 1.45              | 15°                        | 4                 | 52                       |
| 01-00485-20203 |             | R0.02                   | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20204 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20206 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20210 |             |                         | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20403 |             | R0.05                   | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20404 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20406 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20410 |             |                         | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20503 |             | R0.1                    | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20504 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20506 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20510 |             |                         | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20603 |             | R0.2                    | 3                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20604 |             |                         | 4                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20606 |             |                         | 6                            | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-20610 |             |                         | 10                           | 1.2                     | 1.94              | 15°                        | 4                 | 53                       |
| 01-00485-30406 | 3           | R0.05                   | 6                            | 1.8                     | 2.85              | 15°                        | 6                 | 53                       |
| 01-00485-30409 |             |                         | 9                            | 1.8                     | 2.85              | 15°                        | 6                 | 53                       |
| 01-00485-30412 |             |                         | 12                           | 1.8                     | 2.85              | 15°                        | 6                 | 63                       |
| 01-00485-30415 |             |                         | 15                           | 1.8                     | 2.85              | 15°                        | 6                 | 63                       |
| 01-00485-30506 |             |                         | 6                            | 1.8                     | 2.85              | 15°                        | 6                 | 53                       |
| 01-00485-30509 |             | R0.1                    | 9                            | 1.8                     | 2.85              | 15°                        | 6                 | 53                       |
| 01-00485-30512 |             |                         | 12                           | 1.8                     | 2.85              | 15°                        | 6                 | 63                       |
| 01-00485-30515 |             |                         | 15                           | 1.8                     | 2.85              | 15°                        | 6                 | 63                       |
| 01-00485-30606 |             |                         | 6                            | 1.8                     | 2.85              | 15°                        | 6                 | 53                       |
| 01-00485-30609 |             | R0.2                    | 9                            | 1.8                     | 2.85              | 15°                        | 6                 | 53                       |
| 01-00485-30612 |             |                         | 12                           | 1.8                     | 2.85              | 15°                        | 6                 | 63                       |
| 01-00485-30615 |             |                         | 15                           | 1.8                     | 2.85              | 15°                        | 6                 | 63                       |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |
|                |             |                         |                              |                         |                   |                            |                   |                          |

How to Order

When you order, indicate SHPR400 (D)×(R)×(ℓ1).   ※(γ) is reference value.

Prehardened Steel P

Hardened Steel H  
~ 55 HRC  
~ 65 HRC  
~ 70 HRC



| Work Material |               |                   |     | Prehardened Steels•Hardened Steels<br>NAK80•STAVAX•SKD61<br>(~52HRC) |       |        |                   | Hardened Steels<br>SKD11•ELMAX<br>(~62HRC) |       |              |                   | High Speed Steels<br>SKH•HAP<br>(~68HRC) |       |               |                   |
|---------------|---------------|-------------------|-----|----------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------------|-------------------|------------------------------------------|-------|---------------|-------------------|
| Dia.          | Corner Radius | Under Neck Length | L/D | Depth of Cut                                                         |       | Feed   |                   | Spindle Speed                              |       | Depth of Cut |                   | Feed                                     |       | Spindle Speed |                   |
|               |               |                   |     | ap mm                                                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min       | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min        | min <sup>-1</sup> |
| 0.1           | R0.01         | 0.2               | 2   | 0.002                                                                | 0.015 | 320    | 50,000            | 0.002                                      | 0.01  | 240          | 50,000            | 0.001                                    | 0.01  | 120           | 50,000            |
|               |               | 0.3               | 3   | 0.002                                                                | 0.015 | 240    | 50,000            | 0.001                                      | 0.01  | 160          | 50,000            | 0.001                                    | 0.01  | 60            | 50,000            |
|               |               | 0.5               | 5   | 0.002                                                                | 0.01  | 240    | 50,000            | 0.001                                      | 0.01  | 160          | 50,000            | 0.001                                    | 0.01  | 60            | 50,000            |
|               | R0.02         | 0.2               | 2   | 0.002                                                                | 0.015 | 400    | 50,000            | 0.002                                      | 0.01  | 300          | 50,000            | 0.001                                    | 0.01  | 200           | 50,000            |
|               |               | 0.3               | 3   | 0.002                                                                | 0.015 | 300    | 50,000            | 0.001                                      | 0.01  | 200          | 50,000            | 0.001                                    | 0.01  | 100           | 50,000            |
| 0.15          | R0.02         | 0.2               | 1.3 | 0.003                                                                | 0.02  | 500    | 50,000            | 0.003                                      | 0.02  | 400          | 50,000            | 0.002                                    | 0.015 | 300           | 50,000            |
|               |               | 0.3               | 2   | 0.003                                                                | 0.02  | 400    | 50,000            | 0.003                                      | 0.02  | 300          | 50,000            | 0.002                                    | 0.015 | 200           | 50,000            |
|               |               | 0.5               | 3.3 | 0.002                                                                | 0.02  | 400    | 50,000            | 0.002                                      | 0.02  | 300          | 50,000            | 0.001                                    | 0.015 | 200           | 50,000            |
|               | R0.03         | 0.2               | 1.3 | 0.003                                                                | 0.02  | 500    | 50,000            | 0.003                                      | 0.02  | 400          | 50,000            | 0.002                                    | 0.015 | 300           | 50,000            |
|               |               | 0.3               | 2   | 0.003                                                                | 0.02  | 400    | 50,000            | 0.003                                      | 0.02  | 300          | 50,000            | 0.002                                    | 0.015 | 200           | 50,000            |
| 0.2           | R0.02         | 0.3               | 1.5 | 0.003                                                                | 0.03  | 800    | 50,000            | 0.003                                      | 0.03  | 700          | 50,000            | 0.002                                    | 0.02  | 500           | 50,000            |
|               |               | 0.5               | 2.5 | 0.003                                                                | 0.03  | 600    | 50,000            | 0.003                                      | 0.03  | 600          | 50,000            | 0.002                                    | 0.02  | 400           | 50,000            |
|               |               | 1                 | 5   | 0.003                                                                | 0.02  | 400    | 50,000            | 0.003                                      | 0.02  | 400          | 50,000            | 0.002                                    | 0.01  | 200           | 50,000            |
|               | R0.03         | 0.3               | 1.5 | 0.003                                                                | 0.03  | 800    | 50,000            | 0.003                                      | 0.03  | 700          | 50,000            | 0.002                                    | 0.02  | 500           | 50,000            |
|               |               | 0.5               | 2.5 | 0.003                                                                | 0.03  | 600    | 50,000            | 0.003                                      | 0.03  | 600          | 50,000            | 0.002                                    | 0.02  | 400           | 50,000            |
| 0.3           | R0.02         | 0.5               | 1.7 | 0.003                                                                | 0.05  | 800    | 50,000            | 0.003                                      | 0.05  | 700          | 50,000            | 0.002                                    | 0.03  | 500           | 50,000            |
|               |               | 0.75              | 2.5 | 0.003                                                                | 0.05  | 800    | 50,000            | 0.003                                      | 0.05  | 640          | 50,000            | 0.002                                    | 0.03  | 480           | 50,000            |
|               |               | 1                 | 3.3 | 0.003                                                                | 0.05  | 800    | 50,000            | 0.003                                      | 0.05  | 640          | 50,000            | 0.002                                    | 0.03  | 480           | 50,000            |
|               | R0.05         | 1.5               | 5   | 0.003                                                                | 0.03  | 640    | 50,000            | 0.003                                      | 0.03  | 480          | 50,000            | 0.002                                    | 0.02  | 320           | 50,000            |
|               |               | 2                 | 6.7 | 0.003                                                                | 0.03  | 640    | 50,000            | 0.003                                      | 0.03  | 480          | 50,000            | 0.002                                    | 0.02  | 320           | 50,000            |
| 0.4           | R0.02         | 0.5               | 1.3 | 0.004                                                                | 0.1   | 900    | 50,000            | 0.004                                      | 0.1   | 800          | 50,000            | 0.003                                    | 0.08  | 600           | 50,000            |
|               |               | 1                 | 2.5 | 0.004                                                                | 0.1   | 900    | 50,000            | 0.004                                      | 0.1   | 800          | 50,000            | 0.003                                    | 0.08  | 600           | 50,000            |
|               |               | 1.5               | 3.8 | 0.004                                                                | 0.1   | 900    | 50,000            | 0.004                                      | 0.1   | 800          | 50,000            | 0.003                                    | 0.08  | 600           | 50,000            |
|               | R0.05         | 2                 | 5   | 0.004                                                                | 0.08  | 800    | 50,000            | 0.004                                      | 0.08  | 700          | 50,000            | 0.003                                    | 0.05  | 500           | 50,000            |
|               |               | 2.5               | 6.3 | 0.004                                                                | 0.08  | 800    | 50,000            | 0.004                                      | 0.08  | 700          | 50,000            | 0.003                                    | 0.05  | 500           | 50,000            |
| 0.5           | R0.01         | 0.5               | 1.3 | 0.005                                                                | 0.1   | 1,100  | 50,000            | 0.005                                      | 0.1   | 1,000        | 50,000            | 0.004                                    | 0.08  | 800           | 50,000            |
|               |               | 1                 | 2.5 | 0.005                                                                | 0.1   | 1,100  | 50,000            | 0.005                                      | 0.1   | 1,000        | 50,000            | 0.004                                    | 0.08  | 800           | 50,000            |
|               |               | 1.5               | 3.8 | 0.005                                                                | 0.1   | 1,100  | 50,000            | 0.005                                      | 0.1   | 1,000        | 50,000            | 0.004                                    | 0.08  | 800           | 50,000            |
|               | R0.02         | 2                 | 5   | 0.005                                                                | 0.08  | 1,000  | 50,000            | 0.005                                      | 0.08  | 800          | 50,000            | 0.004                                    | 0.05  | 600           | 50,000            |
|               |               | 2.5               | 6.3 | 0.005                                                                | 0.08  | 1,000  | 50,000            | 0.005                                      | 0.08  | 800          | 50,000            | 0.004                                    | 0.05  | 600           | 50,000            |
| 0.5           | R0.05         | 0.5               | 1   | 0.01                                                                 | 0.15  | 1,200  | 50,000            | 0.01                                       | 0.15  | 1,200        | 50,000            | 0.007                                    | 0.1   | 1,000         | 50,000            |
|               |               | 1                 | 2   | 0.01                                                                 | 0.15  | 1,200  | 50,000            | 0.01                                       | 0.15  | 1,200        | 50,000            | 0.007                                    | 0.1   | 1,000         | 50,000            |
|               |               | 1.5               | 3   | 0.01                                                                 | 0.15  | 1,200  | 50,000            | 0.01                                       | 0.15  | 1,200        | 50,000            | 0.007                                    | 0.1   | 1,000         | 50,000            |
|               | R0.05         | 2                 | 4   | 0.007                                                                | 0.12  | 1,200  | 50,000            | 0.007                                      | 0.12  | 1,200        | 50,000            | 0.005                                    | 0.08  | 1,000         | 50,000            |
|               |               | 2.5               | 5   | 0.007                                                                | 0.1   | 1,200  | 50,000            | 0.007                                      | 0.1   | 1,200        | 50,000            | 0.005                                    | 0.07  | 1,000         | 50,000            |

Prehardened Steel P

Hardened Steel H  
~ 55 HRC  
~ 65 HRC  
~ 70 HRC





Prehardened Steel **P**

| Work Material |               |                   |     | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(~52HRC) |       |        |                   | Hardened Steels<br>SKD11・ELMAX<br>(~62HRC) |       |              |                   | High Speed Steels<br>SKH・HAP<br>(~68HRC) |              |        |                   |
|---------------|---------------|-------------------|-----|----------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------------|-------------------|------------------------------------------|--------------|--------|-------------------|
| Dia.          | Corner Radius | Under Neck Length | L/D | Depth of Cut                                                         |       | Feed   |                   | Spindle Speed                              |       | Depth of Cut | Feed              | Spindle Speed                            | Depth of Cut | Feed   | Spindle Speed     |
|               |               |                   |     | ap mm                                                                | ae mm | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm | mm/min       | min <sup>-1</sup> | ap mm                                    | ae mm        | mm/min | min <sup>-1</sup> |
| 0.5           | R0.1          | 0.5               | 1   | 0.02                                                                 | 0.15  | 1,600  | 50,000            | 0.02                                       | 0.15  | 1,500        | 50,000            | 0.01                                     | 0.1          | 1,400  | 50,000            |
|               |               | 1                 | 2   | 0.02                                                                 | 0.15  | 1,600  | 50,000            | 0.02                                       | 0.15  | 1,500        | 50,000            | 0.01                                     | 0.1          | 1,400  | 50,000            |
|               |               | 1.5               | 3   | 0.02                                                                 | 0.15  | 1,600  | 50,000            | 0.02                                       | 0.15  | 1,500        | 50,000            | 0.01                                     | 0.1          | 1,400  | 50,000            |
|               |               | 2                 | 4   | 0.01                                                                 | 0.12  | 1,600  | 50,000            | 0.01                                       | 0.12  | 1,500        | 50,000            | 0.008                                    | 0.08         | 1,400  | 50,000            |
|               |               | 2.5               | 5   | 0.008                                                                | 0.1   | 1,600  | 50,000            | 0.008                                      | 0.1   | 1,500        | 50,000            | 0.005                                    | 0.07         | 1,400  | 50,000            |
| 0.6           | R0.02         | 0.5               | 0.8 | 0.005                                                                | 0.18  | 1,200  | 50,000            | 0.005                                      | 0.18  | 1,200        | 50,000            | 0.003                                    | 0.15         | 1,000  | 50,000            |
|               |               | 1                 | 1.7 | 0.005                                                                | 0.18  | 1,200  | 50,000            | 0.005                                      | 0.18  | 1,200        | 50,000            | 0.003                                    | 0.15         | 1,000  | 50,000            |
|               |               | 1.5               | 2.5 | 0.005                                                                | 0.18  | 1,200  | 50,000            | 0.005                                      | 0.18  | 1,200        | 50,000            | 0.003                                    | 0.15         | 1,000  | 50,000            |
|               |               | 2                 | 3.3 | 0.005                                                                | 0.18  | 1,200  | 50,000            | 0.005                                      | 0.18  | 1,200        | 50,000            | 0.003                                    | 0.15         | 1,000  | 50,000            |
|               |               | 2.5               | 4.2 | 0.005                                                                | 0.15  | 1,200  | 50,000            | 0.005                                      | 0.15  | 1,200        | 50,000            | 0.003                                    | 0.12         | 1,000  | 50,000            |
|               | R0.05         | 0.5               | 0.8 | 0.01                                                                 | 0.18  | 1,400  | 50,000            | 0.01                                       | 0.18  | 1,400        | 50,000            | 0.007                                    | 0.15         | 1,200  | 50,000            |
|               |               | 1                 | 1.7 | 0.01                                                                 | 0.18  | 1,400  | 50,000            | 0.01                                       | 0.18  | 1,400        | 50,000            | 0.007                                    | 0.15         | 1,200  | 50,000            |
|               |               | 1.5               | 2.5 | 0.01                                                                 | 0.18  | 1,400  | 50,000            | 0.01                                       | 0.18  | 1,400        | 50,000            | 0.007                                    | 0.15         | 1,200  | 50,000            |
|               |               | 2                 | 3.3 | 0.01                                                                 | 0.18  | 1,400  | 50,000            | 0.01                                       | 0.18  | 1,400        | 50,000            | 0.007                                    | 0.15         | 1,200  | 50,000            |
|               |               | 2.5               | 4.2 | 0.01                                                                 | 0.15  | 1,400  | 50,000            | 0.01                                       | 0.15  | 1,400        | 50,000            | 0.007                                    | 0.12         | 1,200  | 50,000            |
|               | R0.1          | 0.5               | 0.8 | 0.02                                                                 | 0.2   | 1,800  | 50,000            | 0.02                                       | 0.18  | 1,600        | 50,000            | 0.01                                     | 0.15         | 1,400  | 50,000            |
|               |               | 1                 | 1.7 | 0.02                                                                 | 0.2   | 1,800  | 50,000            | 0.02                                       | 0.18  | 1,600        | 50,000            | 0.01                                     | 0.15         | 1,400  | 50,000            |
|               |               | 1.5               | 2.5 | 0.02                                                                 | 0.2   | 1,800  | 50,000            | 0.02                                       | 0.18  | 1,600        | 50,000            | 0.01                                     | 0.15         | 1,400  | 50,000            |
|               |               | 2                 | 3.3 | 0.02                                                                 | 0.2   | 1,800  | 50,000            | 0.02                                       | 0.18  | 1,600        | 50,000            | 0.01                                     | 0.15         | 1,400  | 50,000            |
|               |               | 2.5               | 4.2 | 0.02                                                                 | 0.18  | 1,800  | 50,000            | 0.02                                       | 0.15  | 1,600        | 50,000            | 0.01                                     | 0.12         | 1,400  | 50,000            |
| 0.8           | R0.02         | 1.5               | 1.9 | 0.005                                                                | 0.2   | 1,400  | 45,000            | 0.005                                      | 0.2   | 1,400        | 45,000            | 0.003                                    | 0.1          | 1,000  | 40,000            |
|               |               | 2.5               | 3.1 | 0.005                                                                | 0.2   | 1,400  | 45,000            | 0.005                                      | 0.2   | 1,400        | 45,000            | 0.003                                    | 0.1          | 1,000  | 40,000            |
|               |               | 5                 | 6.3 | 0.005                                                                | 0.1   | 1,400  | 45,000            | 0.005                                      | 0.1   | 1,400        | 45,000            | 0.003                                    | 0.05         | 1,000  | 40,000            |
|               | R0.05         | 1.5               | 1.9 | 0.01                                                                 | 0.25  | 1,800  | 45,000            | 0.01                                       | 0.2   | 1,600        | 45,000            | 0.007                                    | 0.1          | 1,200  | 40,000            |
|               |               | 2.5               | 3.1 | 0.01                                                                 | 0.25  | 1,800  | 45,000            | 0.01                                       | 0.2   | 1,600        | 45,000            | 0.007                                    | 0.1          | 1,200  | 40,000            |
|               |               | 5                 | 6.3 | 0.01                                                                 | 0.2   | 1,800  | 45,000            | 0.01                                       | 0.15  | 1,600        | 45,000            | 0.005                                    | 0.1          | 1,200  | 40,000            |
|               | R0.1          | 1.5               | 1.9 | 0.02                                                                 | 0.3   | 2,200  | 45,000            | 0.02                                       | 0.2   | 1,800        | 45,000            | 0.01                                     | 0.1          | 1,400  | 40,000            |
|               |               | 2.5               | 3.1 | 0.02                                                                 | 0.3   | 2,200  | 45,000            | 0.02                                       | 0.2   | 1,800        | 45,000            | 0.01                                     | 0.1          | 1,400  | 40,000            |
|               |               | 5                 | 6.3 | 0.01                                                                 | 0.2   | 2,200  | 45,000            | 0.01                                       | 0.15  | 1,800        | 45,000            | 0.005                                    | 0.1          | 1,400  | 40,000            |
|               |               | 1                 | 1   | 0.005                                                                | 0.4   | 1,400  | 40,000            | 0.005                                      | 0.3   | 1,400        | 40,000            | 0.005                                    | 0.2          | 1,200  | 36,000            |
| 1             | R0.02         | 2                 | 2   | 0.005                                                                | 0.4   | 1,400  | 40,000            | 0.005                                      | 0.3   | 1,400        | 40,000            | 0.005                                    | 0.2          | 1,200  | 36,000            |
|               |               | 3                 | 3   | 0.005                                                                | 0.3   | 1,400  | 40,000            | 0.005                                      | 0.2   | 1,400        | 40,000            | 0.005                                    | 0.1          | 1,200  | 36,000            |
|               |               | 5                 | 5   | 0.005                                                                | 0.3   | 1,400  | 40,000            | 0.005                                      | 0.2   | 1,400        | 40,000            | 0.005                                    | 0.1          | 1,200  | 36,000            |
|               |               | 1                 | 1   | 0.015                                                                | 0.4   | 2,000  | 40,000            | 0.01                                       | 0.3   | 1,600        | 40,000            | 0.01                                     | 0.2          | 1,200  | 36,000            |
|               | R0.05         | 2                 | 2   | 0.015                                                                | 0.4   | 2,000  | 40,000            | 0.01                                       | 0.3   | 1,600        | 40,000            | 0.01                                     | 0.2          | 1,200  | 36,000            |
|               |               | 3                 | 3   | 0.015                                                                | 0.3   | 2,000  | 40,000            | 0.01                                       | 0.2   | 1,600        | 40,000            | 0.01                                     | 0.1          | 1,200  | 36,000            |
|               |               | 5                 | 5   | 0.01                                                                 | 0.3   | 1,800  | 40,000            | 0.01                                       | 0.2   | 1,600        | 40,000            | 0.005                                    | 0.1          | 1,200  | 36,000            |
|               | R0.1          | 1                 | 1   | 0.02                                                                 | 0.4   | 2,200  | 40,000            | 0.02                                       | 0.3   | 2,000        | 40,000            | 0.01                                     | 0.2          | 1,500  | 36,000            |
|               |               | 2                 | 2   | 0.02                                                                 | 0.4   | 2,200  | 40,000            | 0.02                                       | 0.3   | 2,000        | 40,000            | 0.01                                     | 0.2          | 1,500  | 36,000            |
|               |               | 3                 | 3   | 0.02                                                                 | 0.3   | 2,200  | 40,000            | 0.02                                       | 0.2   | 2,000        | 40,000            | 0.01                                     | 0.1          | 1,500  | 36,000            |
|               |               | 5                 | 5   | 0.015                                                                | 0.3   | 2,200  | 40,000            | 0.015                                      | 0.2   | 2,000        | 40,000            | 0.007                                    | 0.1          | 1,500  | 36,000            |
|               | R0.2          | 1                 | 1   | 0.03                                                                 | 0.4   | 2,500  | 40,000            | 0.03                                       | 0.3   | 2,000        | 40,000            | 0.01                                     | 0.2          | 1,500  | 36,000            |
|               |               | 2                 | 2   | 0.03                                                                 | 0.4   | 2,500  | 40,000            | 0.03                                       | 0.3   | 2,000        | 40,000            | 0.01                                     | 0.2          | 1,500  | 36,000            |
|               |               | 3                 | 3   | 0.02                                                                 | 0.3   | 2,500  | 40,000            | 0.02                                       | 0.2   | 2,000        | 40,000            | 0.01                                     | 0.1          | 1,500  | 36,000            |
| 1.5           | R0.02         | 2                 | 1.3 | 0.005                                                                | 0.6   | 2,200  | 36,000            | 0.005                                      | 0.5   | 1,800        | 30,000            | 0.005                                    | 0.3          | 1,300  | 24,000            |
|               |               | 3                 | 2   | 0.005                                                                | 0.6   | 2,200  | 36,000            | 0.005                                      | 0.5   | 1,800        | 30,000            | 0.005                                    | 0.3          | 1,300  | 24,000            |
|               |               | 4.5               | 3   | 0.005                                                                | 0.6   | 2,200  | 36,000            | 0.005                                      | 0.5   | 1,800        | 30,000            | 0.005                                    | 0.3          | 1,200  | 24,000            |
|               |               | 7.5               | 5   | 0.005                                                                | 0.5   | 2,000  | 36,000            | 0.005                                      | 0.4   | 1,700        | 30,000            | 0.005                                    | 0.2          | 1,200  | 24,000            |
|               | R0.05         | 2                 | 1.3 | 0.02                                                                 | 0.6   | 2,500  | 36,000            | 0.02                                       | 0.5   | 2,000        | 30,000            | 0.01                                     | 0.3          | 1,500  | 24,000            |
|               |               | 3                 | 2   | 0.02                                                                 | 0.6   | 2,500  | 36,000            | 0.02                                       | 0.5   | 2,000        | 30,000            | 0.01                                     | 0.3          | 1,500  | 24,000            |
|               |               | 4.5               | 3   | 0.02                                                                 | 0.6   | 2,500  | 36,000            | 0.02                                       | 0.5   | 2,000        | 30,000            | 0.01                                     | 0.3          | 1,500  | 24,000            |
|               |               | 7.5               | 5   | 0.02                                                                 | 0.5   | 2,400  | 36,000            | 0.01                                       | 0.4   | 2,000        | 30,000            | 0.01                                     | 0.2          | 1,400  | 24,000            |

~ 55 HRC  
~ 65 HRC  
~ 70 HRC



Prehardened Steel **P**

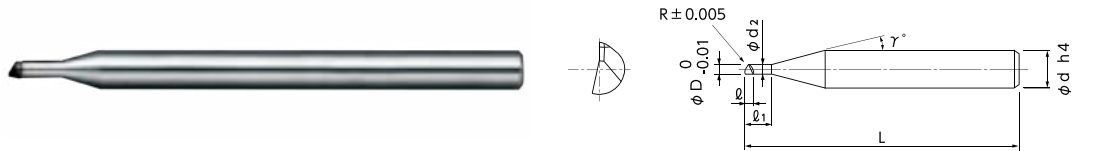
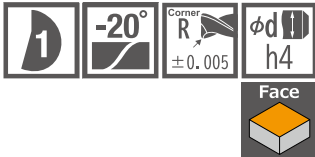
| Work Material |               |                   |      | Prehardened Steels・Hardened Steels<br>NAK80・STAVAX・SKD61<br>(~52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |        |                   | Hardened Steels<br>SKD11・ELMAX<br>(~62HRC) |        |              |        | High Speed Steels<br>SKH・HAP<br>(~68HRC) |                   |              |        |               |       |
|---------------|---------------|-------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-------------------|--------------------------------------------|--------|--------------|--------|------------------------------------------|-------------------|--------------|--------|---------------|-------|
| Dia.          | Corner Radius | Under Neck Length | L/D  | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        | Feed   |                   | Spindle Speed                              |        | Depth of Cut | Feed   | Spindle Speed                            |                   | Depth of Cut | Feed   | Spindle Speed |       |
|               |               |                   |      | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ae mm  | mm/min | min <sup>-1</sup> | ap mm                                      | ae mm  |              |        | mm/min                                   | min <sup>-1</sup> |              |        | ap mm         | ae mm |
| 1.5           | R0.1          | 2                 | 1.3  | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 4,000  | 36,000            | 0.03                                       | 0.5    | 3,200        | 30,000 | 0.015                                    | 0.3               | 2,000        | 24,000 |               |       |
|               |               | 3                 | 2    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 3,500  | 36,000            | 0.03                                       | 0.5    | 2,800        | 30,000 | 0.015                                    | 0.3               | 1,800        | 24,000 |               |       |
|               |               | 4.5               | 3    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 3,500  | 36,000            | 0.03                                       | 0.5    | 2,800        | 30,000 | 0.01                                     | 0.3               | 1,800        | 24,000 |               |       |
|               |               | 7.5               | 5    | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.5    | 3,000  | 36,000            | 0.02                                       | 0.4    | 2,500        | 30,000 | 0.01                                     | 0.2               | 1,600        | 24,000 |               |       |
|               | R0.2          | 2                 | 1.3  | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 4,000  | 36,000            | 0.03                                       | 0.5    | 3,200        | 30,000 | 0.015                                    | 0.3               | 2,000        | 24,000 |               |       |
|               |               | 3                 | 2    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 3,500  | 36,000            | 0.03                                       | 0.5    | 2,800        | 30,000 | 0.015                                    | 0.3               | 1,800        | 24,000 |               |       |
|               |               | 4.5               | 3    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 3,500  | 36,000            | 0.03                                       | 0.5    | 2,800        | 30,000 | 0.01                                     | 0.3               | 1,800        | 24,000 |               |       |
| 2             | R0.02         | 3                 | 1.5  | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8    | 2,500  | 30,000            | 0.005                                      | 0.7    | 2,000        | 24,000 | 0.005                                    | 0.4               | 1,200        | 16,000 |               |       |
|               |               | 4                 | 2    | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8    | 2,300  | 30,000            | 0.005                                      | 0.7    | 1,800        | 24,000 | 0.005                                    | 0.4               | 1,100        | 16,000 |               |       |
|               |               | 6                 | 3    | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8    | 2,300  | 30,000            | 0.005                                      | 0.7    | 1,800        | 24,000 | 0.005                                    | 0.4               | 1,100        | 16,000 |               |       |
|               |               | 10                | 5    | 0.005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.6    | 2,200  | 30,000            | 0.005                                      | 0.5    | 1,700        | 24,000 | 0.005                                    | 0.3               | 1,000        | 16,000 |               |       |
|               | R0.05         | 3                 | 1.5  | 0.025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8    | 2,700  | 30,000            | 0.02                                       | 0.7    | 2,200        | 24,000 | 0.015                                    | 0.4               | 1,300        | 16,000 |               |       |
|               |               | 4                 | 2    | 0.025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8    | 2,700  | 30,000            | 0.02                                       | 0.7    | 2,200        | 24,000 | 0.015                                    | 0.3               | 1,300        | 16,000 |               |       |
|               |               | 6                 | 3    | 0.025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8    | 2,700  | 30,000            | 0.02                                       | 0.7    | 2,200        | 24,000 | 0.015                                    | 0.3               | 1,300        | 16,000 |               |       |
|               |               | 10                | 5    | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6    | 2,500  | 30,000            | 0.015                                      | 0.5    | 2,000        | 24,000 | 0.01                                     | 0.3               | 1,200        | 16,000 |               |       |
|               | R0.1          | 3                 | 1.5  | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.8    | 4,000  | 30,000            | 0.04                                       | 0.7    | 3,200        | 24,000 | 0.02                                     | 0.4               | 1,500        | 16,000 |               |       |
|               |               | 4                 | 2    | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.8    | 3,500  | 30,000            | 0.04                                       | 0.7    | 2,800        | 24,000 | 0.02                                     | 0.3               | 1,500        | 16,000 |               |       |
|               |               | 6                 | 3    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.8    | 3,500  | 30,000            | 0.03                                       | 0.7    | 2,800        | 24,000 | 0.02                                     | 0.3               | 1,500        | 16,000 |               |       |
| 10            |               | 5                 | 0.03 | 0.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3,000  | 30,000 | 0.02              | 0.5                                        | 2,400  | 24,000       | 0.01   | 0.3                                      | 1,300             | 16,000       |        |               |       |
| R0.2          | 3             | 1.5               | 0.05 | 0.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4,000  | 30,000 | 0.04              | 0.7                                        | 3,200  | 24,000       | 0.02   | 0.4                                      | 1,500             | 16,000       |        |               |       |
|               | 4             | 2                 | 0.05 | 0.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3,500  | 30,000 | 0.04              | 0.7                                        | 2,800  | 24,000       | 0.02   | 0.3                                      | 1,500             | 16,000       |        |               |       |
|               | 6             | 3                 | 0.04 | 0.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3,500  | 30,000 | 0.03              | 0.7                                        | 2,800  | 24,000       | 0.02   | 0.3                                      | 1,500             | 16,000       |        |               |       |
|               | 10            | 5                 | 0.03 | 0.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3,000  | 30,000 | 0.02              | 0.5                                        | 2,400  | 24,000       | 0.01   | 0.3                                      | 1,300             | 16,000       |        |               |       |
| 3             | R0.05         | 6                 | 2    | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1      | 2,700  | 24,000            | 0.02                                       | 0.85   | 2,200        | 20,000 | 0.015                                    | 0.6               | 1,300        | 12,000 |               |       |
|               |               | 9                 | 3    | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1      | 2,700  | 24,000            | 0.02                                       | 0.85   | 2,200        | 20,000 | 0.015                                    | 0.6               | 1,300        | 12,000 |               |       |
|               |               | 12                | 4    | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.85   | 2,700  | 24,000            | 0.02                                       | 0.7    | 2,200        | 20,000 | 0.015                                    | 0.5               | 1,300        | 12,000 |               |       |
|               |               | 15                | 5    | 0.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.85   | 2,500  | 24,000            | 0.02                                       | 0.7    | 2,000        | 20,000 | 0.01                                     | 0.5               | 1,200        | 12,000 |               |       |
|               | R0.1          | 6                 | 2    | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1      | 4,000  | 24,000            | 0.04                                       | 0.85   | 3,200        | 20,000 | 0.02                                     | 0.6               | 1,500        | 12,000 |               |       |
|               |               | 9                 | 3    | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1      | 3,500  | 24,000            | 0.04                                       | 0.85   | 2,800        | 20,000 | 0.02                                     | 0.6               | 1,500        | 12,000 |               |       |
|               |               | 12                | 4    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.85   | 3,500  | 24,000            | 0.04                                       | 0.7    | 2,800        | 20,000 | 0.02                                     | 0.5               | 1,500        | 12,000 |               |       |
|               |               | 15                | 5    | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.85   | 3,000  | 24,000            | 0.03                                       | 0.7    | 2,400        | 20,000 | 0.015                                    | 0.5               | 1,300        | 12,000 |               |       |
|               | R0.2          | 6                 | 2    | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1      | 4,000  | 24,000            | 0.04                                       | 0.85   | 3,200        | 20,000 | 0.02                                     | 0.6               | 1,500        | 12,000 |               |       |
|               |               | 9                 | 3    | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1      | 3,500  | 24,000            | 0.04                                       | 0.85   | 2,800        | 20,000 | 0.02                                     | 0.6               | 1,500        | 12,000 |               |       |
|               |               | 12                | 4    | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.85   | 3,500  | 24,000            | 0.04                                       | 0.7    | 2,800        | 20,000 | 0.02                                     | 0.5               | 1,500        | 12,000 |               |       |
| 15            | 5             | 0.03              | 0.85 | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 24,000 | 0.03   | 0.7               | 2,400                                      | 20,000 | 0.015        | 0.5    | 1,300                                    | 12,000            |              |        |               |       |
| Notes         |               |                   |      | ※1 Depth of Cut shows maximum value for semi-finishing and finishing. Adjust milling conditions depending on rigidity of machine, desired accuracy and milling shape.<br>※2 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br>※3 To achieve better cutting surface, obtain uniform stock amount on cutting surface in semi-finishing.<br>※4 When machining at high load area, such as corners, please pay attention to set cutting condition and tool paths.<br>※5 Recommend to apply helical or ramping for approaching into axial direction.<br>※6 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※7 We recommend using oil mist coolant. |        |        |                   |                                            |        |              |        |                                          |                   |              |        |               |       |



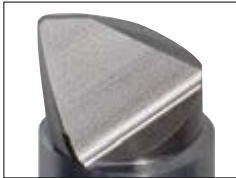
CBN Super Surface End Mill

Recommended Milling Conditions

Single flute end mill for hardened steels  
Specialized for accurate finishing on flat surface



- Appropriate for datum plane machining on precision machining.
- NS original design and corner R to realize stable machining surface.



Cutting edge shape

| Work Material | Hardened Steels・High Speed Steels<br>STAVAX・SKD11・SKH<br>(~68HRC)                                                                                                                                                                |       |        |                   |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|
|               | Depth of Cut                                                                                                                                                                                                                     |       | Feed   | Spindle Speed     |
| Dia.          | ap mm                                                                                                                                                                                                                            | ae mm | mm/min | min <sup>-1</sup> |
| 0.2           | 0.002                                                                                                                                                                                                                            | 0.003 | 50     | 60,000            |
| 0.3           | 0.002                                                                                                                                                                                                                            | 0.003 | 100    | 60,000            |
| 0.4           | 0.002                                                                                                                                                                                                                            | 0.003 | 150    | 60,000            |
| 0.5           | 0.003                                                                                                                                                                                                                            | 0.005 | 200    | 60,000            |
| 0.6           | 0.003                                                                                                                                                                                                                            | 0.005 | 240    | 60,000            |
| 0.8           | 0.003                                                                                                                                                                                                                            | 0.008 | 280    | 60,000            |
| 1             | 0.005                                                                                                                                                                                                                            | 0.01  | 300    | 60,000            |
| 1.5           | 0.005                                                                                                                                                                                                                            | 0.02  | 400    | 60,000            |
| 2             | 0.005                                                                                                                                                                                                                            | 0.03  | 500    | 60,000            |
| Notes         | ※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 We recommend using oil mist coolant.<br>※3 Machine, tool chuck must be sufficiently accurate.<br>※4 Length of tool overhang must be as short as possible. |       |        |                   |

| Unit : mm      |          |                   |                   |                        |                |                      |                |                    |
|----------------|----------|-------------------|-------------------|------------------------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Corner Radius (R) | Length of Cut (l) | Under Neck Length (l1) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00470-00020 | 0.2      | R0.05             | 0.1               | 0.5                    | 0.19           | 15°                  | 4              | 50                 |
| 01-00470-00030 | 0.3      | R0.05             | 0.15              | 0.75                   | 0.28           | 15°                  | 4              | 50                 |
| 01-00470-00040 | 0.4      | R0.05             | 0.2               | 1                      | 0.37           | 15°                  | 4              | 50                 |
| 01-00470-00050 | 0.5      | R0.05             | 0.25              | 1.25                   | 0.46           | 15°                  | 4              | 50                 |
| 01-00470-00060 | 0.6      | R0.05             | 0.3               | 1.5                    | 0.56           | 15°                  | 4              | 50                 |
| 01-00470-00080 | 0.8      | R0.05             | 0.4               | 2                      | 0.76           | 15°                  | 4              | 50                 |
| 01-00470-00100 | 1        | R0.1              | 0.5               | 2.5                    | 0.95           | 15°                  | 4              | 50                 |
| 01-00470-00150 | 1.5      | R0.1              | 0.75              | 3.8                    | 1.45           | 15°                  | 4              | 52                 |
| 01-00470-00200 | 2        | R0.1              | 1                 | 5                      | 1.94           | 15°                  | 4              | 52                 |

How to Order

When you order, indicate SSF120 (D). ※(γ) is reference value.

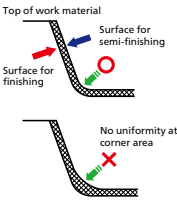
Points in Use

Advice on Cutting Environment

- ① Minimize the deflection of cutting edge.
- ② To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

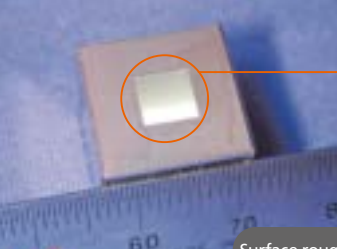
Advice on Finishing Allowance (stock amount)

- ① When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- ② When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



Machining Case 1

Work Material DC53(SKD11) 60HRC Tool SSF120  $\phi 0.5$



Surface roughness: Rz16.3nm

(1nm = 0.001μm)

Conditions (Finishing process)

|                |                          |
|----------------|--------------------------|
| Spindle speed  | 120,000min <sup>-1</sup> |
| Feed           | 300mm/min                |
| Depth of cut   | 2μm×5μm (ap×ae)          |
| Coolant        | Oil mist                 |
| Machining time | 30min                    |

Sodick Nano Machining Center AZ150  
Taylor Hobson Talysurf Measurement System

Machining Case 2

Work Material DC53(SKD11) 60HRC



Tool  
SSF120  $\phi 0.8$

Work size  
10×6×2mm

Surface roughness: Rz70nm

(1nm = 0.001μm)

Conditions (Finishing process)

|                | Bottom face milling     | Side face milling |
|----------------|-------------------------|-------------------|
| Spindle speed  | 35,000min <sup>-1</sup> |                   |
| Feed           | 150mm/min               |                   |
| Depth of cut   | 3μm×8μm (ap×ae)         | 10μm×10μm (ap×ae) |
| Coolant        | Oil mist                |                   |
| Machining time | 1hr 30min               |                   |

Taylor Hobson Talysurf Measurement System

PCD Core Line

Achieves nano-level surface roughness like a mirror surface by milling

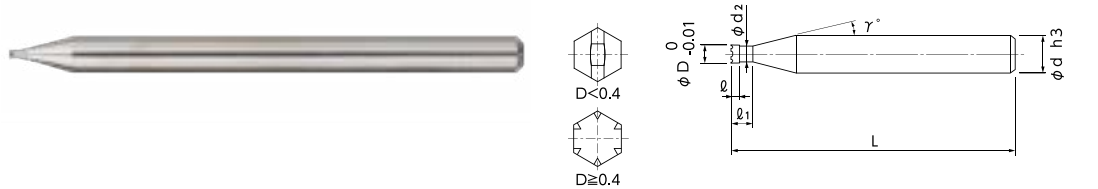
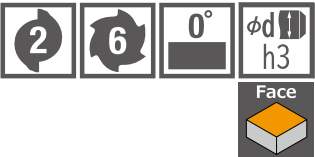
| Model                                                                                                | Size                                              | Under Neck Length | Number of Flute                                                                     | Helix Angle                                                                         | Side Milling | Slot Milling | Face Milling                                                                        | 3D Milling                                                                          | Work Material |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      | Number of Sizes | Page  |        |        |
|------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------|-------------|------------------------------------------------------------------------------------|-----------------|-----------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------|-------|--------|--------|
|                                                                                                      |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     | P             | P           | P                                                                                  | M               | N               | N                                                                                   | N                                                                                     | N                                                                                    | S                     | H                                                                                    |                                                                                      |                 |       |        |        |
|                                                                                                      |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     | Carbon Steel  | Alloy Steel | Prehardened Steel                                                                  | Stainless Steel | Aluminium Alloy | Copper                                                                              | Resin                                                                                 | Graphite                                                                             | Hard Brittle Material | Heat Resistant Alloy etc                                                             | Hardened Steel                                                                       |                 |       |        |        |
|                                                                                                      |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      | 55 HRC                                                                               |                 |       | 65 HRC | 70 HRC |
| PCD Long Neck Square                                                                                 |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
| <br>PCDSE            | $\phi 0.1 \sim \phi 0.3$                          | 1D                |    |    | -            | -            |    | -                                                                                   | -             | -           | -                                                                                  | -               | -               |  | -                                                                                     | -                                                                                    | -                     | 3                                                                                    | C-004                                                                                |                 |       |        |        |
|                                                                                                      | $\phi 0.4 \sim \phi 1$                            |                   |    | -                                                                                   | -            | -            | -                                                                                   | -                                                                                   | -             | -           | -                                                                                  | -               | -               | -                                                                                   | -                                                                                     | 5                                                                                    |                       |                                                                                      |                                                                                      |                 |       |        |        |
| PCD square end mill. Realized nano level finished surface roughness on hard brittle materials        |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
| PCD Long Neck Ball                                                                                   |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
| <br>PCDRB           | $R0.05 \sim R1$                                   | $\cong 2.5D$      | -                                                                                   | -                                                                                   | -            | -            | -                                                                                   |   | -             | -           |  | -               | -               | -                                                                                   | -                                                                                     |  | -                     |  |  | 10              | C-006 |        |        |
| Capable to machine nano level surface roughness, and mirror finishing                                |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
| PCD Long Neck Corner Radius                                                                          |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
| <br>PCDRS          | $\phi 0.3 \times R0.05$                           | 1D                |  |  | -            | -            |  |  | -             | -           | -                                                                                  | -               | -               | -                                                                                   |  | -                                                                                    | -                     | -                                                                                    | 1                                                                                    | C-008           |       |        |        |
|                                                                                                      | $\phi 0.4 \times R0.05 \sim \phi 0.5 \times R0.1$ |                   | 3                                                                                   |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
|                                                                                                      | $\phi 0.6 \times R0.05 \sim \phi 1 \times R0.1$   |                   | 6                                                                                   |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |
| PCD corner radius end mill. Realized nano level finished surface roughness on hard brittle materials |                                                   |                   |                                                                                     |                                                                                     |              |              |                                                                                     |                                                                                     |               |             |                                                                                    |                 |                 |                                                                                     |                                                                                       |                                                                                      |                       |                                                                                      |                                                                                      |                 |       |        |        |



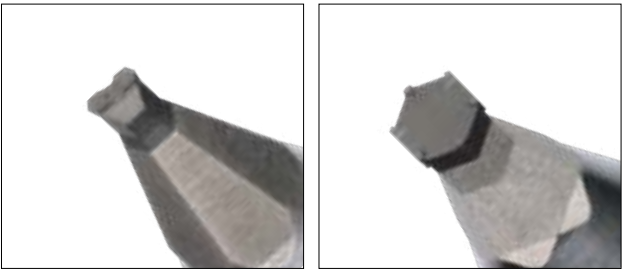
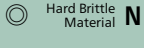
PCD Square End Mill

Recommended Milling Conditions

PCD square end mill. Realized nano level finished surface roughness on hard brittle materials



- Fine and stable milling surface realized on cemented carbide material.
- Possible to get the nano-level surface roughness required on ultra-high precision machining.
- NS original flute design of cutting edge enabled a strong resistance against wear and chipping.



Cutting edge shape 2-Flute

Cutting edge shape 6-Flute



Actual diameter is indicated in 1 micron units on product label, and enables high precision machining.  
※Micron units dimensions cannot be specified.

Unit : mm

| Code No.       | Dia. (D) | Under Neck Length (l1) | Length of Cut (l) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Number of Flute |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|-----------------|
| 04-00300-00100 | 0.1      | 0.1                    | 0.02              | 0.09           | 15°                  | 4              | 48                 | 2               |
| 04-00300-00200 | 0.2      | 0.2                    | 0.04              | 0.18           | 15°                  | 4              | 48                 | 2               |
| 04-00300-00300 | 0.3      | 0.3                    | 0.06              | 0.27           | 15°                  | 4              | 48                 | 2               |
| 04-00300-00400 | 0.4      | 0.4                    | 0.08              | 0.36           | 15°                  | 4              | 48                 | 6               |
| 04-00300-00500 | 0.5      | 0.5                    | 0.1               | 0.45           | 15°                  | 4              | 48                 | 6               |
| 04-00300-00600 | 0.6      | 0.6                    | 0.12              | 0.54           | 15°                  | 4              | 48                 | 6               |
| 04-00300-00800 | 0.8      | 0.8                    | 0.16              | 0.72           | 15°                  | 4              | 48                 | 6               |
| 04-00300-01000 | 1        | 1                      | 0.2               | 0.9            | 15°                  | 4              | 48                 | 6               |

How to Order

When you order, indicate PCDSE (D). ※(γ) is reference value.

Machining case

W-009

Machining Case 1

Connector Model



Work size : 10×10mm  
Cutting depth : 0.5mm

- Work Material : Cemented Carbide 92.5HRA
- Coolant : Water-insoluble fluid

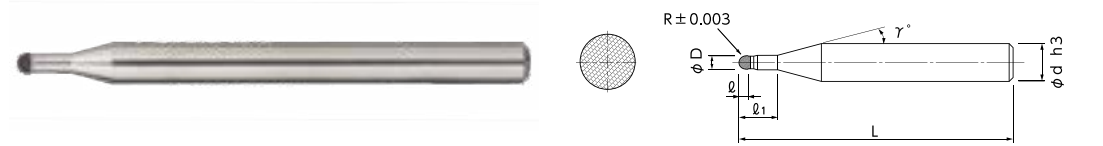
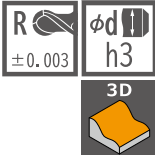
| Process                            | Contour line finishing | Bottom finishing |
|------------------------------------|------------------------|------------------|
| Tool                               | PCDSE $\phi$ 0.5       |                  |
| Spindle speed [min <sup>-1</sup> ] | 120,000                |                  |
| Feed [mm/min]                      | 100                    | 50               |
| Depth of cut $a_p \times a_e$ [mm] | 0.002×0.001            | 0.0005×0.002     |
| Cutting length [m]                 | 64                     |                  |
| Machining time                     | 11hr 2min              |                  |

| Surface Roughness |                                    |
|-------------------|------------------------------------|
| Side              | Ra0.017 $\mu$ m / Rz0.096 $\mu$ m  |
| Bottom            | Ra0.0007 $\mu$ m / Rz0.008 $\mu$ m |

PCD Ball End Mill

Recommended Milling Conditions

Capable to machine nano level surface roughness, and mirror finishing



- Unique tool geometry makes stable surface.
- Polish-less machining become reality by nano-level roughness on profiling finish.
- Upgraded tool edge design makes stable high quality surface.



Actual diameter is indicated in 1 micron units on product label, and enables high precision machining.  
※Micron units dimensions cannot be specified.



Cutting edge shape

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ°) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------------------------|-------------------|----------|-----------------------|----------------|--------------------|
| 04-00500-00501 | R0.05      | 0.15                                | 0.05              | 0.1      | 15°                   | 4              | 48                 |
| 04-00500-00502 |            | 0.25                                | 0.05              | 0.1      | 15°                   | 4              | 48                 |
| 04-00500-00751 | R0.075     | 0.23                                | 0.075             | 0.15     | 15°                   | 4              | 48                 |
| 04-00500-00752 |            | 0.38                                | 0.075             | 0.15     | 15°                   | 4              | 48                 |
| 04-00500-01001 | R0.1       | 0.5                                 | 0.1               | 0.2      | 15°                   | 4              | 48                 |
| 04-00500-02001 | R0.2       | 1                                   | 0.2               | 0.4      | 15°                   | 4              | 48                 |
| 04-00500-03001 | R0.3       | 1.5                                 | 0.3               | 0.6      | 15°                   | 4              | 48                 |
| 04-00500-05001 | R0.5       | 2.5                                 | 0.5               | 1        | 15°                   | 4              | 50                 |
| 04-00500-07501 | R0.75      | 3.8                                 | 0.75              | 1.5      | 15°                   | 4              | 48                 |
| 04-00500-10001 | R1         | 5                                   | 1                 | 2        | 15°                   | 4              | 48                 |

**How to Order** When you order, indicate PCDRB (R)×(ℓ<sub>1</sub>). ※(γ°) is reference value.

**Machining case** W-010

| Work Material |                   | Prehardened Steels•Hardened Steels•High Speed Tool Steels (~68HRC)                                                                                  |        |       |              |       | Cemented Carbide  |        |       |              |       |
|---------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|--------------|-------|-------------------|--------|-------|--------------|-------|
|               |                   | Spindle Speed                                                                                                                                       | Feed   | Stock | Depth of Cut |       | Spindle Speed     | Feed   | Stock | Depth of Cut |       |
| Radius        | Under Neck Length | min <sup>-1</sup>                                                                                                                                   | mm/min | mm    | ap mm        | ae mm | min <sup>-1</sup> | mm/min | mm    | ap mm        | ae mm |
| 0.05          | 0.15              | 40,000                                                                                                                                              | 50     | 0.001 | 0.001        | 0.001 | 40,000            | 50     | 0.001 | 0.001        | 0.001 |
|               | 0.25              | 40,000                                                                                                                                              | 25     | 0.001 | 0.001        | 0.001 | 40,000            | 25     | 0.001 | 0.001        | 0.001 |
| 0.075         | 0.23              | 40,000                                                                                                                                              | 100    | 0.001 | 0.001        | 0.001 | 40,000            | 100    | 0.001 | 0.001        | 0.001 |
|               | 0.38              | 40,000                                                                                                                                              | 50     | 0.001 | 0.001        | 0.001 | 40,000            | 50     | 0.001 | 0.001        | 0.001 |
| 0.1           | 0.5               | 40,000                                                                                                                                              | 100    | 0.001 | 0.001        | 0.001 | 40,000            | 100    | 0.001 | 0.001        | 0.001 |
| 0.2           | 1                 | 40,000                                                                                                                                              | 200    | 0.002 | 0.002        | 0.002 | 40,000            | 150    | 0.002 | 0.001        | 0.002 |
| 0.3           | 1.5               | 40,000                                                                                                                                              | 400    | 0.003 | 0.003        | 0.003 | 40,000            | 200    | 0.002 | 0.002        | 0.002 |
| 0.5           | 2.5               | 40,000                                                                                                                                              | 500    | 0.005 | 0.005        | 0.005 | 40,000            | 300    | 0.003 | 0.003        | 0.003 |
| 0.75          | 3.8               | 40,000                                                                                                                                              | 600    | 0.005 | 0.005        | 0.005 | 40,000            | 400    | 0.004 | 0.004        | 0.004 |
| 1             | 5                 | 40,000                                                                                                                                              | 800    | 0.005 | 0.005        | 0.005 | 40,000            | 500    | 0.005 | 0.005        | 0.005 |
| Notes         |                   | ※1 ap: Axial Depth of Cut, ae: Radial Depth of Cut.                                                                                                 |        |       |              |       |                   |        |       |              |       |
|               |                   | ※2 Described Depth of Cut is max value. Adjust it depending on machine rigidity, main spindle rigidity, and required precision.                     |        |       |              |       |                   |        |       |              |       |
|               |                   | ※3 Obtain uniform stock amount on the cutting surface in the pre-stage cutting (semi-finishing).                                                    |        |       |              |       |                   |        |       |              |       |
|               |                   | ※4 In order to perform lubricity and chip flow well, coolant must be always reached cutting points.                                                 |        |       |              |       |                   |        |       |              |       |
|               |                   | ※5 Careful set up for milling condition and tool path are required especially when operate with high cutting load such as corner area and slotting. |        |       |              |       |                   |        |       |              |       |
|               |                   | ※6 Water-insoluble fluid is recommended.                                                                                                            |        |       |              |       |                   |        |       |              |       |

Machining Case 1

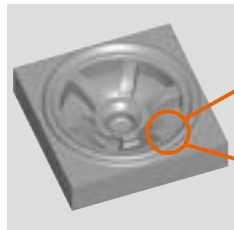
Wheel model

- Work Material : ELMAX 60HRC
- Coolant : Water-insoluble fluid
- Total machining time : 50hr 13min

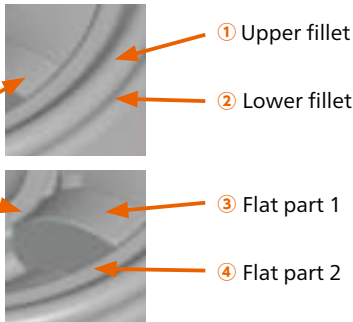
Work size : 50×50mm



Surface Roughness



| Process                            | Roughing①         | Roughing②          | Semi-finishing     | Finishing            |
|------------------------------------|-------------------|--------------------|--------------------|----------------------|
| Tool                               | MRBH230 R1×6      | MRBH230 R1×6       | SSPB220 R1×5       | PCDRB R1×5           |
| Spindle speed [min <sup>-1</sup> ] | 25,000            | 25,000             | 40,000             | 40,000               |
| Feed [mm/min]                      | 2,000             | 1,000              | 800                | 500                  |
| Depth of cut [mm]                  | ap 0.15<br>ae 0.3 | ap 0.02<br>ae 0.05 | ap 0.01<br>ae 0.01 | ap 0.003<br>ae 0.003 |
| Stock [mm]                         | 0.033             | 0.013              | 0.003              | 0                    |
| Machining time                     | 2hr 17min         | 1hr 45min          | 7hr 12min          | 38hr 58min           |



|   | Rz[μm] |
|---|--------|
| ① | 0.209  |
| ② | 0.212  |
| ③ | 0.159  |
| ④ | 0.330  |

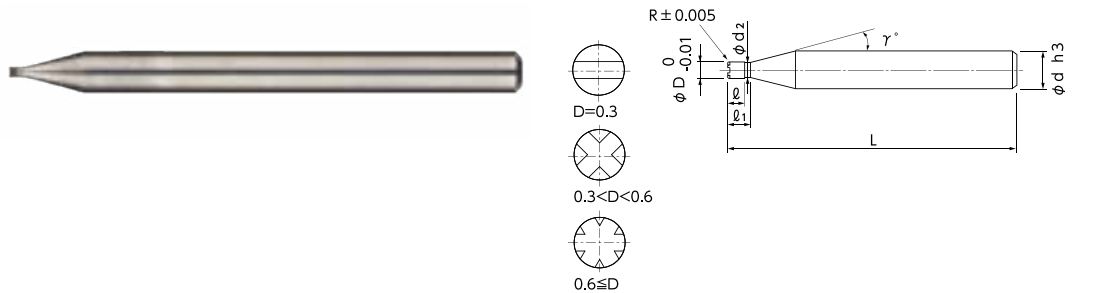
- PCDRB can realize mirror like finishing on full surface machining and achieve the sub-micro level surface roughness, even for approx. 39hrs finishing process.
- Before finishing, use CBN to process semi-finishing. Leaving constant stock amount on semi-finished surface will have great affects in the finishing process.



PCD Radius End Mill

Recommended Milling Conditions

PCD corner radius end mill.  
Realized nano level finished surface roughness on hard brittle materials



- Ultimate high quality surface is realized in the corner radius shape with superior cutting performance on curved and plane surface!



Cutting edge shape 2-Flute



Cutting edge shape 4-Flute



Cutting edge shape 6-Flute



Actual diameter is indicated in 1 micron units on product label, and enables high precision machining.  
※Micron units dimensions cannot be specified.

| Unit : mm      |          |                   |                                     |                   |                             |                      |                |                    |                 |
|----------------|----------|-------------------|-------------------------------------|-------------------|-----------------------------|----------------------|----------------|--------------------|-----------------|
| Code No.       | Dia. (D) | Corner Radius (R) | Under Neck Length (l <sub>1</sub> ) | Length of Cut (l) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Number of Flute |
| 04-00700-03050 | 0.3      | R0.05             | 0.3                                 | 0.09              | 0.27                        | 15°                  | 4              | 48                 | 2               |
| 04-00700-04050 | 0.4      | R0.05             | 0.4                                 | 0.12              | 0.36                        | 15°                  | 4              | 48                 | 4               |
| 04-00700-05050 | 0.5      | R0.05             | 0.5                                 | 0.15              | 0.45                        | 15°                  | 4              | 48                 | 4               |
| 04-00700-05100 |          | R0.1              | 0.5                                 | 0.15              | 0.45                        | 15°                  | 4              | 48                 | 4               |
| 04-00700-06050 | 0.6      | R0.05             | 0.6                                 | 0.18              | 0.54                        | 15°                  | 4              | 48                 | 6               |
| 04-00700-06100 |          | R0.1              | 0.6                                 | 0.18              | 0.54                        | 15°                  | 4              | 48                 | 6               |
| 04-00700-08050 | 0.8      | R0.05             | 0.8                                 | 0.24              | 0.72                        | 15°                  | 4              | 48                 | 6               |
| 04-00700-08100 |          | R0.1              | 0.8                                 | 0.24              | 0.72                        | 15°                  | 4              | 48                 | 6               |
| 04-00700-10050 | 1        | R0.05             | 1                                   | 0.3               | 0.9                         | 15°                  | 4              | 48                 | 6               |
| 04-00700-10100 |          | R0.1              | 1                                   | 0.3               | 0.9                         | 15°                  | 4              | 48                 | 6               |

How to Order

When you order, indicate PCDRS (D)×(R). ※(γ) is reference value.

| Work Material |               | Cemented Carbide                                                                                                                                                                                                                                                                                                       |        |                            |                   |
|---------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------------------|-------------------|
| Dia.          | Corner Radius | Spindle Speed                                                                                                                                                                                                                                                                                                          | Feed   | Depth of Cut for Finishing |                   |
|               |               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                      | mm/min | a <sub>p</sub> mm          | a <sub>e</sub> mm |
| 0.3           | R0.05         | 50,000                                                                                                                                                                                                                                                                                                                 | 50     | 0.001                      | 0.005             |
| 0.4           | R0.05         | 50,000                                                                                                                                                                                                                                                                                                                 | 100    | 0.001                      | 0.01              |
| 0.5           | R0.05         | 50,000                                                                                                                                                                                                                                                                                                                 | 100    | 0.001                      | 0.01              |
|               | R0.1          | 50,000                                                                                                                                                                                                                                                                                                                 | 150    | 0.001                      | 0.015             |
| 0.6           | R0.05         | 50,000                                                                                                                                                                                                                                                                                                                 | 100    | 0.001                      | 0.01              |
|               | R0.1          | 50,000                                                                                                                                                                                                                                                                                                                 | 150    | 0.001                      | 0.015             |
| 0.8           | R0.05         | 50,000                                                                                                                                                                                                                                                                                                                 | 150    | 0.001                      | 0.015             |
|               | R0.1          | 50,000                                                                                                                                                                                                                                                                                                                 | 200    | 0.001                      | 0.03              |
| 1             | R0.05         | 50,000                                                                                                                                                                                                                                                                                                                 | 150    | 0.001                      | 0.015             |
|               | R0.1          | 50,000                                                                                                                                                                                                                                                                                                                 | 200    | 0.001                      | 0.03              |
| Notes         |               | ※1 Minimal tool runout is required to avoid the tool breakage and to increase the work accuracy.<br>※2 Due to infinitesimal Depth of Cut (a <sub>p</sub> ), recommend to assess the machine characters, such as expansion of the spindle and others before using the tool.<br>※3 Water-insoluble fluid is recommended. |        |                            |                   |

Machining Case 1

Work size :  $\phi$  15mm    Cutting depth : 0.924mm



- Work Material : Cemented Carbide 92.5HRA
- Coolant : Water-insoluble fluid
- Total machining time : 9hr 48min

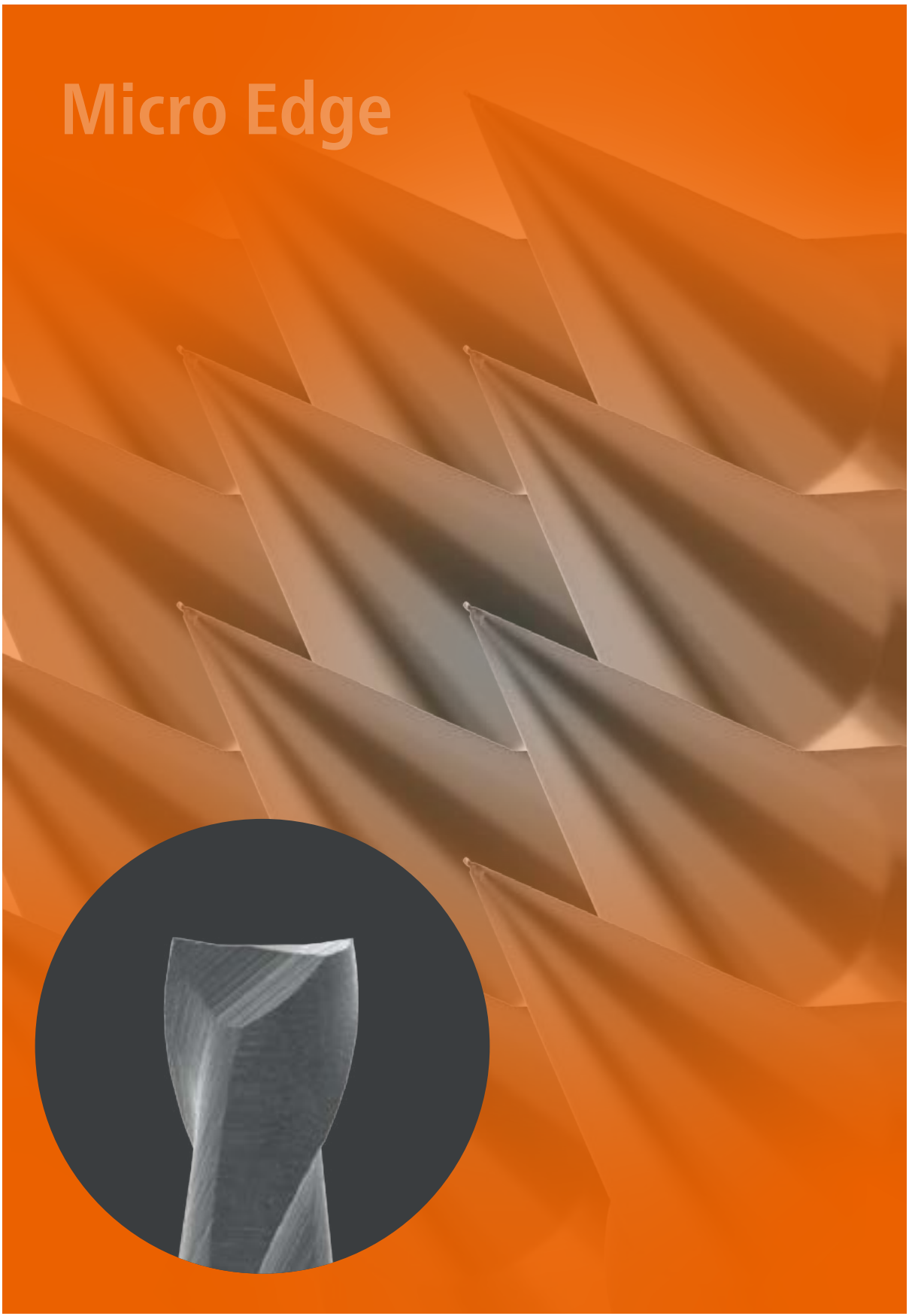
| Process                                          | Finishing                  |                       |
|--------------------------------------------------|----------------------------|-----------------------|
|                                                  | Contour line milling       | Scanning line milling |
| Tool                                             | PCDRS $\phi$ 0.3×R0.05×0.3 |                       |
| Spindle speed [min <sup>-1</sup> ]               | 40,000                     |                       |
| Feed [mm/min]                                    | 70                         |                       |
| Depth of cut a <sub>p</sub> ×a <sub>e</sub> [mm] | 0.002~0.006×0.002          | 0.001×0.005~0.01      |
| Stock [mm]                                       | 0.002                      | 0.001                 |
| Cutting length                                   | 28m                        | 12m                   |
| Machining time                                   | 6hr23min                   | 3hr25min              |



## Micro Edge

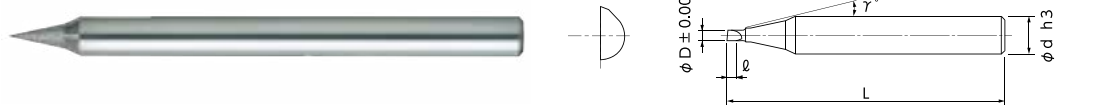
## Various lineup for micro manufacturing

| Model                                                                                       | Size           | Length of Cut | Number of Flute | Helix Angle | Supplement | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  | Number of Sizes | Page |
|---------------------------------------------------------------------------------------------|----------------|---------------|-----------------|-------------|------------|--------------|--------------|------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|----------|-----------------------|--------------------------------------------------|--------|--------|--------|---|-------|--|-----------------|------|
|                                                                                             |                |               |                 |             |            |              |              |            | P             | P           | P                 | M               | N              | N      | N     | N        | S                     | H                                                |        |        |        |   |       |  |                 |      |
|                                                                                             |                |               |                 |             |            |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc                         | 55 HRC | 65 HRC | 70 HRC |   |       |  |                 |      |
| CBN Micro Edge Square                                                                       |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |
|  SMEZ120   | φ0.03 ~ φ0.1   | 1D            | 1               | -20°        | 90°        | Slot         | -            | -          | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                                                | ○      | ○      | -      | 8 | D-004 |  |                 |      |
| CBN micro end mill with standardized of Dia.0.1mm or smaller                                |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       | ※ Listed at "CBN Core Line" as well (Page B-004) |        |        |        |   |       |  |                 |      |
| Micro Edge Square                                                                           |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |
|  NSME100   | φ0.01 ~ φ0.05  | 1D            | 1               | 0°          | 90°        | Slot         | Face         | -          | ○             | ○           | ○                 | ○               | ○              | ○      | -     | -        | -                     | -                                                | -      | -      | -      | 5 | D-006 |  |                 |      |
| Smallest Dia.0.01mm. Single straight flute end mill for ultra micro milling                 |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |
|  NSME230  | φ0.03 ~ φ0.09  | 1.5D          | 2               | 30°         | -          | Slot         | Face         | -          | ○             | ○           | ○                 | ○               | ○              | ○      | -     | -        | -                     | -                                                | -      | -      | -      | 7 | D-008 |  |                 |      |
| 2-flute 30° square end mill for micro milling. Dia.0.03mm to Dia.0.09mm                     |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |
| CBN Micro Edge Ball                                                                         |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |
|  SMB120  | R0.01 ~ R0.05  | 1D            | 1               | -20°        | -          | -            | -            | 3D         | -             | -           | ○                 | -               | -              | -      | -     | -        | -                     | -                                                | ○      | ○      | ○      | 7 | D-010 |  |                 |      |
| Realized micro milling by size line up R0.01 - R0.05                                        |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       | ※ Listed at "CBN Core Line" as well (Page B-010) |        |        |        |   |       |  |                 |      |
| Micro Edge Ball                                                                             |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |
|  NSMB100 | R0.005 ~ R0.05 | 1D            | 1               | 0°          | -          | -            | -            | 3D         | ○             | ○           | ○                 | ○               | ○              | ○      | -     | -        | -                     | -                                                | -      | -      | -      | 8 | D-012 |  |                 |      |
| Standardized from the smallest R0.005 for ultra micro milling                               |                |               |                 |             |            |              |              |            |               |             |                   |                 |                |        |       |          |                       |                                                  |        |        |        |   |       |  |                 |      |

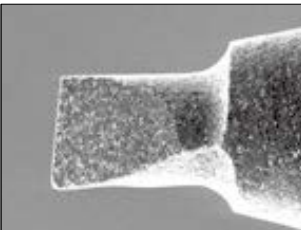


CBN micro end mill with standardized of Dia.0.1mm or smaller

**PATENTED** PAT. No. 5177982



- NS engineering technology and selected CBN material realize sharp edge.
- Tolerance of flute diameter is  $\pm 2\mu\text{m}$ .
- Tolerance of shank diameter is h3 (0~0.0025).



Cutting edge shape

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00480-00030 | 0.03     | 0.03              | 15°                  | 4              | 50                 |
| 01-00480-00040 | 0.04     | 0.04              | 15°                  | 4              | 50                 |
| 01-00480-00050 | 0.05     | 0.05              | 15°                  | 4              | 50                 |
| 01-00480-00060 | 0.06     | 0.06              | 15°                  | 4              | 50                 |
| 01-00480-00070 | 0.07     | 0.07              | 15°                  | 4              | 50                 |
| 01-00480-00080 | 0.08     | 0.08              | 15°                  | 4              | 50                 |
| 01-00480-00090 | 0.09     | 0.09              | 15°                  | 4              | 50                 |
| 01-00480-00100 | 0.1      | 0.1               | 15°                  | 4              | 50                 |

How to Order

When you order, indicate SMEZ120 (D). ※ ( γ ) is reference value.

| Work Material | Prehardened Steels•Hardened Steels<br>NAK•STAVAX•SKD11•PD613<br>(~62HRC)                                                                                                                                                                                                                                                                                                          |       |        |                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|
| Dia.          | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                      |       | Feed   | Spindle Speed     |
|               | ap mm                                                                                                                                                                                                                                                                                                                                                                             | ae mm | mm/min | min <sup>-1</sup> |
| 0.03          | 0.0005                                                                                                                                                                                                                                                                                                                                                                            | 0.003 | 10     | 60,000            |
| 0.04          | 0.001                                                                                                                                                                                                                                                                                                                                                                             | 0.003 | 20     | 60,000            |
| 0.05          | 0.001                                                                                                                                                                                                                                                                                                                                                                             | 0.005 | 30     | 60,000            |
| 0.06          | 0.002                                                                                                                                                                                                                                                                                                                                                                             | 0.005 | 40     | 60,000            |
| 0.07          | 0.002                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 50     | 60,000            |
| 0.08          | 0.003                                                                                                                                                                                                                                                                                                                                                                             | 0.015 | 65     | 60,000            |
| 0.09          | 0.003                                                                                                                                                                                                                                                                                                                                                                             | 0.02  | 80     | 60,000            |
| 0.1           | 0.003                                                                                                                                                                                                                                                                                                                                                                             | 0.025 | 100    | 60,000            |
| Notes         | ※1 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 Handle with care when exchanging and presetting tool.<br>※3 We recommend using oil mist coolant.<br>※4 Minimize chucking runout.<br>(Recommend to measure actual runout at activated spindle speed.)<br>※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut. |       |        |                   |

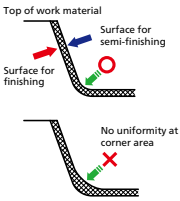
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

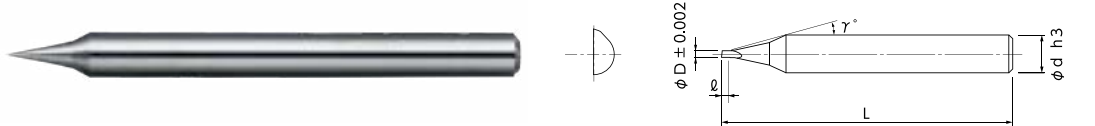
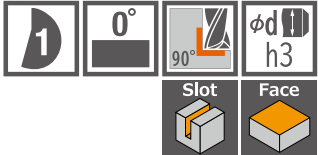
- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



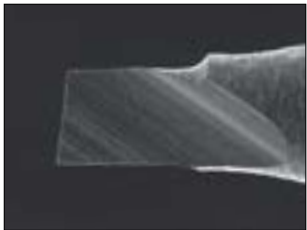
- ☐ Carbon Steel **P**
- ☐ Alloy Steel **P**
- ☐ Prehardened Steel **P**
- ☒ Stainless Steel **M**
- ☐ Aluminium Alloy **N**
- ☐ Copper **N**
- ☐ Resin **N**

- P** Carbon Steel ☐
- P** Alloy Steel ☐
- P** Prehardened Steel ☐
- M** Stainless Steel ☒
- N** Aluminium Alloy ☐
- N** Copper ☐
- N** Resin ☐

Smallest Dia.0.01mm  
Single straight flute end mill for ultra micro milling



- Ultra-high-precision accuracy is guaranteed with  $\pm 2\mu\text{m}$  tolerance of flute diameter and h3 tolerance of shank diameter (circularity  $0.1\mu\text{m}$ ).
- One straight flute, 5 items from 0.01 to 0.05mm diameter.



Cutting edge shape

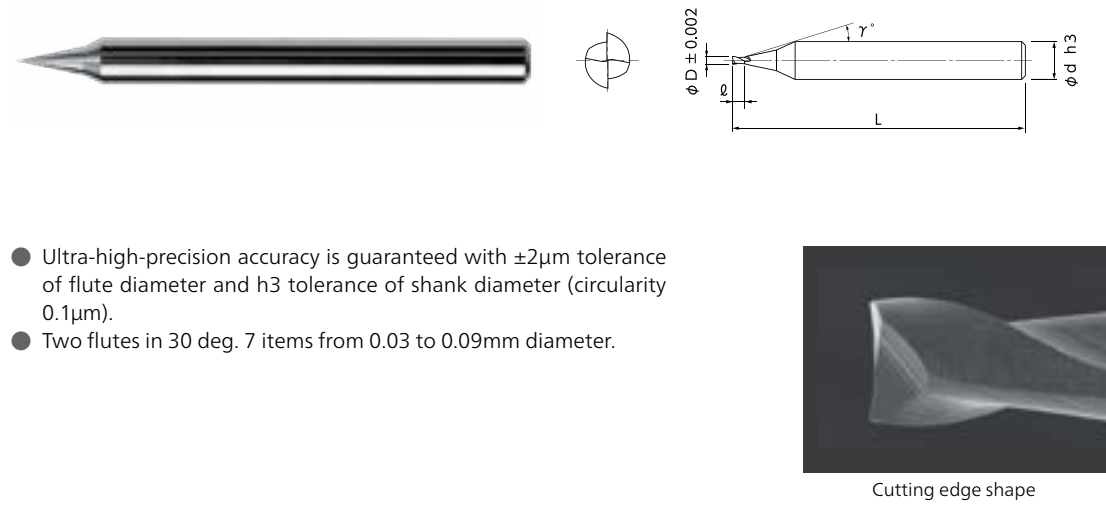
| Work Material | Tough Pitch Copper・Aluminium Alloy                                                                                                                                                                                                                                                                                                                                                        |          |        |                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|-------------------|
| Dia           | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                              |          | Feed   | Spindle Speed     |
|               | $a_p$ mm                                                                                                                                                                                                                                                                                                                                                                                  | $a_e$ mm | mm/min | $\text{min}^{-1}$ |
| 0.01          | 0.0001                                                                                                                                                                                                                                                                                                                                                                                    | 0.0005   | 10     | 60,000            |
| 0.02          | 0.0003                                                                                                                                                                                                                                                                                                                                                                                    | 0.001    | 15     | 60,000            |
| 0.03          | 0.0005                                                                                                                                                                                                                                                                                                                                                                                    | 0.001    | 20     | 60,000            |
| 0.04          | 0.001                                                                                                                                                                                                                                                                                                                                                                                     | 0.001    | 20     | 60,000            |
| 0.05          | 0.001                                                                                                                                                                                                                                                                                                                                                                                     | 0.002    | 30     | 60,000            |
| Notes         | ※1 Depth of Cut : $a_p$ =Axial Depth of Cut / $a_e$ =Radial Depth of Cut.<br>※2 Handle with care when exchanging and presetting tool.<br>※3 We recommend using oil mist coolant.<br>※4 Minimize chucking runout.<br>(Recommend to measure actual runout at activated spindle speed.)<br>※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut. |          |        |                   |

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 01-00001-00010 | 0.01        | 0.01                 | 15°                              | 4                 | 45                    |
| 01-00001-00020 | 0.02        | 0.02                 | 15°                              | 4                 | 45                    |
| 01-00001-00030 | 0.03        | 0.03                 | 15°                              | 4                 | 45                    |
| 01-00001-00040 | 0.04        | 0.04                 | 15°                              | 4                 | 45                    |
| 01-00001-00050 | 0.05        | 0.05                 | 15°                              | 4                 | 45                    |

**How to Order** When you order, indicate NSME100 (D). ※( $\gamma$ ) is reference value.

| Work Material | Tough Pitch Copper・Aluminium Alloy                                                                                                                                                                                                                                                                                                                                                |       |        |                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|
| Dia           | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                      |       | Feed   | Spindle Speed     |
|               | ap mm                                                                                                                                                                                                                                                                                                                                                                             | ae mm | mm/min | min <sup>-1</sup> |
| 0.03          | 0.0015                                                                                                                                                                                                                                                                                                                                                                            | 0.002 | 20     | 60,000            |
| 0.04          | 0.0015                                                                                                                                                                                                                                                                                                                                                                            | 0.002 | 25     | 60,000            |
| 0.05          | 0.002                                                                                                                                                                                                                                                                                                                                                                             | 0.003 | 30     | 60,000            |
| 0.06          | 0.002                                                                                                                                                                                                                                                                                                                                                                             | 0.004 | 40     | 60,000            |
| 0.07          | 0.0025                                                                                                                                                                                                                                                                                                                                                                            | 0.005 | 50     | 60,000            |
| 0.08          | 0.003                                                                                                                                                                                                                                                                                                                                                                             | 0.005 | 70     | 60,000            |
| 0.09          | 0.004                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 80     | 60,000            |
| Notes         | ※1 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 Handle with care when exchanging and presetting tool.<br>※3 We recommend using oil mist coolant.<br>※4 Minimize chucking runout.<br>(Recommend to measure actual runout at activated spindle speed.)<br>※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut. |       |        |                   |



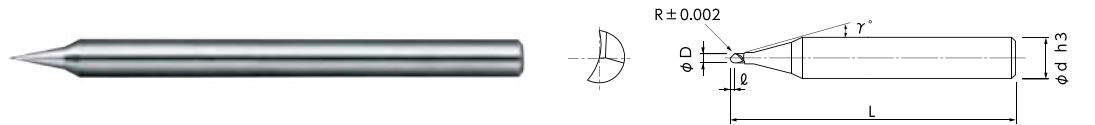
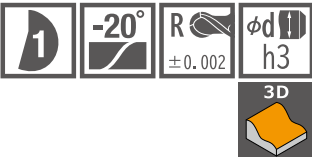
| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00002-00030 | 0.03        | 0.045                | 15°                              | 4                 | 45                    |
| 01-00002-00040 | 0.04        | 0.060                | 15°                              | 4                 | 45                    |
| 01-00002-00050 | 0.05        | 0.075                | 15°                              | 4                 | 45                    |
| 01-00002-00060 | 0.06        | 0.090                | 15°                              | 4                 | 45                    |
| 01-00002-00070 | 0.07        | 0.105                | 15°                              | 4                 | 45                    |
| 01-00002-00080 | 0.08        | 0.120                | 15°                              | 4                 | 45                    |
| 01-00002-00090 | 0.09        | 0.135                | 15°                              | 4                 | 45                    |

**How to Order** When you order, indicate NSME230 (D). ※(γ) is reference value.

CBN Ball End Mill for precision machining “CBN Micro Ball” ※ Listed at “CBN Core Line” as well (Page B-010)

Recommended Milling Conditions

Realized micro milling by size line up R0.01 - R0.05



- CBN Micro Ball develops new machining capability in high-precision technology.
- Standardized sizes from R0.01.
- Realized sharp edge by maximizing features of CBN.
- Long machining on pre-hardened to high-hardened steels (60HRC~).



Cutting edge shape

Unit : mm

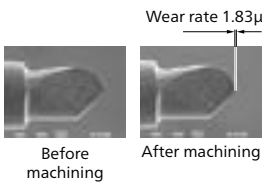
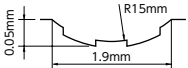
| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 01-00460-00010 | R0.01      | 0.02              | 0.02     | 15°                  | 4              | 50                 |
| 01-00460-00015 | R0.015     | 0.03              | 0.03     | 15°                  | 4              | 50                 |
| 01-00460-00020 | R0.02      | 0.04              | 0.04     | 15°                  | 4              | 50                 |
| 01-00460-00025 | R0.025     | 0.05              | 0.05     | 15°                  | 4              | 50                 |
| 01-00460-00030 | R0.03      | 0.06              | 0.06     | 15°                  | 4              | 50                 |
| 01-00460-00040 | R0.04      | 0.08              | 0.08     | 15°                  | 4              | 50                 |
| 01-00460-00050 | R0.05      | 0.1               | 0.1      | 15°                  | 4              | 50                 |

How to Order

When you order, indicate SMB120 (R). ※(γ) is reference value.

Machining Case 1

R0.05 NS Logo



|                  |                            |                             |
|------------------|----------------------------|-----------------------------|
| Work Material    | STAVAX 52HRC               |                             |
| Spindle speed    | 80,000min <sup>-1</sup>    |                             |
| Feed             | Roughing : 200mm/min       | Finishing : 50mm/min        |
| Depth of cut     | Roughing : 2μm×5μm (ap×ae) | Finishing : 2μm×2μm (ap×ae) |
| Machining time   | 1hr 50min                  |                             |
| Machining length | 7.7m                       |                             |
| Coolant          | Oil mist                   |                             |

● Full process done by one tool.

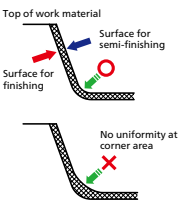
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

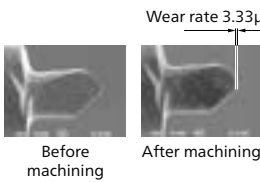
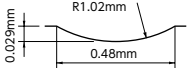
Advice on Finishing Allowance (stock amount)

- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



Machining Case 2

R0.03 Lens Array Model



|                  |                            |                             |
|------------------|----------------------------|-----------------------------|
| Work Material    | PD613 60HRC                |                             |
| Spindle speed    | 80,000min <sup>-1</sup>    |                             |
| Feed             | Roughing : 50mm/min        | Finishing : 30mm/min        |
| Depth of cut     | Roughing : 1μm×2μm (ap×ae) | Finishing : 1μm×1μm (ap×ae) |
| Machining time   | 4hr                        |                             |
| Machining length | 10.4m                      |                             |
| Coolant          | Oil mist                   |                             |

● Full process done by one tool.

Machining case

W-003



Micro Edge

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

P

P

P

M

N

N

N

NSMB100

Size R0.005 ~ R0.05

SMG

≤40

HRC

NSMB100

Ball End Mill for precision machining “Micro Ball”

Recommended Milling Conditions

Standardized from the smallest R0.005 for ultra micro milling

1

0°

R

±0.002

φd

h3

3D

● The world’s first standardization of Ball size R0.005. Micro Ball develops new machining field in high-precision technology.

● The world’s smallest ball end mill “Micro Ball” extends precision machining field.

● NS original R design exercises fine finishing surface.

Cutting edge shape

Unit : mm

| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 01-00003-00005 | R0.005     | 0.01              | 0.01     | 15°                  | 4              | 45                 |
| 01-00003-00010 | R0.01      | 0.02              | 0.02     | 15°                  | 4              | 45                 |
| 01-00003-00015 | R0.015     | 0.03              | 0.03     | 15°                  | 4              | 45                 |
| 01-00003-00020 | R0.02      | 0.04              | 0.04     | 15°                  | 4              | 45                 |
| 01-00003-00025 | R0.025     | 0.05              | 0.05     | 15°                  | 4              | 45                 |
| 01-00003-00030 | R0.03      | 0.06              | 0.06     | 15°                  | 4              | 45                 |
| 01-00003-00040 | R0.04      | 0.08              | 0.08     | 15°                  | 4              | 45                 |
| 01-00003-00050 | R0.05      | 0.1               | 0.1      | 15°                  | 4              | 45                 |

How to Order

When you order, indicate NSMB100 (R). ※ ( γ ) is reference value.

Work Material

Tough Pitch Copper・Aluminium Alloy

| Radius | Depth of Cut |        | Feed   | Approaching Feed | Spindle Speed     |
|--------|--------------|--------|--------|------------------|-------------------|
|        | ap mm        | ae mm  | mm/min | mm/min           | min <sup>-1</sup> |
| 0.005  | 0.0003       | 0.0005 | 5      | 2                | 60,000            |
| 0.01   | 0.0005       | 0.001  | 10     | 3                | 60,000            |
| 0.02   | 0.001        | 0.002  | 20     | 5                | 60,000            |
| 0.03   | 0.002        | 0.003  | 80     | 10               | 60,000            |
| 0.04   | 0.002        | 0.004  | 200    | 30               | 60,000            |
| 0.05   | 0.003        | 0.005  | 300    | 30               | 60,000            |

Notes

※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.

※2 Handle with care when exchanging and presetting tool.

※3 Use proper type of coolant for material and machining process.

※4 Minimize chucking runout

(Recommend to measure actual runout at activated spindle speed.)

※5 Tool approaching angle must be 3 degrees or below.

※6 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.

Ball

Ball

D-012

D-013

| NEW | Model | Size | Maximum Cutting Depth | Coating | Number of Flutes | Helix Angle | 3D Milling | Work Material |             |                   |                 |                 |        |       |          |                       |                          |                |  |  | Number of Sizes | Page |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|     |       |      |                       |         |                  |             |            | P             | P           | P                 | M               | N               | N      | N     | N        | N                     | S                        | H              |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |       |      |                       |         |                  |             |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |       |      |                       |         |                  |             |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

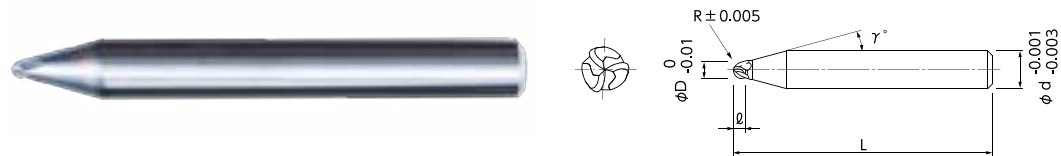
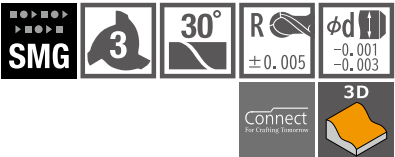


Regular Line  
MUGEN COATING PREMIUM Plus

MUGEN COATING PREMIUM Plus 3-Flute Ball End Mill for 5-axis machining

Recommended Milling Conditions

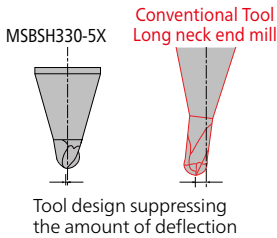
3-flute high rigidity ball design conforms features of 5-axis machine to reduce total manufacturing cost with high precision and high efficiency machining



- 3-flute high rigidity ball design conforms features of 5-axis machine to reduce total manufacturing cost with high precision and high efficiency machining.
- Even hardened steel of 45 to 70HRC can be machining with long tool life and high efficiency.
- By adopting positive cutting edge for carbide material emphasized breakage resistance that suppresses chattering by 3-flute and unequal flute.
- R accuracy is ±0.005mm (R accuracy is based on a half value of actual diameter).
- Shank diameter tolerance , high accuracy type, is - 0.001 ~ - 0.003.



Machining case



Tool design suppressing the amount of deflection



Unequal spacing suppresses chattering even high feed rate machining

| Work Material | Hardened Steels<br>STAVAX・SKD11 (～60HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |        |                   | High Speed Steels<br>SKH51・HAP40 (～65HRC) |       |        |                   | High Speed Steels<br>SKH57・HAP72 (～70HRC) |       |        |                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|-------------------------------------------|-------|--------|-------------------|-------------------------------------------|-------|--------|-------------------|
| Radius        | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       | Feed   | Spindle Speed     | Depth of Cut                              |       | Feed   | Spindle Speed     | Depth of Cut                              |       | Feed   | Spindle Speed     |
|               | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ae mm | mm/min | min <sup>-1</sup> | ap mm                                     | ae mm | mm/min | min <sup>-1</sup> | ap mm                                     | ae mm | mm/min | min <sup>-1</sup> |
| R0.1          | 0.005 ～ 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.005 | 400    | 40,000            | 0.003 ～ 0.005                             | 0.003 | 300    | 40,000            | 0.003 ～ 0.005                             | 0.003 | 220    | 40,000            |
| R0.15         | 0.005 ～ 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.007 | 450    | 40,000            | 0.003 ～ 0.005                             | 0.005 | 400    | 40,000            | 0.003 ～ 0.005                             | 0.005 | 270    | 40,000            |
| R0.2          | 0.02 ～ 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.03  | 1,100  | 40,000            | 0.008 ～ 0.012                             | 0.02  | 850    | 40,000            | 0.008 ～ 0.012                             | 0.02  | 650    | 35,000            |
| R0.25         | 0.02 ～ 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.03  | 1,300  | 40,000            | 0.01 ～ 0.015                              | 0.02  | 1,000  | 35,000            | 0.01 ～ 0.015                              | 0.02  | 700    | 30,000            |
| R0.3          | 0.03 ～ 0.045                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.06  | 1,500  | 40,000            | 0.02 ～ 0.03                               | 0.05  | 1,100  | 30,000            | 0.02 ～ 0.03                               | 0.05  | 800    | 25,000            |
| R0.5          | 0.1 ～ 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.2   | 3,000  | 30,000            | 0.08 ～ 0.12                               | 0.1   | 2,000  | 25,000            | 0.05 ～ 0.075                              | 0.1   | 1,500  | 20,000            |
| R0.75         | 0.1 ～ 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.3   | 3,800  | 30,000            | 0.1 ～ 0.15                                | 0.2   | 3,000  | 25,000            | 0.06 ～ 0.09                               | 0.2   | 2,200  | 20,000            |
| R1            | 0.2 ～ 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.5   | 3,800  | 25,000            | 0.15 ～ 0.22                               | 0.3   | 3,000  | 20,000            | 0.1 ～ 0.15                                | 0.3   | 2,200  | 16,000            |
| Notes         | <p>※1 Depth of cut ap indicates Axial Depth of Cut, ae indicates Radial Depth of Cut.</p> <p>※2 Adjust milling condition according to machine rigidity and clamp condition of work material.</p> <p>※3 Since the neck angle is 15°, please be careful to set the inclined angle to avoid interfering.</p> <p>※4 Adjust milling condition with necessity when high cutting load occurred by angle of tool or work material and feed direction.</p> <p>※5 The depth of cut ap is a guideline value according to the inclined angle of the tool or work material.</p> <p>※6 In case of chattering etc., please adjust cutting conditions if necessary.</p> <p>※7 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly.</p> <p>※8 Adjust both spindle speed and feed at the same rate.</p> <p>※9 Attention to a risk of chipping and breakage when insufficient chip flow.</p> <p>※10 We recommend using oil mist coolant.</p> |       |        |                   |                                           |       |        |                   |                                           |       |        |                   |



| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 08-00610-00100 | R0.1       | 0.12              | 0.2      | 15°                  | 6              | 50                 |
| 08-00610-00150 | R0.15      | 0.18              | 0.3      | 15°                  | 6              | 50                 |
| 08-00610-00200 | R0.2       | 0.24              | 0.4      | 15°                  | 6              | 50                 |
| 08-00610-00250 | R0.25      | 0.3               | 0.5      | 15°                  | 6              | 50                 |
| 08-00610-00300 | R0.3       | 0.36              | 0.6      | 15°                  | 6              | 50                 |
| 08-00610-00500 | R0.5       | 0.6               | 1        | 15°                  | 6              | 50                 |
| 08-00610-00750 | R0.75      | 0.9               | 1.5      | 15°                  | 6              | 50                 |
| 08-00610-01000 | R1         | 1.2               | 2        | 15°                  | 6              | 50                 |

Unit : mm

**How to Order** When you order, indicate MSBSH330-5X(R). ※( γ ) is reference value.

**Machining case** W-011

# MRBSH230SF New

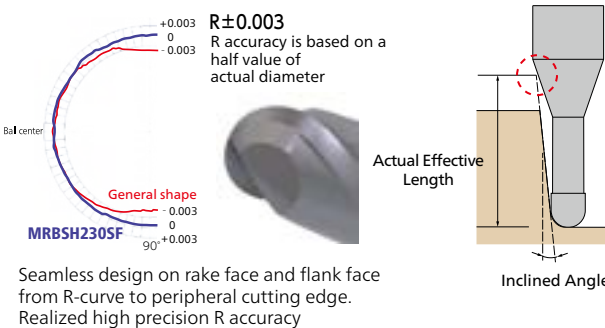
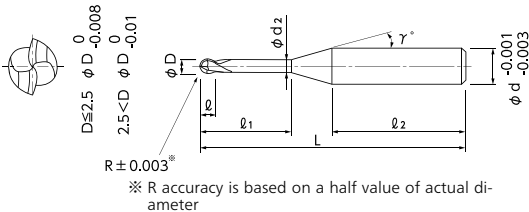
Size R0.05 ~ R3



MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill  
with Short Shank for Hardened Steel and High accuracy cutting

High precision and long tool life even for hardened steels  
up to 70HRC

- Realize stable cutting performance even for 70 HRC hardened steels.
- Developed new MUGEN COATING PREMIUM Plus to upgrade oxidation resistance and abrasion resistance.
- Adopt optimized new tool material and tool design to reduce cutting load.
- R accuracy is  $\pm 0.003\text{mm}$  (R accuracy is based on a half value of actual diameter).
- Shank diameter tolerance, high accuracy type, is - 0.001mm / - 0.003mm.



| Code No.       | Radius (R) | Under Neck Length (L1) | Length of Cut (L) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Shank Length (L2) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|-------------------|--------------------|------------------------------------------------------------------|------|-------|------|------|
|                |            |                        |                   |          |                |                      |                |                   |                    | 30°                                                              | 1°   | 1°30' | 2°   | 3°   |
| 08-00537-00052 | R0.05      | 0.2                    | 0.07              | 0.1      | 0.085          | 15°                  | 4              | 27.4              | 35                 | 0.23                                                             | 0.24 | 0.24  | 0.25 | 0.27 |
| 08-00537-00053 |            | 0.3                    | 0.07              | 0.1      | 0.085          | 15°                  | 4              | 27.3              | 35                 | 0.33                                                             | 0.34 | 0.35  | 0.36 | 0.39 |
| 08-00537-00055 |            | 0.5                    | 0.07              | 0.1      | 0.085          | 15°                  | 4              | 27.1              | 35                 | 0.54                                                             | 0.56 | 0.57  | 0.59 | 0.64 |
| 08-00537-00072 | R0.075     | 0.3                    | 0.1               | 0.15     | 0.13           | 15°                  | 4              | 27.4              | 35                 | 0.34                                                             | 0.35 | 0.36  | 0.37 | 0.40 |
| 08-00537-00073 |            | 0.5                    | 0.1               | 0.15     | 0.13           | 15°                  | 4              | 27.2              | 35                 | 0.55                                                             | 0.56 | 0.58  | 0.60 | 0.65 |
| 08-00537-00101 | R0.1       | 0.3                    | 0.15              | 0.2      | 0.18           | 15°                  | 4              | 27.5              | 35                 | 0.34                                                             | 0.35 | 0.36  | 0.37 | 0.39 |
| 08-00537-00102 |            | 0.5                    | 0.15              | 0.2      | 0.18           | 15°                  | 4              | 27.3              | 35                 | 0.55                                                             | 0.56 | 0.58  | 0.60 | 0.64 |
| 08-00537-00103 |            | 0.75                   | 0.15              | 0.2      | 0.18           | 15°                  | 4              | 27.1              | 35                 | 0.81                                                             | 0.83 | 0.86  | 0.89 | 0.95 |
| 08-00537-00105 | R0.15      | 1                      | 0.15              | 0.2      | 0.18           | 15°                  | 4              | 26.8              | 35                 | 1.06                                                             | 1.10 | 1.13  | 1.17 | 1.26 |
| 08-00537-00150 |            | 0.5                    | 0.2               | 0.3      | 0.28           | 15°                  | 4              | 27.5              | 35                 | 0.55                                                             | 0.56 | 0.57  | 0.59 | 0.63 |
| 08-00537-00151 |            | 0.6                    | 0.2               | 0.3      | 0.28           | 15°                  | 4              | 27.4              | 35                 | 0.65                                                             | 0.67 | 0.69  | 0.71 | 0.75 |
| 08-00537-00152 | R0.2       | 0.75                   | 0.2               | 0.3      | 0.28           | 15°                  | 4              | 27.3              | 35                 | 0.80                                                             | 0.83 | 0.85  | 0.88 | 0.94 |
| 08-00537-00153 |            | 1                      | 0.2               | 0.3      | 0.28           | 15°                  | 4              | 27.0              | 35                 | 1.06                                                             | 1.09 | 1.13  | 1.17 | 1.25 |
| 08-00537-00155 |            | 1.5                    | 0.2               | 0.3      | 0.28           | 15°                  | 4              | 26.5              | 35                 | 1.58                                                             | 1.63 | 1.68  | 1.74 | 1.87 |
| 08-00537-00201 | R0.25      | 0.5                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 27.7              | 35                 | 0.56                                                             | 0.58 | 0.59  | 0.60 | 0.64 |
| 08-00537-00202 |            | 0.8                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 27.4              | 35                 | 0.87                                                             | 0.90 | 0.92  | 0.95 | 1.01 |
| 08-00537-00203 |            | 1                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 27.2              | 35                 | 1.08                                                             | 1.11 | 1.14  | 1.18 | 1.26 |
| 08-00537-00204 | R0.3       | 1.5                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 26.7              | 35                 | 1.60                                                             | 1.65 | 1.70  | 1.75 | 1.88 |
| 08-00537-00205 |            | 2                      | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 26.2              | 35                 | 2.11                                                             | 2.18 | 2.25  | 2.33 | 2.50 |
| 08-00537-00206 |            | 2.5                    | 0.3               | 0.4      | 0.37           | 15°                  | 4              | 25.7              | 35                 | 2.63                                                             | 2.72 | 2.81  | 2.90 | 3.13 |
| 08-00537-00252 | R0.4       | 1                      | 0.35              | 0.5      | 0.46           | 15°                  | 4              | 27.3              | 35                 | 1.10                                                             | 1.13 | 1.16  | 1.19 | 1.27 |
| 08-00537-00253 |            | 1.5                    | 0.35              | 0.5      | 0.46           | 15°                  | 4              | 26.8              | 35                 | 1.61                                                             | 1.66 | 1.71  | 1.77 | 1.89 |
| 08-00537-00254 |            | 2                      | 0.35              | 0.5      | 0.46           | 15°                  | 4              | 26.3              | 35                 | 2.13                                                             | 2.20 | 2.27  | 2.34 | 2.51 |
| 08-00537-00255 | R0.5       | 2.5                    | 0.35              | 0.5      | 0.46           | 15°                  | 4              | 25.8              | 35                 | 2.65                                                             | 2.73 | 2.82  | 2.92 | 3.14 |
| 08-00537-00256 |            | 3                      | 0.35              | 0.5      | 0.46           | 15°                  | 4              | 25.3              | 35                 | 3.16                                                             | 3.27 | 3.38  | 3.49 | 3.76 |

## How to Order

When you order, indicate MRBSH230SF (R)×(L1). ※(γ) is reference value.

## Machining case

W-012

# MRBSH230SF

MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill  
with Short Shank for Hardened Steel and High accuracy cutting

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (L <sub>1</sub> ) | Length of Cut (L) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Shank Length (L <sub>2</sub> ) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                                     |                   |          |                             |                      |                |                                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00537-00300 | R0.3       | 1                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 27.5                           | 35                 | 1.10                                                             | 1.12  | 1.15  | 1.19  | 1.26  |
| 08-00537-00301 |            | 1.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 27.0                           | 35                 | 1.61                                                             | 1.66  | 1.71  | 1.76  | 1.88  |
| 08-00537-00302 |            | 2                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 26.5                           | 35                 | 2.13                                                             | 2.19  | 2.26  | 2.34  | 2.50  |
| 08-00537-00303 |            | 2.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 26.0                           | 35                 | 2.65                                                             | 2.73  | 2.82  | 2.91  | 3.12  |
| 08-00537-00304 |            | 3                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 25.5                           | 35                 | 3.16                                                             | 3.26  | 3.37  | 3.49  | 3.75  |
| 08-00537-00305 |            | 3.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 25.0                           | 35                 | 3.68                                                             | 3.80  | 3.92  | 4.06  | 4.37  |
| 08-00537-00306 | R0.4       | 4                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 29.5                           | 40                 | 4.20                                                             | 4.33  | 4.48  | 4.64  | 4.99  |
| 08-00537-00402 |            | 2                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 26.9                           | 35                 | 2.13                                                             | 2.19  | 2.25  | 2.32  | 2.48  |
| 08-00537-00403 |            | 3                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 25.9                           | 35                 | 3.16                                                             | 3.26  | 3.36  | 3.47  | 3.72  |
| 08-00537-00405 |            | 4                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 24.9                           | 35                 | 4.19                                                             | 4.33  | 4.47  | 4.62  | 4.97  |
| 08-00537-00406 | R0.5       | 5                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 28.9                           | 40                 | 5.23                                                             | 5.40  | 5.58  | 5.77  | 6.21  |
| 08-00537-00501 |            | 2                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 27.3                           | 35                 | 2.14                                                             | 2.20  | 2.26  | 2.33  | 2.48  |
| 08-00537-00502 |            | 2.5                                 | 0.75              | 1        | 0.95                        | 15°                  | 4              | 26.8                           | 35                 | 2.66                                                             | 2.73  | 2.82  | 2.90  | 3.10  |
| 08-00537-00503 |            | 3                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 26.3                           | 35                 | 3.18                                                             | 3.27  | 3.37  | 3.48  | 3.72  |
| 08-00537-00504 |            | 4                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 25.3                           | 35                 | 4.21                                                             | 4.34  | 4.48  | 4.63  | 4.97  |
| 08-00537-00505 |            | 5                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 29.3                           | 40                 | 5.24                                                             | 5.41  | 5.59  | 5.78  | 6.21  |
| 08-00537-00506 | R0.6       | 6                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 28.3                           | 40                 | 6.28                                                             | 6.48  | 6.69  | 6.93  | 7.45  |
| 08-00537-00602 |            | 2.4                                 | 0.9               | 1.2      | 1.15                        | 15°                  | 4              | 27.2                           | 35                 | 2.55                                                             | 2.62  | 2.69  | 2.77  | 2.95  |
| 08-00537-00603 |            | 4                                   | 0.9               | 1.2      | 1.15                        | 15°                  | 4              | 25.6                           | 35                 | 4.21                                                             | 4.33  | 4.47  | 4.61  | 4.94  |
| 08-00537-00605 |            | 6                                   | 0.9               | 1.2      | 1.15                        | 15°                  | 4              | 28.6                           | 40                 | 6.27                                                             | 6.47  | 6.68  | 6.91  | 7.43  |
| 08-00537-00606 | R0.75      | 8                                   | 0.9               | 1.2      | 1.15                        | 15°                  | 4              | 26.6                           | 40                 | 8.34                                                             | 8.61  | 8.90  | 9.21  | 9.91  |
| 08-00537-00752 |            | 3                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 27.2                           | 35                 | 3.17                                                             | 3.25  | 3.34  | 3.44  | 3.66  |
| 08-00537-00753 |            | 4                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 26.2                           | 35                 | 4.20                                                             | 4.32  | 4.45  | 4.59  | 4.91  |
| 08-00537-00754 |            | 6                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 29.2                           | 40                 | 6.27                                                             | 6.46  | 6.67  | 6.89  | 7.39  |
| 08-00537-00755 |            | 8                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 27.2                           | 40                 | 8.34                                                             | 8.60  | 8.88  | 9.19  | 9.88  |
| 08-00537-00756 |            | 10                                  | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 25.2                           | 40                 | 10.40                                                            | 10.74 | 11.10 | 11.49 | 12.36 |
| 08-00537-00805 | R0.8       | 8                                   | 1.2               | 1.6      | 1.55                        | 15°                  | 4              | 27.4                           | 40                 | 8.33                                                             | 8.60  | 8.88  | 9.18  | 9.87  |
| 08-00537-01000 | R1         | 3                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 28.1                           | 35                 | 3.18                                                             | 3.25  | 3.34  | 3.43  | 3.63  |
| 08-00537-01001 |            | 4                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 27.1                           | 35                 | 4.21                                                             | 4.32  | 4.45  | 4.58  | 4.87  |
| 08-00537-01002 |            | 6                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 25.1                           | 35                 | 6.28                                                             | 6.46  | 6.66  | 6.88  | 7.36  |
| 08-00537-01003 |            | 8                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 28.1                           | 40                 | 8.35                                                             | 8.60  | 8.88  | 9.18  | 9.84  |
| 08-00537-01004 |            | 10                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 26.1                           | 40                 | 10.41                                                            | 10.74 | 11.10 | 11.48 | 12.33 |
| 08-00537-01005 |            | 12                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 29.1                           | 45                 | 12.48                                                            | 12.88 | 13.31 | 13.77 | 14.82 |
| 08-00537-01252 | R1.25      | 6                                   | 2.3               | 2.5      | 2.4                         | 15°                  | 4              | 26.0                           | 35                 | 6.35                                                             | 6.53  | 6.72  | 6.92  | 7.39  |
| 08-00537-01253 |            | 8                                   | 2.3               | 2.5      | 2.4                         | 15°                  | 4              | 29.0                           | 40                 | 8.42                                                             | 8.67  | 8.93  | 9.22  | 9.88  |
| 08-00537-01254 |            | 10                                  | 2.3               | 2.5      | 2.4                         | 15°                  | 4              | 27.0                           | 40                 | 10.48                                                            | 10.81 | 11.15 | 11.52 | 12.36 |
| 08-00537-01256 | R1.5       | 15                                  | 2.3               | 2.5      | 2.4                         | 15°                  | 4              | 27.0                           | 45                 | 15.65                                                            | 16.15 | 16.69 | 17.27 | Free  |
| 08-00537-01500 |            | 6                                   | 2.5               | 3        | 2.85                        | 15°                  | 6              | 33.1                           | 45                 | 6.44                                                             | 6.61  | 6.79  | 7.00  | 7.45  |
| 08-00537-01501 |            | 8                                   | 2.5               | 3        | 2.85                        | 15°                  | 6              | 31.1                           | 45                 | 8.50                                                             | 8.75  | 9.01  | 9.29  | 9.93  |
| 08-00537-01502 |            | 10                                  | 2.5               | 3        | 2.85                        | 15°                  | 6              | 29.1                           | 45                 | 10.57                                                            | 10.89 | 11.23 | 11.59 | 12.42 |
| 08-00537-01503 |            | 12                                  | 2.5               | 3        | 2.85                        | 15°                  | 6              | 27.1                           | 45                 | 12.64                                                            | 13.03 | 13.44 | 13.89 | 14.91 |
| 08-00537-01504 |            | 14                                  | 2.5               | 3        | 2.85                        | 15°                  | 6              | 30.1                           | 50                 | 14.71                                                            | 15.17 | 15.66 | 16.19 | 17.39 |
| 08-00537-01505 | R2         | 16                                  | 2.5               | 3        | 2.85                        | 15°                  | 6              | 28.1                           | 50                 | 16.77                                                            | 17.31 | 17.88 | 18.49 | 19.88 |
| 08-00537-01506 |            | 20                                  | 2.5               | 3        | 2.85                        | 15°                  | 6              | 29.1                           | 55                 | 20.91                                                            | 21.58 | 22.31 | 23.09 | 24.85 |
| 08-00537-02000 |            | 8                                   | 3                 | 4        | 3.8                         | 15°                  | 6              | 32.8                           | 45                 | 8.58                                                             | 8.81  | 9.06  | 9.33  | 9.93  |
| 08-00537-02001 |            | 10                                  | 3                 | 4        | 3.8                         | 15°                  | 6              | 30.8                           | 45                 | 10.65                                                            | 10.95 | 11.28 | 11.63 | 12.42 |
| 08-00537-02002 | R2.5       | 12                                  | 3                 | 4        | 3.8                         | 15°                  | 6              | 28.8                           | 45                 | 12.72                                                            | 13.09 | 13.49 | 13.93 | 14.90 |
| 08-00537-02004 |            | 15                                  | 3                 | 4        | 3.8                         | 15°                  | 6              | 30.8                           | 50                 | 15.82                                                            | 16.30 | 16.82 | 17.38 | 18.63 |
| 08-00537-02005 |            | 20                                  | 3                 | 4        | 3.8                         | 15°                  | 6              | 30.8                           | 55                 | 20.99                                                            | 21.65 | 22.36 | 23.13 | Free  |
| 08-00537-02006 |            | 25                                  | 3                 | 4        | 3.8                         | 15°                  | 6              | 30.8                           | 60                 | 26.16                                                            | 27.00 | 27.90 | 28.88 | Free  |
| 08-00537-02502 | R2.5       | 10                                  | 3.5               | 5        | 4.8                         | 15°                  | 6              | 32.7                           | 45                 | 10.63                                                            | 10.92 | 11.22 | 11.55 | Free  |
| 08-00537-02503 |            | 15                                  | 3.5               | 5        | 4.8                         | 15°                  | 6              | 27.7                           | 45                 | 15.80                                                            | 16.27 | 16.77 | Free  | Free  |
| 08-00537-02504 |            | 20                                  | 3.5               | 5        | 4.8                         | 15°                  | 6              | 27.7                           | 50                 | 20.97                                                            | 21.62 | Free  | Free  | Free  |
| 08-00537-03000 | R3         | 10                                  | 6                 | 6        | 5.7                         | —                    | 6              | 34.4                           | 45                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00537-03001 |            | 15                                  | 6                 | 6        | 5.7                         | —                    | 6              | 29.4                           | 45                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00537-03002 |            | 20                                  | 6                 | 6        | 5.7                         | —                    | 6              | 29.4                           | 50                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00537-03003 |            | 25                                  | 6                 | 6        | 5.7                         | —                    | 6              | 29.4                           | 55                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00537-03004 |            | 30                                  | 6                 | 6        | 5.7                         | —                    | 6              | 29.4                           | 60                 | Free                                                             | Free  | Free  | Free  | Free  |



| Work Material |                   |      | SKH51・SKD11 (～62HRC) |       |       |               | High Speed Steels<br>SKH55・HAP40 (～66HRC) |       |       |               | High Speed Steels<br>SKH57・HAP72 (～70HRC) |       |       |               |
|---------------|-------------------|------|----------------------|-------|-------|---------------|-------------------------------------------|-------|-------|---------------|-------------------------------------------|-------|-------|---------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut         |       | Feed  | Spindle Speed | Depth of Cut                              |       | Feed  | Spindle Speed | Depth of Cut                              |       | Feed  | Spindle Speed |
|               |                   |      | ap mm                | ae mm |       |               | ap mm                                     | ae mm |       |               | ap mm                                     | ae mm |       |               |
| R0.05         | 0.2               | 2    | 0.002                | 0.005 | 100   | 40,000        | 0.002                                     | 0.003 | 70    | 40,000        | 0.002                                     | 0.003 | 50    | 40,000        |
|               | 0.3               | 3    | 0.002                | 0.005 | 70    | 40,000        | 0.002                                     | 0.003 | 50    | 40,000        | 0.002                                     | 0.003 | 40    | 40,000        |
|               | 0.5               | 5    | 0.001                | 0.003 | 50    | 40,000        | 0.001                                     | 0.002 | 30    | 40,000        | 0.001                                     | 0.002 | 20    | 40,000        |
| R0.075        | 0.3               | 2    | 0.002                | 0.005 | 150   | 40,000        | 0.002                                     | 0.003 | 100   | 40,000        | 0.002                                     | 0.003 | 80    | 40,000        |
|               | 0.5               | 3.3  | 0.002                | 0.005 | 120   | 40,000        | 0.002                                     | 0.003 | 70    | 40,000        | 0.002                                     | 0.003 | 50    | 40,000        |
|               | 0.3               | 1.5  | 0.005                | 0.005 | 300   | 40,000        | 0.003                                     | 0.003 | 200   | 40,000        | 0.003                                     | 0.003 | 150   | 40,000        |
| R0.1          | 0.5               | 2.5  | 0.005                | 0.005 | 280   | 40,000        | 0.003                                     | 0.003 | 180   | 40,000        | 0.003                                     | 0.003 | 130   | 40,000        |
|               | 0.75              | 3.75 | 0.003                | 0.005 | 200   | 40,000        | 0.002                                     | 0.003 | 150   | 40,000        | 0.002                                     | 0.003 | 110   | 40,000        |
|               | 1                 | 5    | 0.002                | 0.003 | 160   | 40,000        | 0.001                                     | 0.002 | 120   | 40,000        | 0.001                                     | 0.002 | 90    | 40,000        |
| R0.15         | 0.5               | 1.7  | 0.007                | 0.01  | 300   | 40,000        | 0.003                                     | 0.005 | 280   | 40,000        | 0.003                                     | 0.005 | 210   | 40,000        |
|               | 0.6               | 2    | 0.005                | 0.007 | 300   | 40,000        | 0.003                                     | 0.005 | 250   | 40,000        | 0.003                                     | 0.005 | 180   | 40,000        |
|               | 0.75              | 2.5  | 0.005                | 0.007 | 280   | 40,000        | 0.003                                     | 0.005 | 230   | 40,000        | 0.003                                     | 0.005 | 170   | 40,000        |
|               | 1                 | 3.3  | 0.005                | 0.007 | 250   | 40,000        | 0.003                                     | 0.005 | 200   | 40,000        | 0.003                                     | 0.005 | 150   | 40,000        |
|               | 1.5               | 5    | 0.003                | 0.005 | 180   | 40,000        | 0.002                                     | 0.003 | 120   | 40,000        | 0.002                                     | 0.003 | 90    | 40,000        |
| R0.2          | 0.5               | 1.25 | 0.03                 | 0.03  | 720   | 40,000        | 0.009                                     | 0.02  | 580   | 40,000        | 0.009                                     | 0.02  | 420   | 35,000        |
|               | 0.8               | 2    | 0.02                 | 0.03  | 720   | 40,000        | 0.008                                     | 0.02  | 580   | 40,000        | 0.008                                     | 0.02  | 420   | 35,000        |
|               | 1                 | 2.5  | 0.02                 | 0.03  | 720   | 40,000        | 0.008                                     | 0.02  | 580   | 40,000        | 0.008                                     | 0.02  | 400   | 35,000        |
|               | 1.5               | 3.75 | 0.01                 | 0.02  | 500   | 40,000        | 0.005                                     | 0.01  | 400   | 40,000        | 0.005                                     | 0.01  | 280   | 35,000        |
|               | 2                 | 5    | 0.007                | 0.01  | 380   | 40,000        | 0.005                                     | 0.007 | 300   | 40,000        | 0.005                                     | 0.007 | 220   | 35,000        |
| R0.25         | 2.5               | 6.25 | 0.005                | 0.007 | 300   | 40,000        | 0.003                                     | 0.005 | 260   | 40,000        | 0.003                                     | 0.005 | 190   | 35,000        |
|               | 1                 | 2    | 0.02                 | 0.03  | 860   | 40,000        | 0.01                                      | 0.02  | 650   | 35,000        | 0.01                                      | 0.02  | 450   | 30,000        |
|               | 1.5               | 3    | 0.01                 | 0.03  | 720   | 40,000        | 0.007                                     | 0.02  | 520   | 35,000        | 0.007                                     | 0.02  | 350   | 30,000        |
|               | 2                 | 4    | 0.01                 | 0.02  | 650   | 40,000        | 0.007                                     | 0.01  | 400   | 35,000        | 0.007                                     | 0.01  | 270   | 30,000        |
|               | 2.5               | 5    | 0.007                | 0.01  | 530   | 40,000        | 0.005                                     | 0.007 | 360   | 35,000        | 0.005                                     | 0.007 | 240   | 30,000        |
| R0.3          | 3                 | 6    | 0.007                | 0.01  | 420   | 35,000        | 0.005                                     | 0.007 | 320   | 35,000        | 0.005                                     | 0.007 | 220   | 30,000        |
|               | 1                 | 1.7  | 0.03                 | 0.06  | 1,000 | 40,000        | 0.02                                      | 0.05  | 720   | 30,000        | 0.02                                      | 0.05  | 540   | 25,000        |
|               | 1.5               | 2.5  | 0.03                 | 0.06  | 1,000 | 40,000        | 0.02                                      | 0.05  | 720   | 30,000        | 0.02                                      | 0.05  | 540   | 25,000        |
|               | 2                 | 3.3  | 0.03                 | 0.06  | 1,000 | 40,000        | 0.02                                      | 0.05  | 720   | 30,000        | 0.02                                      | 0.05  | 540   | 25,000        |
|               | 2.5               | 4.1  | 0.02                 | 0.04  | 840   | 40,000        | 0.02                                      | 0.03  | 640   | 30,000        | 0.02                                      | 0.03  | 480   | 25,000        |
|               | 3                 | 5    | 0.02                 | 0.04  | 840   | 40,000        | 0.02                                      | 0.03  | 600   | 30,000        | 0.02                                      | 0.03  | 450   | 25,000        |
|               | 3.5               | 5.9  | 0.01                 | 0.03  | 600   | 30,000        | 0.01                                      | 0.02  | 420   | 30,000        | 0.01                                      | 0.02  | 310   | 25,000        |
|               | 4                 | 6.7  | 0.01                 | 0.03  | 600   | 30,000        | 0.01                                      | 0.02  | 420   | 30,000        | 0.01                                      | 0.02  | 310   | 25,000        |
|               | 2                 | 2.5  | 0.07                 | 0.1   | 1,600 | 35,000        | 0.05                                      | 0.1   | 1,200 | 30,000        | 0.03                                      | 0.1   | 900   | 25,000        |
|               | 3                 | 3.75 | 0.05                 | 0.1   | 1,600 | 35,000        | 0.05                                      | 0.05  | 1,200 | 30,000        | 0.03                                      | 0.05  | 900   | 25,000        |
| R0.4          | 4                 | 5    | 0.04                 | 0.06  | 1,200 | 30,000        | 0.03                                      | 0.05  | 860   | 25,000        | 0.02                                      | 0.05  | 640   | 20,000        |
|               | 5                 | 6.25 | 0.03                 | 0.05  | 1,000 | 25,000        | 0.02                                      | 0.03  | 620   | 25,000        | 0.015                                     | 0.03  | 460   | 20,000        |
|               | 2                 | 2    | 0.1                  | 0.2   | 2,000 | 30,000        | 0.08                                      | 0.1   | 1,400 | 25,000        | 0.05                                      | 0.1   | 1,000 | 20,000        |
|               | 2.5               | 2.5  | 0.1                  | 0.2   | 2,000 | 30,000        | 0.08                                      | 0.1   | 1,400 | 25,000        | 0.05                                      | 0.1   | 1,000 | 20,000        |
|               | 3                 | 3    | 0.1                  | 0.2   | 2,000 | 30,000        | 0.08                                      | 0.1   | 1,400 | 25,000        | 0.05                                      | 0.1   | 1,000 | 20,000        |
| R0.5          | 4                 | 4    | 0.05                 | 0.15  | 1,600 | 28,000        | 0.05                                      | 0.1   | 1,200 | 25,000        | 0.03                                      | 0.1   | 900   | 20,000        |
|               | 5                 | 5    | 0.04                 | 0.1   | 1,400 | 25,000        | 0.03                                      | 0.05  | 920   | 20,000        | 0.02                                      | 0.05  | 700   | 16,000        |
|               | 6                 | 6    | 0.04                 | 0.05  | 1,200 | 22,000        | 0.02                                      | 0.05  | 740   | 20,000        | 0.015                                     | 0.05  | 550   | 16,000        |
|               | 2.4               | 2    | 0.1                  | 0.2   | 2,000 | 30,000        | 0.08                                      | 0.1   | 1,600 | 25,000        | 0.05                                      | 0.1   | 1,200 | 20,000        |
|               | 4                 | 3.3  | 0.1                  | 0.2   | 2,000 | 30,000        | 0.06                                      | 0.1   | 1,600 | 25,000        | 0.05                                      | 0.1   | 1,200 | 20,000        |
| R0.6          | 6                 | 5    | 0.05                 | 0.1   | 1,400 | 25,000        | 0.03                                      | 0.07  | 1,000 | 20,000        | 0.02                                      | 0.07  | 750   | 16,000        |
|               | 8                 | 6.7  | 0.03                 | 0.07  | 1,200 | 22,000        | 0.02                                      | 0.05  | 850   | 20,000        | 0.015                                     | 0.05  | 650   | 16,000        |
|               | 3                 | 2    | 0.1                  | 0.3   | 2,500 | 30,000        | 0.1                                       | 0.2   | 2,000 | 25,000        | 0.06                                      | 0.2   | 1,500 | 20,000        |
| R0.75         | 4                 | 2.7  | 0.1                  | 0.3   | 2,000 | 25,000        | 0.1                                       | 0.2   | 1,600 | 22,000        | 0.06                                      | 0.2   | 1,200 | 18,000        |
|               | 6                 | 4    | 0.1                  | 0.2   | 1,600 | 22,000        | 0.1                                       | 0.1   | 1,200 | 20,000        | 0.06                                      | 0.1   | 950   | 16,000        |
|               | 8                 | 5.3  | 0.05                 | 0.2   | 1,400 | 20,000        | 0.05                                      | 0.1   | 1,000 | 18,000        | 0.03                                      | 0.1   | 700   | 13,000        |
|               | 10                | 6.7  | 0.05                 | 0.1   | 1,200 | 18,000        | 0.05                                      | 0.05  | 850   | 16,000        | 0.03                                      | 0.05  | 650   | 13,000        |
| R0.8          | 8                 | 5    | 0.07                 | 0.2   | 1,400 | 20,000        | 0.05                                      | 0.1   | 1,000 | 16,000        | 0.03                                      | 0.1   | 750   | 13,000        |

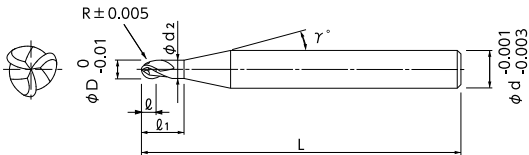
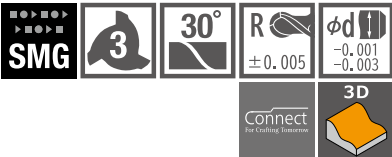
| Work Material |                   |      | High Speed Steels/Hardened Steels<br>SKH51・SKD11 (～62HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |       |               | High Speed Steels<br>SKH55・HAP40 (～66HRC) |       |       |               | High Speed Steels<br>SKH57・HAP72 (～70HRC) |       |       |               |
|---------------|-------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|---------------|-------------------------------------------|-------|-------|---------------|-------------------------------------------|-------|-------|---------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       | Feed  | Spindle Speed | Depth of Cut                              |       | Feed  | Spindle Speed | Depth of Cut                              |       | Feed  | Spindle Speed |
|               |                   |      | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ae mm |       |               | ap mm                                     | ae mm |       |               | ap mm                                     | ae mm |       |               |
| R1            | 3                 | 1.5  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.5   | 2,500 | 25,000        | 0.15                                      | 0.3   | 2,000 | 20,000        | 0.1                                       | 0.3   | 1,500 | 16,000        |
|               | 4                 | 2    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.5   | 2,500 | 25,000        | 0.15                                      | 0.3   | 2,000 | 20,000        | 0.1                                       | 0.3   | 1,500 | 16,000        |
|               | 6                 | 3    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.3   | 2,000 | 22,000        | 0.15                                      | 0.3   | 1,600 | 20,000        | 0.1                                       | 0.3   | 1,200 | 16,000        |
|               | 8                 | 4    | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.2   | 1,600 | 18,000        | 0.1                                       | 0.15  | 1,200 | 16,000        | 0.06                                      | 0.15  | 950   | 13,000        |
|               | 10                | 5    | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.2   | 1,400 | 16,000        | 0.1                                       | 0.1   | 1,000 | 14,000        | 0.06                                      | 0.1   | 750   | 11,000        |
|               | 12                | 6    | 0.07                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.1   | 1,200 | 14,000        | 0.05                                      | 0.1   | 850   | 12,000        | 0.03                                      | 0.1   | 650   | 9,500         |
| R1.25         | 6                 | 2.4  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.5   | 2,500 | 20,000        | 0.15                                      | 0.4   | 2,000 | 18,000        | 0.1                                       | 0.4   | 1,500 | 14,000        |
|               | 8                 | 3.2  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.3   | 2,100 | 20,000        | 0.15                                      | 0.3   | 1,800 | 18,000        | 0.1                                       | 0.3   | 1,300 | 14,000        |
|               | 10                | 4    | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.2   | 1,800 | 18,000        | 0.1                                       | 0.15  | 1,500 | 16,000        | 0.06                                      | 0.15  | 1,100 | 13,000        |
|               | 15                | 6    | 0.07                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.15  | 1,200 | 14,000        | 0.05                                      | 0.1   | 900   | 12,000        | 0.03                                      | 0.1   | 700   | 9,500         |
| R1.5          | 6                 | 2    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.6   | 2,500 | 18,000        | 0.2                                       | 0.5   | 2,000 | 15,000        | 0.12                                      | 0.5   | 1,500 | 12,000        |
|               | 8                 | 2.7  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.6   | 2,500 | 18,000        | 0.2                                       | 0.5   | 2,000 | 15,000        | 0.12                                      | 0.5   | 1,500 | 12,000        |
|               | 10                | 3.3  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.4   | 2,100 | 18,000        | 0.15                                      | 0.3   | 1,800 | 15,000        | 0.1                                       | 0.3   | 1,300 | 12,000        |
|               | 12                | 4    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.4   | 2,000 | 18,000        | 0.1                                       | 0.3   | 1,500 | 15,000        | 0.06                                      | 0.3   | 1,100 | 12,000        |
|               | 14                | 4.7  | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.3   | 1,600 | 16,000        | 0.1                                       | 0.2   | 1,200 | 12,000        | 0.06                                      | 0.2   | 900   | 10,000        |
|               | 16                | 5.3  | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.3   | 1,600 | 16,000        | 0.1                                       | 0.2   | 1,200 | 12,000        | 0.06                                      | 0.2   | 900   | 10,000        |
| R2            | 20                | 6.7  | 0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.2   | 1,200 | 14,000        | 0.08                                      | 0.1   | 850   | 12,000        | 0.06                                      | 0.1   | 650   | 9,500         |
|               | 8                 | 2    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8   | 2,500 | 15,000        | 0.2                                       | 0.6   | 2,000 | 12,000        | 0.15                                      | 0.6   | 1,500 | 9,500         |
|               | 10                | 2.5  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8   | 2,500 | 15,000        | 0.2                                       | 0.6   | 2,000 | 12,000        | 0.15                                      | 0.6   | 1,500 | 9,500         |
|               | 12                | 3    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8   | 2,500 | 15,000        | 0.2                                       | 0.6   | 2,000 | 12,000        | 0.15                                      | 0.6   | 1,500 | 9,500         |
|               | 15                | 3.75 | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.8   | 2,000 | 15,000        | 0.15                                      | 0.6   | 1,600 | 12,000        | 0.12                                      | 0.6   | 1,200 | 9,500         |
|               | 20                | 5    | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.6   | 1,700 | 14,000        | 0.1                                       | 0.4   | 1,200 | 10,000        | 0.08                                      | 0.4   | 900   | 8,000         |
| R2.5          | 25                | 6.25 | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.4   | 1,200 | 14,000        | 0.1                                       | 0.2   | 850   | 10,000        | 0.08                                      | 0.2   | 650   | 8,000         |
|               | 10                | 2    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.2   | 2,500 | 12,000        | 0.2                                       | 0.7   | 2,000 | 10,000        | 0.15                                      | 0.7   | 1,500 | 8,000         |
|               | 15                | 3    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.2   | 2,500 | 12,000        | 0.2                                       | 0.7   | 2,000 | 10,000        | 0.15                                      | 0.7   | 1,500 | 8,000         |
|               | 20                | 4    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1     | 2,000 | 10,000        | 0.15                                      | 0.6   | 1,600 | 8,500         | 0.12                                      | 0.6   | 1,200 | 6,500         |
| R3            | 10                | 1.7  | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.2   | 2,500 | 8,000         | 0.2                                       | 1     | 2,000 | 7,000         | 0.15                                      | 1     | 1,500 | 5,500         |
|               | 15                | 2.5  | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.2   | 2,500 | 8,000         | 0.2                                       | 1     | 2,000 | 7,000         | 0.15                                      | 1     | 1,500 | 5,500         |
|               | 20                | 3.3  | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1.2   | 2,500 | 8,000         | 0.2                                       | 1     | 2,000 | 7,000         | 0.15                                      | 1     | 1,500 | 5,500         |
|               | 25                | 4.1  | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1     | 2,200 | 8,000         | 0.15                                      | 0.7   | 1,600 | 7,000         | 0.12                                      | 0.7   | 1,200 | 5,500         |
|               | 30                | 5    | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1     | 1,800 | 7,000         | 0.15                                      | 0.7   | 1,300 | 6,500         | 0.12                                      | 0.7   | 950   | 5,000         |
| Notes         |                   |      | ※1 Depth of Cut ap indicates Axial Depth of Cut, ae indicates Radial Depth of Cut.<br>※2 In case of chattering etc., please adjust cutting conditions if necessary.<br>※3 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly.<br>※4 Adjust both spindle speed and feed at the same rate.<br>※5 A shrink fit type is recommended for tool holder. When using collet type or others, strictly adhere to minimum gripping length.<br>※6 We recommend using oil mist coolant. |       |       |               |                                           |       |       |               |                                           |       |       |               |



MUGEN COATING PREMIUM Plus High Efficient 3-Flute small-diameter  
Long Neck Ball End Mill for Hardened Steel

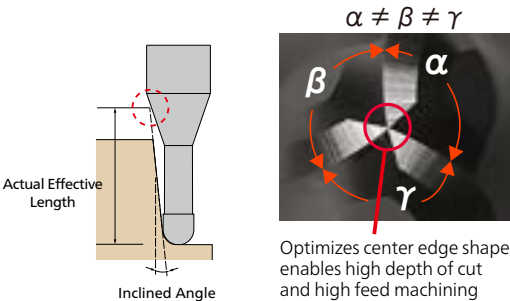
Recommended Milling Conditions

High efficiency 3-flute ball end mill optimizes shape of ball center and enables high depth of cut and high feed machining



- High-efficiency 3-flute ball end mill optimizes a shape of central edge and enables high depth of cutting.
- Even hardened steel of 45 to 70HRC can be machining with long tool life and high efficiency.
- R accuracy is ±0.005mm (R accuracy is based on a half value of actual diameter).
- Shank diameter tolerance, high accuracy type, is - 0.001 ~ - 0.003.

Unequal spacing suppresses chattering even high feed rate machining



Optimizes center edge shape, enables high depth of cut and high feed machining

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|------|-------|------|------|
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°   | 1°30' | 2°   | 3°   |
| 08-00634-01003 | R0.1       | 0.3                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.35                                                             | 0.36 | 0.38  | 0.39 | 0.42 |
| 08-00634-01005 |            | 0.5                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.61  | 0.63 | 0.69 |
| 08-00634-01505 | R0.15      | 0.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.60  | 0.62 | 0.67 |
| 08-00634-01506 |            | 0.6                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.66                                                             | 0.69 | 0.71  | 0.74 | 0.81 |
| 08-00634-01507 |            | 0.75                   | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.82                                                             | 0.85 | 0.88  | 0.92 | 1.01 |
| 08-00634-01510 |            | 1                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.08                                                             | 1.12 | 1.17  | 1.22 | 1.34 |
| 08-00634-02005 | R0.2       | 0.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 0.58                                                             | 0.60 | 0.62  | 0.64 | 0.69 |
| 08-00634-02008 |            | 0.8                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 0.89                                                             | 0.93 | 0.96  | 1.00 | 1.09 |
| 08-00634-02010 |            | 1                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 1.1                                                              | 1.14 | 1.19  | 1.24 | 1.35 |
| 08-00634-02510 | R0.25      | 1                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 1.13                                                             | 1.16 | 1.21  | 1.26 | 1.37 |
| 08-00634-02515 |            | 1.5                    | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 1.65                                                             | 1.71 | 1.78  | 1.85 | 2.03 |
| 08-00634-03010 | R0.3       | 1                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 1.12                                                             | 1.16 | 1.20  | 1.25 | 1.35 |
| 08-00634-03015 |            | 1.5                    | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 1.64                                                             | 1.71 | 1.77  | 1.84 | 2.02 |
| 08-00634-03020 |            | 2                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 2.17                                                             | 2.25 | 2.34  | 2.44 | 2.68 |
| 08-00634-05020 | R0.5       | 2                      | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 2.18                                                             | 2.26 | 2.34  | 2.43 | 2.65 |
| 08-00634-05025 |            | 2.5                    | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 2.7                                                              | 2.80 | 2.91  | 3.03 | 3.31 |
| 08-00634-05030 |            | 3                      | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 3.22                                                             | 3.35 | 3.48  | 3.63 | 3.97 |
| 08-00634-07503 | R0.75      | 3                      | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 3.21                                                             | 3.33 | 3.45  | 3.58 | 3.89 |
| 08-00634-07504 |            | 4                      | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 4.26                                                             | 4.41 | 4.59  | 4.78 | 5.22 |
| 08-00634-10003 | R1         | 3                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 3.23                                                             | 3.33 | 3.44  | 3.56 | 3.85 |
| 08-00634-10004 |            | 4                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 4.27                                                             | 4.42 | 4.58  | 4.76 | 5.17 |
| 08-00634-10006 |            | 6                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 6.36                                                             | 6.60 | 6.86  | 7.15 | 7.83 |

How to Order

When you order, indicate MRBSH330 (R)×(ℓ1). ※ (γ) is reference value.

| Work Material |                   |      | High Speed Steels/Hardened Steels SKH51・SKD11 (～62HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       |        |                   | High Speed Steels SKH55・HAP40 (～66HRC) |       |        |                   | High Speed Steels SKH57・HAP72 (～70HRC) |       |        |                   |
|---------------|-------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|----------------------------------------|-------|--------|-------------------|----------------------------------------|-------|--------|-------------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       | Feed   | Spindle Speed     | Depth of Cut                           |       | Feed   | Spindle Speed     | Depth of Cut                           |       | Feed   | Spindle Speed     |
|               |                   |      | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ae mm | mm/min | min <sup>-1</sup> | ap mm                                  | ae mm | mm/min | min <sup>-1</sup> | ap mm                                  | ae mm | mm/min | min <sup>-1</sup> |
| R0.1          | 0.3               | 1.5  | 0.006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.007 | 450    | 40,000            | 0.004                                  | 0.005 | 300    | 40,000            | 0.004                                  | 0.005 | 220    | 40,000            |
|               | 0.5               | 2.5  | 0.006                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.007 | 400    | 40,000            | 0.004                                  | 0.005 | 250    | 40,000            | 0.004                                  | 0.005 | 190    | 40,000            |
| R0.15         | 0.5               | 1.7  | 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.01  | 450    | 40,000            | 0.005                                  | 0.005 | 400    | 40,000            | 0.005                                  | 0.005 | 300    | 40,000            |
|               | 0.6               | 2    | 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.007 | 450    | 40,000            | 0.005                                  | 0.005 | 350    | 40,000            | 0.005                                  | 0.005 | 270    | 40,000            |
|               | 0.75              | 2.5  | 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.007 | 400    | 40,000            | 0.005                                  | 0.005 | 350    | 40,000            | 0.005                                  | 0.005 | 250    | 40,000            |
|               | 1                 | 3.3  | 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.007 | 350    | 40,000            | 0.005                                  | 0.005 | 300    | 40,000            | 0.005                                  | 0.005 | 220    | 40,000            |
| R0.2          | 0.5               | 1.25 | 0.035                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.04  | 1,100  | 40,000            | 0.013                                  | 0.02  | 850    | 40,000            | 0.013                                  | 0.02  | 650    | 35,000            |
|               | 0.8               | 2    | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 1,000  | 40,000            | 0.012                                  | 0.02  | 850    | 40,000            | 0.012                                  | 0.02  | 600    | 35,000            |
| R0.25         | 1                 | 2.5  | 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.03  | 1,000  | 40,000            | 0.012                                  | 0.02  | 850    | 40,000            | 0.012                                  | 0.02  | 600    | 35,000            |
|               | 1.5               | 3    | 0.015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.03  | 1,000  | 40,000            | 0.01                                   | 0.02  | 800    | 35,000            | 0.01                                   | 0.02  | 500    | 30,000            |
| R0.3          | 1                 | 1.7  | 0.045                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.06  | 1,500  | 40,000            | 0.03                                   | 0.05  | 1,100  | 30,000            | 0.03                                   | 0.05  | 800    | 25,000            |
|               | 1.5               | 2.5  | 0.045                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.06  | 1,500  | 40,000            | 0.03                                   | 0.05  | 1,100  | 30,000            | 0.03                                   | 0.05  | 800    | 25,000            |
| R0.5          | 2                 | 2    | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.2   | 3,000  | 30,000            | 0.12                                   | 0.1   | 2,000  | 25,000            | 0.075                                  | 0.1   | 1,500  | 20,000            |
|               | 2.5               | 2.5  | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.2   | 3,000  | 30,000            | 0.12                                   | 0.1   | 2,000  | 25,000            | 0.075                                  | 0.1   | 1,500  | 20,000            |
| R0.75         | 3                 | 3    | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.2   | 3,000  | 30,000            | 0.12                                   | 0.1   | 2,000  | 25,000            | 0.075                                  | 0.1   | 1,500  | 20,000            |
|               | 3                 | 2    | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.3   | 3,800  | 30,000            | 0.15                                   | 0.2   | 3,000  | 25,000            | 0.09                                   | 0.2   | 2,200  | 20,000            |
|               | 4                 | 2.7  | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.3   | 3,000  | 25,000            | 0.15                                   | 0.2   | 2,400  | 22,000            | 0.09                                   | 0.2   | 1,800  | 18,000            |
| R1            | 3                 | 1.5  | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.5   | 3,800  | 25,000            | 0.22                                   | 0.3   | 3,000  | 20,000            | 0.15                                   | 0.3   | 2,200  | 16,000            |
|               | 4                 | 2    | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.5   | 3,800  | 25,000            | 0.22                                   | 0.3   | 3,000  | 20,000            | 0.15                                   | 0.3   | 2,200  | 16,000            |
|               | 6                 | 3    | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.3   | 3,000  | 22,000            | 0.22                                   | 0.3   | 2,400  | 20,000            | 0.15                                   | 0.3   | 1,800  | 16,000            |
| Notes         |                   |      | ※1 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br>※2 Adjust milling condition according to machine rigidity and clamp condition of work material.<br>※3 In case of chattering etc., please adjust cutting conditions if necessary.<br>※4 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly.<br>※5 If machine tool vibration is high during machining, adjust the feed rate as necessary.<br>※6 Attention to a risk of chipping and breakage when insufficient chip flow.<br>※7 Adjust both spindle speed and feed at the same rate.<br>※8 Overhang of end mill should be as short as possible from spindle nose.<br>※9 We recommend using oil mist coolant. |       |        |                   |                                        |       |        |                   |                                        |       |        |                   |



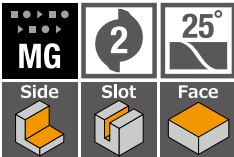
| Model                                                                                                                           | Size        | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Work Material |             |                   |                 |                |        |       |          |                       |                          |        |        |        | Number of Sizes | Page  |
|---------------------------------------------------------------------------------------------------------------------------------|-------------|---------------|---------|-----------------|-------------|--------------|--------------|--------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|----------|-----------------------|--------------------------|--------|--------|--------|-----------------|-------|
|                                                                                                                                 |             |               |         |                 |             |              |              |              | P             | P           | P                 | M               | N              | N      | N     | N        | N                     | S                        | H      |        |        |                 |       |
|                                                                                                                                 |             |               |         |                 |             |              |              |              | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC | 65 HRC | 70 HRC |                 |       |
| Square                                                                                                                          |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH225                                                                                                                          | φ 0.1 ~ φ 6 | 1D            |         |                 | 25°         |              |              |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 25              | F-004 |
| Applicable to stainless steels and titanium alloy. L/D=1. High rigidity with short length of cut. Suitable for slotting process |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH230                                                                                                                          | φ 0.1 ~ φ 6 | 2D            |         |                 | 30°         |              |              |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 36              | F-006 |
| Applicable to stainless steels and titanium alloy. L/D=2. Applicable to both slotting and side milling                          |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH235                                                                                                                          | φ 0.1 ~ φ 6 | 3D            |         |                 | 35°         |              |              |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 36              | F-008 |
| Applicable to stainless steels and titanium alloy. L/D=3. Applicable both slotting and side milling                             |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH240                                                                                                                          | φ 0.3 ~ φ 6 | 4D            |         |                 | 40°         |              | -            |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 14              | F-010 |
| Applicable to stainless steels and titanium alloy. L/D=4                                                                        |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH245                                                                                                                          | φ 0.3 ~ φ 6 | 5D            |         |                 | 45°         |              | -            |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 14              | F-012 |
| Applicable to stainless steels and titanium alloy. L/D=5                                                                        |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH225P                                                                                                                         | φ 0.1 ~ φ 6 | 1D            |         |                 | 25°         |              | -            |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 25              | F-014 |
| Applicable to stainless steels and titanium alloy. L/D=1. Sharp edge type                                                       |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH230P                                                                                                                         | φ 0.1 ~ φ 6 | 2D            |         |                 | 30°         |              | -            |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 36              | F-016 |
| Applicable to stainless steels and titanium alloy. L/D=2. Sharp edge type                                                       |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |
| MXH235P                                                                                                                         | φ 0.1 ~ φ 6 | 3D            |         |                 | 35°         |              | -            |              | -             | -           |                   |                 | -              | -      | -     | -        | -                     |                          |        |        |        | 36              | F-018 |
| Applicable to stainless steels and titanium alloy. L/D=3. Sharp edge type                                                       |             |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |        |        |        |                 |       |

| Model         | Size                                                                                                               | Length of Cut                                     | Coating            | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                |        |       |          |                       |                          |                |        |        | Number of Sizes | Page  |
|---------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------|-----------------|-------------|--------------|--------------|--------------|------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|----------|-----------------------|--------------------------|----------------|--------|--------|-----------------|-------|
|               |                                                                                                                    |                                                   |                    |                 |             |              |              |              |            | P             | P           | P                 | M               | N              | N      | N     | N        | N                     | S                        | H              |        |        |                 |       |
|               |                                                                                                                    |                                                   |                    |                 |             |              |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |        |        |                 |       |
|               |                                                                                                                    |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          | 55 HRC         | 65 HRC | 70 HRC |                 |       |
| Square        |                                                                                                                    |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
| MHDH          | MHDH445                                                                                                            | $\phi 1 \sim \phi 4$                              | 2D                 |                 | 4           | 45°          |              |              |            | -             | -           |                   | -               | -              | -      | -     | -        | -                     | -                        |                |        | -      | 5               | F-020 |
|               | 4-flute with high helix angle. For finishing of prehardened steels and hardened steels ( ~ 65HRC)                  |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
|               | MHDH645                                                                                                            | $\phi 5 \sim \phi 12$                             | 2D<br>3D           |                 | 6           | 45°          |              |              |            | -             | -           |                   | -               | -              | -      | -     | -        | -                     | -                        |                |        | -      | 10              | F-022 |
|               | 6-flute with high helix angle. For finishing of prehardened steels and hardened steels ( ~ 65HRC)                  |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
| Ball          |                                                                                                                    |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
| MSBH          | MSBH230                                                                                                            | R0.05 ~ R6                                        | $\frac{\pi}{1.5D}$ |                 | 2           | 30°          | -            | -            | -          |               | -           |                   |                 | -              | -      | -     | -        | -                     |                          |                |        | -      | 20              | F-024 |
|               | Ball end mill for prehardened steels and hardened steels up to 65HRC. For multi-purpose from roughing to finishing |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
|               | MSBH345                                                                                                            | R0.5 ~ R3                                         | $\frac{\pi}{1.5D}$ |                 | 3           | 45°          | -            | -            | -          |               | -           |                   |                 | -              | -      | -     | -        | -                     |                          |                |        | -      | 26              | F-026 |
|               | 3-flute high helix angle ball end mill for prehardened steels and hardened steels up to 65HRC                      |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
| Corner Radius |                                                                                                                    |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
| MHDH-R        | MHDH445R                                                                                                           | $\phi 3 \times R0.2$<br>$\sim \phi 4 \times R0.5$ | 2D                 |                 | 4           | 45°          |              |              |            | -             | -           |                   | -               | -              | -      | -     | -        | -                     | -                        |                |        | -      | 6               | F-028 |
|               | 4-flute high helix angle corner radius end mill for prehardened steels and hardened steels up to 65HRC             |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |
|               | MHDH645R                                                                                                           | $\phi 5 \times R0.2$<br>$\sim \phi 12 \times R2$  | 2D                 |                 | 6           | 45°          |              |              |            | -             | -           |                   | -               | -              | -      | -     | -        | -                     | -                        |                |        | -      | 21              | F-030 |
|               | 6-flute high helix angle corner radius end mill for prehardened steels and hardened steels up to 65HRC             |                                                   |                    |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |

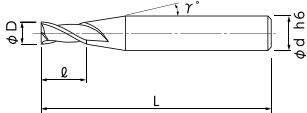
MUGEN COATING PREMIUM 2-Flute LEAD25 End Mill

Recommended Milling Conditions

Applicable to stainless steels and titanium alloy. L/D=1. High rigidity with short length of cut. Suitable for slotting process



$D < 0.5 \quad \phi D_{-0.01}^{+0}$   
 $0.5 \leq D \leq 3 \quad \phi D_{-0.015}^{+0}$   
 $3 < D < 6 \quad \phi D_{-0.02}^{+0}$   
 $D = 6 \quad \phi D_{-0.03}^{+0.01}$



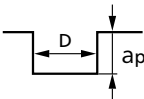
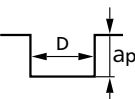
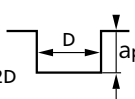
- Applicable for heat resistance alloy such as stainless steels and titanium alloy by MUGEN COATING PREMIUM.
- L/D=1 and helix 25° to increase rigidity and realize high efficient machining.
- Suppress chattering and deflection in slotting process.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| 08-00005-00010 | 0.1         | 0.1                  | 12°                     | 4                 | 45                    |
| 08-00005-00020 | 0.2         | 0.2                  | 12°                     | 4                 | 45                    |
| 08-00005-00030 | 0.3         | 0.3                  | 12°                     | 4                 | 45                    |
| 08-00005-00040 | 0.4         | 0.4                  | 12°                     | 4                 | 45                    |
| 08-00005-00050 | 0.5         | 0.5                  | 12°                     | 4                 | 45                    |
| 08-00005-00060 | 0.6         | 0.6                  | 12°                     | 4                 | 45                    |
| 08-00005-00070 | 0.7         | 0.7                  | 12°                     | 4                 | 45                    |
| 08-00005-00080 | 0.8         | 0.8                  | 12°                     | 4                 | 45                    |
| 08-00005-00090 | 0.9         | 0.9                  | 12°                     | 4                 | 45                    |
| 08-00005-00100 | 1           | 1                    | 12°                     | 4                 | 45                    |
| 08-00005-00110 | 1.1         | 1.1                  | 12°                     | 4                 | 45                    |
| 08-00005-00120 | 1.2         | 1.2                  | 12°                     | 4                 | 45                    |
| 08-00005-00130 | 1.3         | 1.3                  | 12°                     | 4                 | 45                    |
| 08-00005-00140 | 1.4         | 1.4                  | 12°                     | 4                 | 45                    |
| 08-00005-00150 | 1.5         | 1.5                  | 12°                     | 4                 | 45                    |
| 08-00005-00160 | 1.6         | 1.6                  | 12°                     | 4                 | 45                    |
| 08-00005-00170 | 1.7         | 1.7                  | 12°                     | 4                 | 45                    |
| 08-00005-00180 | 1.8         | 1.8                  | 12°                     | 4                 | 45                    |
| 08-00005-00190 | 1.9         | 1.9                  | 12°                     | 4                 | 45                    |
| 08-00005-00200 | 2           | 2                    | 12°                     | 4                 | 45                    |
| 08-00005-00250 | 2.5         | 2.5                  | 12°                     | 4                 | 45                    |
| 08-00005-00300 | 3           | 3                    | 12°                     | 6                 | 45                    |
| 08-00005-00400 | 4           | 4                    | 12°                     | 6                 | 45                    |
| 08-00005-00500 | 5           | 5                    | 12°                     | 6                 | 50                    |
| 08-00005-00600 | 6           | 6                    | —                       | 6                 | 50                    |

How to Order

When you order, indicate MXH225 (D). ※( γ ) is reference value.

| Work Material | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |          | Titanium Alloy<br>Ti-6Al-4V |                 |          | Heat Resistance Alloy<br>Inconel® 718                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |          | Hardened Steels<br>SKD61 (∼52HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |          |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|
| Dia.          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Feed            |          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Feed            |          |
|               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | mm/min          |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | mm/min          |          |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Side<br>Milling | Slotting |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Side<br>Milling | Slotting |
| 0.1           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30              | 15       | 48,000                      | 30              | 15       | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10              | 10       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | —               | 15       |
| 0.2           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 50              | 25       | 48,000                      | 50              | 25       | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 15              | 10       | 47,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | —               | 20       |
| 0.3           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 90              | 35       | 48,000                      | 90              | 35       | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 30              | 15       | 31,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | —               | 20       |
| 0.4           | 47,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 130             | 50       | 45,000                      | 130             | 50       | 23,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 40              | 20       | 23,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 50              | 25       |
| 0.5           | 38,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 130             | 50       | 37,000                      | 130             | 50       | 19,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 40              | 20       | 19,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 60              | 30       |
| 0.6           | 34,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 130             | 50       | 33,000                      | 130             | 50       | 17,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 40              | 20       | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 60              | 30       |
| 0.7           | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 130             | 50       | 29,000                      | 130             | 50       | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 40              | 20       | 13,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 60              | 30       |
| 0.8           | 26,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 140             | 50       | 25,000                      | 140             | 50       | 13,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 45              | 20       | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 60              | 30       |
| 0.9           | 22,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 140             | 55       | 21,000                      | 140             | 55       | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 45              | 25       | 10,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 60              | 30       |
| 1             | 19,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 18,000                      | 150             | 55       | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.1           | 17,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 16,000                      | 150             | 55       | 8,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 8,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.2           | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 15,000                      | 150             | 55       | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.3           | 14,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 13,500                      | 150             | 55       | 7,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 7,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.4           | 13,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 12,500                      | 150             | 55       | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 6,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.5           | 12,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 12,000                      | 150             | 55       | 6,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.6           | 11,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 150             | 55       | 11,500                      | 150             | 55       | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.7           | 11,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 160             | 55       | 10,900                      | 160             | 55       | 5,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 5,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.8           | 10,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 160             | 55       | 10,300                      | 160             | 55       | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 50              | 25       | 5,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 1.9           | 10,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 170             | 60       | 9,700                       | 170             | 60       | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 55              | 30       | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 2             | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 170             | 60       | 9,100                       | 170             | 60       | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 55              | 30       | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 2.5           | 7,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 180             | 65       | 7,200                       | 180             | 65       | 3,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 60              | 30       | 3,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       |
| 3             | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 190             | 70       | 6,000                       | 190             | 70       | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 65              | 35       | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 80              | 40       |
| 4             | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 190             | 70       | 4,400                       | 190             | 70       | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 65              | 35       | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 95              | 50       |
| 5             | 3,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 230             | 75       | 3,400                       | 230             | 75       | 1,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 75              | 40       | 1,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 95              | 50       |
| 6             | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 260             | 85       | 2,800                       | 260             | 85       | 1,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 80              | 40       | 1,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100             | 50       |
| Depth of Cut  | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 0.1 \sim 0.9 = 0.05D</math><br/><math>\phi 1 \sim 2.5 = 0.1D</math><br/><math>\phi 3 \sim 6 = 0.2D</math></div> <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 0.1 \sim 0.4 = 0.05D</math><br/><math>\phi 0.5 \sim 1.4 = 0.2D</math><br/><math>\phi 1.5 \sim 3 = 0.7D</math><br/><math>\phi 4 \sim 6 = 1D</math></div> |                 |          |                             |                 |          | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 0.1 \sim 0.9 = 0.01D</math><br/><math>\phi 1 \sim 2.5 = 0.02D</math><br/><math>\phi 3 \sim 6 = 0.04D</math></div> <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 0.1 \sim 0.4 = 0.01D</math><br/><math>\phi 0.5 \sim 1.4 = 0.1D</math><br/><math>\phi 1.5 \sim 3 = 0.3D</math><br/><math>\phi 4 \sim 6 = 0.5D</math></div> |                 |          | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 0.1 \sim 0.9 = 0.01D</math><br/><math>\phi 1 \sim 2.5 = 0.02D</math><br/><math>\phi 3 \sim 6 = 0.04D</math></div> <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 0.1 \sim 0.4 = 0.05D</math><br/><math>\phi 0.5 \sim 6 = 0.2D</math></div> |                 |          |
|               | (D: Dia.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |          |                             |                 |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |          |
| Notes         | ※1 Adjust milling condition conforming to machine rigidity and clamping condition.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Use rigid and precise machine and chuck holder.<br>※4 Adjust milling condition with caution for chip evacuation and smoke generation when milling with water-insoluble fluid.                                                                                                                                                                                                                                                                          |                 |          |                             |                 |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |          |

P Prehardened Steel

M Stainless Steel

S Titanium Alloy Heat Resistant Alloy

H Hardened Steel

F-007



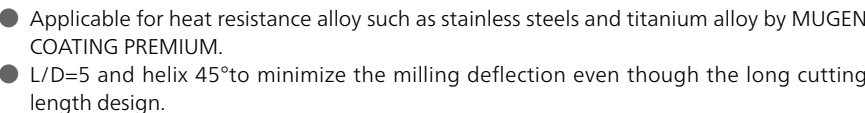






## MXH245

## Recommended Milling Conditions

Unit : mm

**How to Order** When you order, indicate MXH245 (D). ※( $\gamma$ ) is reference value.

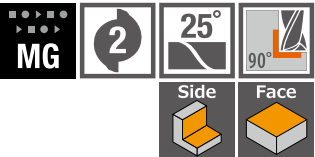


**Square**  
**Coating**

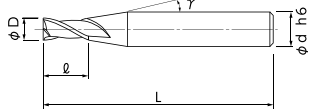
MUGEN COATING PREMIUM 2-Flute Sharp Edge LEAD25 End Mill

Recommended Milling Conditions

Applicable to stainless steels and titanium alloy. L/D=1. Sharp edge type



$D < 0.5 \quad \phi D_{-0.01}^{+0}$   
 $0.5 \leq D \leq 3 \quad \phi D_{-0.015}^{+0}$   
 $3 < D < 6 \quad \phi D_{-0.02}^{+0}$   
 $D = 6 \quad \phi D_{-0.03}^{+0.01}$



- Applicable for heat resistance alloy such as stainless steels and titanium alloy by MUGEN COATING PREMIUM with sharp edge type.
- L/D=1 and helix 25°.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00015-00010 | 0.1         | 0.1                  | 12°                              | 4                 | 45                    |
| 08-00015-00020 | 0.2         | 0.2                  | 12°                              | 4                 | 45                    |
| 08-00015-00030 | 0.3         | 0.3                  | 12°                              | 4                 | 45                    |
| 08-00015-00040 | 0.4         | 0.4                  | 12°                              | 4                 | 45                    |
| 08-00015-00050 | 0.5         | 0.5                  | 12°                              | 4                 | 45                    |
| 08-00015-00060 | 0.6         | 0.6                  | 12°                              | 4                 | 45                    |
| 08-00015-00070 | 0.7         | 0.7                  | 12°                              | 4                 | 45                    |
| 08-00015-00080 | 0.8         | 0.8                  | 12°                              | 4                 | 45                    |
| 08-00015-00090 | 0.9         | 0.9                  | 12°                              | 4                 | 45                    |
| 08-00015-00100 | 1           | 1                    | 12°                              | 4                 | 45                    |
| 08-00015-00110 | 1.1         | 1.1                  | 12°                              | 4                 | 45                    |
| 08-00015-00120 | 1.2         | 1.2                  | 12°                              | 4                 | 45                    |
| 08-00015-00130 | 1.3         | 1.3                  | 12°                              | 4                 | 45                    |
| 08-00015-00140 | 1.4         | 1.4                  | 12°                              | 4                 | 45                    |
| 08-00015-00150 | 1.5         | 1.5                  | 12°                              | 4                 | 45                    |
| 08-00015-00160 | 1.6         | 1.6                  | 12°                              | 4                 | 45                    |
| 08-00015-00170 | 1.7         | 1.7                  | 12°                              | 4                 | 45                    |
| 08-00015-00180 | 1.8         | 1.8                  | 12°                              | 4                 | 45                    |
| 08-00015-00190 | 1.9         | 1.9                  | 12°                              | 4                 | 45                    |
| 08-00015-00200 | 2           | 2                    | 12°                              | 4                 | 45                    |
| 08-00015-00250 | 2.5         | 2.5                  | 12°                              | 4                 | 45                    |
| 08-00015-00300 | 3           | 3                    | 12°                              | 6                 | 45                    |
| 08-00015-00400 | 4           | 4                    | 12°                              | 6                 | 45                    |
| 08-00015-00500 | 5           | 5                    | 12°                              | 6                 | 50                    |
| 08-00015-00600 | 6           | 6                    | —                                | 6                 | 50                    |

How to Order

When you order, indicate MXH225P (D). ※( $\gamma$ ) is reference value.

| Work Material                 | Stainless Steels<br>SUS304                                                                                                                                                                                                                                          |        | Titanium Alloy<br>Ti-6Al-4V |        | Heat Resistance Alloy<br>Inconel®718                                                                                                                                                                                                                                  |        |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Dia.                          | Side Milling                                                                                                                                                                                                                                                        |        | Side Milling                |        | Side Milling                                                                                                                                                                                                                                                          |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                       | Feed   | Spindle Speed               | Feed   | Spindle Speed                                                                                                                                                                                                                                                         | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                   | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>                                                                                                                                                                                                                                                     | mm/min |
| 0.1                           | 50,000                                                                                                                                                                                                                                                              | 30     | 48,000                      | 30     | 25,000                                                                                                                                                                                                                                                                | 10     |
| 0.2                           | 50,000                                                                                                                                                                                                                                                              | 50     | 48,000                      | 50     | 25,000                                                                                                                                                                                                                                                                | 15     |
| 0.3                           | 50,000                                                                                                                                                                                                                                                              | 90     | 48,000                      | 90     | 25,000                                                                                                                                                                                                                                                                | 30     |
| 0.4                           | 47,700                                                                                                                                                                                                                                                              | 130    | 45,000                      | 130    | 23,000                                                                                                                                                                                                                                                                | 40     |
| 0.5                           | 38,200                                                                                                                                                                                                                                                              | 130    | 37,000                      | 130    | 19,000                                                                                                                                                                                                                                                                | 40     |
| 0.6                           | 34,000                                                                                                                                                                                                                                                              | 130    | 33,000                      | 130    | 17,000                                                                                                                                                                                                                                                                | 40     |
| 0.7                           | 30,000                                                                                                                                                                                                                                                              | 130    | 29,000                      | 130    | 15,000                                                                                                                                                                                                                                                                | 40     |
| 0.8                           | 26,000                                                                                                                                                                                                                                                              | 140    | 25,000                      | 140    | 13,000                                                                                                                                                                                                                                                                | 45     |
| 0.9                           | 22,000                                                                                                                                                                                                                                                              | 140    | 21,000                      | 140    | 11,000                                                                                                                                                                                                                                                                | 45     |
| 1                             | 19,100                                                                                                                                                                                                                                                              | 150    | 18,000                      | 150    | 9,500                                                                                                                                                                                                                                                                 | 50     |
| 1.1                           | 17,500                                                                                                                                                                                                                                                              | 150    | 16,000                      | 150    | 8,500                                                                                                                                                                                                                                                                 | 50     |
| 1.2                           | 16,000                                                                                                                                                                                                                                                              | 150    | 15,000                      | 150    | 8,000                                                                                                                                                                                                                                                                 | 50     |
| 1.3                           | 14,500                                                                                                                                                                                                                                                              | 150    | 13,500                      | 150    | 7,200                                                                                                                                                                                                                                                                 | 50     |
| 1.4                           | 13,000                                                                                                                                                                                                                                                              | 150    | 12,500                      | 150    | 6,500                                                                                                                                                                                                                                                                 | 50     |
| 1.5                           | 12,700                                                                                                                                                                                                                                                              | 150    | 12,000                      | 150    | 6,200                                                                                                                                                                                                                                                                 | 50     |
| 1.6                           | 11,900                                                                                                                                                                                                                                                              | 150    | 11,500                      | 150    | 6,000                                                                                                                                                                                                                                                                 | 50     |
| 1.7                           | 11,300                                                                                                                                                                                                                                                              | 160    | 10,900                      | 160    | 5,500                                                                                                                                                                                                                                                                 | 50     |
| 1.8                           | 10,700                                                                                                                                                                                                                                                              | 160    | 10,300                      | 160    | 5,200                                                                                                                                                                                                                                                                 | 50     |
| 1.9                           | 10,100                                                                                                                                                                                                                                                              | 170    | 9,700                       | 170    | 5,000                                                                                                                                                                                                                                                                 | 55     |
| 2                             | 9,500                                                                                                                                                                                                                                                               | 170    | 9,100                       | 170    | 4,800                                                                                                                                                                                                                                                                 | 55     |
| 2.5                           | 7,600                                                                                                                                                                                                                                                               | 180    | 7,200                       | 180    | 3,800                                                                                                                                                                                                                                                                 | 60     |
| 3                             | 6,400                                                                                                                                                                                                                                                               | 190    | 6,000                       | 190    | 3,200                                                                                                                                                                                                                                                                 | 65     |
| 4                             | 4,800                                                                                                                                                                                                                                                               | 190    | 4,400                       | 190    | 2,400                                                                                                                                                                                                                                                                 | 65     |
| 5                             | 3,800                                                                                                                                                                                                                                                               | 230    | 3,400                       | 230    | 1,900                                                                                                                                                                                                                                                                 | 75     |
| 6                             | 3,200                                                                                                                                                                                                                                                               | 260    | 2,800                       | 260    | 1,600                                                                                                                                                                                                                                                                 | 80     |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 0.1\sim 0.9=0.05D</math><br/><math>\phi 1\sim 2.5=0.1D</math><br/><math>\phi 3\sim 6=0.2D</math></div> |        |                             |        | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 0.1\sim 0.9=0.01D</math><br/><math>\phi 1\sim 2.5=0.02D</math><br/><math>\phi 3\sim 6=0.04D</math></div> |        |
| Notes                         | ※1 Adjust milling condition conforming to machine rigidity and clamping condition.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Use a rigid and precise machine and chuck holder.                                                                            |        |                             |        |                                                                                                                                                                                                                                                                       |        |



Coating  
Square

Regular Line  
MUGEN PREMIUM  
Full Cutting Length Type

## Recommended Milling Conditions

- Unit : mm

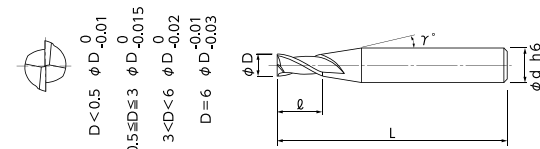
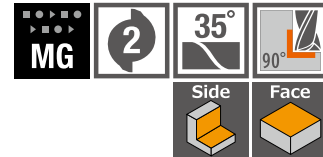
| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (r) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00016-00280 | 2.8      | 5.6               | 12°                  | 4              | 45                 |
| 08-00016-00290 | 2.9      | 5.8               | 12°                  | 4              | 45                 |
| 08-00016-00300 | 3        | 6                 | 12°                  | 6              | 45                 |
| 08-00016-00350 | 3.5      | 7                 | 12°                  | 6              | 45                 |
| 08-00016-00400 | 4        | 8                 | 12°                  | 6              | 45                 |
| 08-00016-00450 | 4.5      | 9                 | 12°                  | 6              | 50                 |
| 08-00016-00500 | 5        | 10                | 12°                  | 6              | 50                 |
| 08-00016-00550 | 5.5      | 11                | 12°                  | 6              | 50                 |
| 08-00016-00600 | 6        | 12                | —                    | 6              | 50                 |

When you order, indicate MXH230P (D). ※(γ) is reference value.



Square

Applicable to stainless steels and titanium alloy. L/D=3. Sharp edge type



- Applicable for heat resistance alloy such as stainless steels and titanium alloy by MUGEN COATING PREMIUM with sharp edge type.
- L/D=3 and helix 35°.

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00017-00010 | 0.1      | 0.3               | 12°                  | 4              | 45                 |
| 08-00017-00020 | 0.2      | 0.6               | 12°                  | 4              | 45                 |
| 08-00017-00030 | 0.3      | 0.9               | 12°                  | 4              | 45                 |
| 08-00017-00040 | 0.4      | 1.2               | 12°                  | 4              | 45                 |
| 08-00017-00050 | 0.5      | 1.5               | 12°                  | 4              | 45                 |
| 08-00017-00060 | 0.6      | 1.8               | 12°                  | 4              | 45                 |
| 08-00017-00070 | 0.7      | 2.1               | 12°                  | 4              | 45                 |
| 08-00017-00080 | 0.8      | 2.4               | 12°                  | 4              | 45                 |
| 08-00017-00090 | 0.9      | 2.7               | 12°                  | 4              | 45                 |
| 08-00017-00100 | 1        | 3                 | 12°                  | 4              | 45                 |
| 08-00017-00110 | 1.1      | 3.3               | 12°                  | 4              | 45                 |
| 08-00017-00120 | 1.2      | 3.6               | 12°                  | 4              | 45                 |
| 08-00017-00130 | 1.3      | 3.9               | 12°                  | 4              | 45                 |
| 08-00017-00140 | 1.4      | 4.2               | 12°                  | 4              | 45                 |
| 08-00017-00150 | 1.5      | 4.5               | 12°                  | 4              | 45                 |
| 08-00017-00160 | 1.6      | 4.8               | 12°                  | 4              | 45                 |
| 08-00017-00170 | 1.7      | 5.1               | 12°                  | 4              | 45                 |
| 08-00017-00180 | 1.8      | 5.4               | 12°                  | 4              | 45                 |
| 08-00017-00190 | 1.9      | 5.7               | 12°                  | 4              | 45                 |
| 08-00017-00200 | 2        | 6                 | 12°                  | 4              | 45                 |
| 08-00017-00210 | 2.1      | 6.3               | 12°                  | 4              | 45                 |
| 08-00017-00220 | 2.2      | 6.6               | 12°                  | 4              | 45                 |
| 08-00017-00230 | 2.3      | 6.9               | 12°                  | 4              | 45                 |
| 08-00017-00240 | 2.4      | 7.2               | 12°                  | 4              | 45                 |
| 08-00017-00250 | 2.5      | 7.5               | 12°                  | 4              | 45                 |
| 08-00017-00260 | 2.6      | 7.8               | 12°                  | 4              | 45                 |
| 08-00017-00270 | 2.7      | 8.1               | 12°                  | 4              | 45                 |

|                |          |                   |                               |                | Unit : mm          |
|----------------|----------|-------------------|-------------------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle ( $\gamma$ ) | Shank Dia. (d) | Overall Length (L) |
| 08-00017-00280 | 2.8      | 8.4               | 12°                           | 4              | 45                 |
| 08-00017-00290 | 2.9      | 8.7               | 12°                           | 4              | 45                 |
| 08-00017-00300 | 3        | 9                 | 12°                           | 6              | 45                 |
| 08-00017-00350 | 3.5      | 10.5              | 12°                           | 6              | 45                 |
| 08-00017-00400 | 4        | 12                | 12°                           | 6              | 50                 |
| 08-00017-00450 | 4.5      | 13.5              | 12°                           | 6              | 50                 |
| 08-00017-00500 | 5        | 15                | 12°                           | 6              | 55                 |
| 08-00017-00550 | 5.5      | 16.5              | 12°                           | 6              | 60                 |
| 08-00017-00600 | 6        | 18                | —                             | 6              | 60                 |

Unit : mm

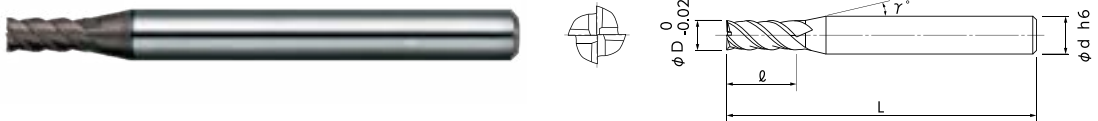
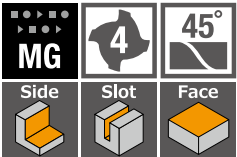
| Work Material                 | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                     |        | Titanium Alloy<br>Ti-6Al-4V |        | Heat Resistance Alloy<br>Inconel®718                                                                                                                                                                                                                                            |        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                   |        | Side Milling                |        | Side Milling                                                                                                                                                                                                                                                                    |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                                  | Feed   | Spindle Speed               | Feed   | Spindle Speed                                                                                                                                                                                                                                                                   | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                              | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>                                                                                                                                                                                                                                                               | mm/min |
| 0.1                           | 50,000                                                                                                                                                                                                                                                                         | 30     | 40,000                      | 30     | 25,000                                                                                                                                                                                                                                                                          | 10     |
| 0.2                           | 50,000                                                                                                                                                                                                                                                                         | 50     | 40,000                      | 50     | 25,000                                                                                                                                                                                                                                                                          | 15     |
| 0.3                           | 50,000                                                                                                                                                                                                                                                                         | 90     | 40,000                      | 90     | 25,000                                                                                                                                                                                                                                                                          | 30     |
| 0.4                           | 43,800                                                                                                                                                                                                                                                                         | 120    | 35,000                      | 120    | 22,000                                                                                                                                                                                                                                                                          | 40     |
| 0.5                           | 35,000                                                                                                                                                                                                                                                                         | 120    | 28,000                      | 120    | 17,000                                                                                                                                                                                                                                                                          | 40     |
| 0.6                           | 31,500                                                                                                                                                                                                                                                                         | 120    | 25,000                      | 120    | 15,000                                                                                                                                                                                                                                                                          | 40     |
| 0.7                           | 28,000                                                                                                                                                                                                                                                                         | 120    | 22,500                      | 120    | 14,000                                                                                                                                                                                                                                                                          | 40     |
| 0.8                           | 24,500                                                                                                                                                                                                                                                                         | 130    | 19,600                      | 130    | 12,000                                                                                                                                                                                                                                                                          | 45     |
| 0.9                           | 21,000                                                                                                                                                                                                                                                                         | 130    | 17,000                      | 130    | 10,500                                                                                                                                                                                                                                                                          | 45     |
| 1                             | 17,500                                                                                                                                                                                                                                                                         | 140    | 14,000                      | 140    | 8,700                                                                                                                                                                                                                                                                           | 45     |
| 1.1                           | 16,400                                                                                                                                                                                                                                                                         | 140    | 13,000                      | 140    | 8,200                                                                                                                                                                                                                                                                           | 45     |
| 1.2                           | 15,300                                                                                                                                                                                                                                                                         | 140    | 12,000                      | 140    | 7,500                                                                                                                                                                                                                                                                           | 45     |
| 1.3                           | 14,100                                                                                                                                                                                                                                                                         | 140    | 11,000                      | 140    | 7,000                                                                                                                                                                                                                                                                           | 45     |
| 1.4                           | 12,900                                                                                                                                                                                                                                                                         | 140    | 10,000                      | 140    | 6,400                                                                                                                                                                                                                                                                           | 45     |
| 1.5                           | 11,700                                                                                                                                                                                                                                                                         | 140    | 9,400                       | 140    | 5,800                                                                                                                                                                                                                                                                           | 45     |
| 1.6                           | 11,200                                                                                                                                                                                                                                                                         | 140    | 8,900                       | 140    | 5,500                                                                                                                                                                                                                                                                           | 45     |
| 1.7                           | 10,600                                                                                                                                                                                                                                                                         | 140    | 8,500                       | 140    | 5,300                                                                                                                                                                                                                                                                           | 45     |
| 1.8                           | 10,000                                                                                                                                                                                                                                                                         | 150    | 8,000                       | 150    | 5,000                                                                                                                                                                                                                                                                           | 50     |
| 1.9                           | 9,400                                                                                                                                                                                                                                                                          | 160    | 7,500                       | 160    | 4,700                                                                                                                                                                                                                                                                           | 50     |
| 2                             | 8,800                                                                                                                                                                                                                                                                          | 160    | 7,000                       | 160    | 4,400                                                                                                                                                                                                                                                                           | 50     |
| 2.1                           | 8,500                                                                                                                                                                                                                                                                          | 160    | 6,800                       | 160    | 4,200                                                                                                                                                                                                                                                                           | 50     |
| 2.2                           | 8,100                                                                                                                                                                                                                                                                          | 160    | 6,500                       | 160    | 4,000                                                                                                                                                                                                                                                                           | 50     |
| 2.3                           | 7,800                                                                                                                                                                                                                                                                          | 160    | 6,200                       | 160    | 3,900                                                                                                                                                                                                                                                                           | 50     |
| 2.4                           | 7,400                                                                                                                                                                                                                                                                          | 160    | 5,900                       | 160    | 3,700                                                                                                                                                                                                                                                                           | 50     |
| 2.5                           | 7,000                                                                                                                                                                                                                                                                          | 170    | 5,600                       | 170    | 3,500                                                                                                                                                                                                                                                                           | 55     |
| 2.6                           | 6,700                                                                                                                                                                                                                                                                          | 170    | 5,400                       | 170    | 3,300                                                                                                                                                                                                                                                                           | 55     |
| 2.7                           | 6,400                                                                                                                                                                                                                                                                          | 170    | 5,100                       | 170    | 3,200                                                                                                                                                                                                                                                                           | 55     |
| 2.8                           | 6,200                                                                                                                                                                                                                                                                          | 170    | 4,900                       | 170    | 3,100                                                                                                                                                                                                                                                                           | 55     |
| 2.9                           | 6,000                                                                                                                                                                                                                                                                          | 170    | 4,800                       | 170    | 3,000                                                                                                                                                                                                                                                                           | 55     |
| 3                             | 5,800                                                                                                                                                                                                                                                                          | 170    | 4,600                       | 170    | 2,900                                                                                                                                                                                                                                                                           | 55     |
| 3.5                           | 5,000                                                                                                                                                                                                                                                                          | 180    | 4,000                       | 180    | 2,500                                                                                                                                                                                                                                                                           | 60     |
| 4                             | 4,400                                                                                                                                                                                                                                                                          | 180    | 3,500                       | 180    | 2,200                                                                                                                                                                                                                                                                           | 60     |
| 4.5                           | 3,900                                                                                                                                                                                                                                                                          | 200    | 3,100                       | 200    | 1,900                                                                                                                                                                                                                                                                           | 65     |
| 5                             | 3,500                                                                                                                                                                                                                                                                          | 210    | 2,800                       | 210    | 1,700                                                                                                                                                                                                                                                                           | 70     |
| 5.5                           | 3,200                                                                                                                                                                                                                                                                          | 220    | 2,500                       | 220    | 1,600                                                                                                                                                                                                                                                                           | 75     |
| 6                             | 2,900                                                                                                                                                                                                                                                                          | 230    | 2,300                       | 230    | 1,400                                                                                                                                                                                                                                                                           | 75     |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 0.1 \sim 0.9 = 0.04D</math><br/><math>\phi 1 \sim 2.9 = 0.05D</math><br/><math>\phi 3 \sim 6 = 0.1D</math></div> |        |                             |        | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 0.1 \sim 0.9 = 0.01D</math><br/><math>\phi 1 \sim 2.9 = 0.02D</math><br/><math>\phi 3 \sim 6 = 0.05D</math></div> |        |
| Notes                         | ※1 Adjust milling condition conforming to machine rigidity and clamping condition.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Use a rigid and precise machine and chuck holder.                                                                                       |        |                             |        |                                                                                                                                                                                                                                                                                 |        |



MUGEN COATING PREMIUM 4-Flute Square End Mill For Hardened Steel

Recommended Milling Conditions

4-flute with high helix angle. For finishing of prehardened steels and hardened steels (  $\sim 65\text{HRC}$  )



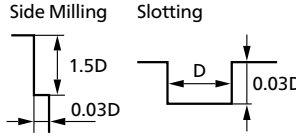
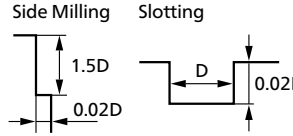
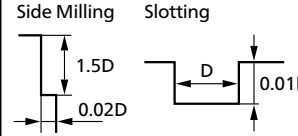
- Realized stably long tool life against high hardened steels (48 $\sim$ 65HRC).
- Improved milling deflection and accuracy by advanced flute design.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00427-00100 | 1           | 2                    | 12°                              | 6                 | 60                    |
| 08-00427-00150 | 1.5         | 3                    | 12°                              | 6                 | 60                    |
| 08-00427-00200 | 2           | 4                    | 12°                              | 6                 | 60                    |
| 08-00427-00300 | 3           | 6                    | 12°                              | 6                 | 60                    |
| 08-00427-00400 | 4           | 8                    | 12°                              | 6                 | 60                    |

How to Order

When you order, indicate MHDH445 (D). ※ ( $\gamma$ ) is reference value.

| Work Material             |                  | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(～55HRC)                                                                                                                                                                                                           |        |                   |        | Hardened Steels<br>SKD11<br>(～62HRC)                                                |        |                   |        | High Speed Steels<br>SKH<br>(～65HRC)                                                |        |                   |        |
|---------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------------------------------------------------------------------------|--------|-------------------|--------|
| Dia.                      | Length<br>of Cut | Side Milling                                                                                                                                                                                                                                                |        | Slotting          |        | Side Milling                                                                        |        | Slotting          |        | Side Milling                                                                        |        | Slotting          |        |
|                           |                  | Spindle<br>Speed                                                                                                                                                                                                                                            | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed                                                                    | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed                                                                    | Feed   | Spindle<br>Speed  | Feed   |
|                           |                  | min <sup>-1</sup>                                                                                                                                                                                                                                           | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                   | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                   | mm/min | min <sup>-1</sup> | mm/min |
| 1                         | 2                | 30,000                                                                                                                                                                                                                                                      | 800    | 24,000            | 400    | 25,000                                                                              | 500    | 20,000            | 300    | 20,000                                                                              | 240    | 16,000            | 120    |
| 1.5                       | 3                | 20,000                                                                                                                                                                                                                                                      | 860    | 16,000            | 460    | 16,000                                                                              | 560    | 12,000            | 380    | 14,000                                                                              | 330    | 10,000            | 160    |
| 2                         | 4                | 15,000                                                                                                                                                                                                                                                      | 920    | 12,000            | 500    | 12,000                                                                              | 630    | 10,000            | 420    | 10,000                                                                              | 480    | 8,000             | 240    |
| 3                         | 6                | 10,000                                                                                                                                                                                                                                                      | 1,000  | 8,000             | 580    | 8,000                                                                               | 700    | 7,500             | 500    | 7,000                                                                               | 560    | 6,000             | 280    |
| 4                         | 8                | 8,500                                                                                                                                                                                                                                                       | 1,200  | 7,500             | 620    | 7,000                                                                               | 800    | 6,000             | 540    | 6,000                                                                               | 600    | 5,000             | 300    |
| Depth of Cut<br>(D: Dia.) |                  |                                                                                                                                                                          |        |                   |        |  |        |                   |        |  |        |                   |        |
| Notes                     |                  | ※1 Use a rigid and precise machine and chuck holder.<br>※2 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Use oilmist coolant or air blow. |        |                   |        |                                                                                     |        |                   |        |                                                                                     |        |                   |        |



Unit : mm

**How to Order** When you order, indicate MHDH645 (D)×(ℓ). ※(γ) is reference value.

**H** Hardened Steel

~ 55 HRC

~ 65 HRC

**Square**

**Coating**

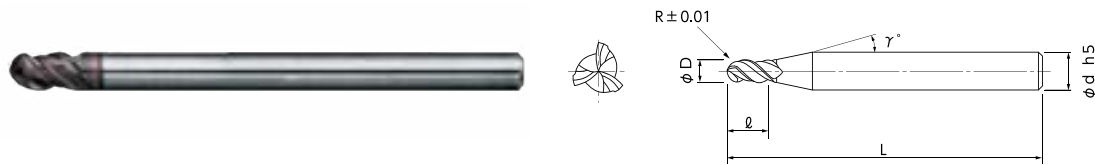




MUGEN COATING PREMIUM 3-Flute Ball End Mill for Hardened Steel

Recommended Milling Conditions

3-flute high helix angle ball end mill  
for prehardened steels and hardened steels up to 65HRC



- MUGEN COATING PREMIUM realizes long tool life for machining on high-hardened steel.
- Original 3-flute design and unequal flute spacing to suppress chattering realize high efficient machining.
-  : Semi-standard item, please inquire for price and delivery.

Unit : mm

| Code No.                                                                                           | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------------------------------------------------------------------------------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 08-00607-00050                                                                                     | R0.5       | 1.5               | 1        | 12°                  | 6              | 60                 |
|  08-00607-00060   | R0.6       | 2                 | 1.2      | 12°                  | 6              | 60                 |
|  08-00607-00070   | R0.7       | 3                 | 1.4      | 12°                  | 6              | 60                 |
|  08-00607-00080   | R0.8       | 3                 | 1.6      | 12°                  | 6              | 60                 |
|  08-00607-00090   | R0.9       | 3                 | 1.8      | 12°                  | 6              | 60                 |
| 08-00607-00100                                                                                     | R1         | 3                 | 2        | 12°                  | 6              | 60                 |
|  08-00607-00110   | R1.1       | 3.5               | 2.2      | 12°                  | 6              | 60                 |
|  08-00607-00120  | R1.2       | 4                 | 2.4      | 12°                  | 6              | 60                 |
|  08-00607-00130 | R1.3       | 4                 | 2.6      | 12°                  | 6              | 60                 |
|  08-00607-00140 | R1.4       | 5                 | 2.8      | 12°                  | 6              | 60                 |
| 08-00607-00150                                                                                     | R1.5       | 5                 | 3        | 12°                  | 6              | 60                 |
|  08-00607-00160 | R1.6       | 5                 | 3.2      | 12°                  | 6              | 60                 |
|  08-00607-00170 | R1.7       | 6                 | 3.4      | 12°                  | 6              | 60                 |
|  08-00607-00180 | R1.8       | 6                 | 3.6      | 12°                  | 6              | 60                 |
|  08-00607-00190 | R1.9       | 6                 | 3.8      | 12°                  | 6              | 60                 |
| 08-00607-00200                                                                                     | R2         | 6                 | 4        | 12°                  | 6              | 70                 |
|  08-00607-00210 | R2.1       | 7                 | 4.2      | 12°                  | 6              | 70                 |
|  08-00607-00220 | R2.2       | 7                 | 4.4      | 12°                  | 6              | 70                 |
|  08-00607-00230 | R2.3       | 7                 | 4.6      | 12°                  | 6              | 70                 |
|  08-00607-00240 | R2.4       | 8                 | 4.8      | 12°                  | 6              | 70                 |
| 08-00607-00250                                                                                     | R2.5       | 8                 | 5        | 12°                  | 6              | 70                 |
|  08-00607-00260 | R2.6       | 8                 | 5.2      | 12°                  | 6              | 70                 |
|  08-00607-00270 | R2.7       | 9                 | 5.4      | 12°                  | 6              | 70                 |
|  08-00607-00280 | R2.8       | 9                 | 5.6      | 12°                  | 6              | 70                 |
|  08-00607-00290 | R2.9       | 9                 | 5.8      | 12°                  | 6              | 70                 |
| 08-00607-00300                                                                                     | R3         | 10                | 6        | —                    | 6              | 80                 |

How to Order

When you order, indicate MSBH345 (R). ※ (γ) is reference value.

Machining Case 1

Binding sample



- Work material : DC53 60HRC
- Total machining time : 15hr 16min
- Coolant : Oil mist
- Work Size : 100 x 100mm (cutting depth 50mm)

| Process                                        | Roughing   | Semi-finishing | Finishing  | Stock removal |
|------------------------------------------------|------------|----------------|------------|---------------|
| Tool                                           | MSBH345 R3 | MSBH345 R3     | MSBH345 R3 | MSBH345 R2    |
| Spindle speed [min <sup>-1</sup> ]             | 7,200      |                |            | 12,000        |
| Feed [mm/min]                                  | 3,000      | 3,000          | 2,200      | 2,200         |
| Depth of cut $\bar{a}_p \times \bar{a}_e$ [mm] | 0.3×1.5    | 0.3×0.5        | 0.1×0.1    | 0.1×0.1       |
| Machining time                                 | 6hr 40min  | 49min          | 7hr20min   | 27min         |

| Work Material | Hardened Steels SKD61-STAVAX (∼52HRC)                                                                                                                                                                                                                                                                                                                                                                                   |                |        |                   | Hardened Steels SKD11 (∼62HRC) |                |        |                   | High Speed Steels SKH (∼65HRC) |                |        |                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|-------------------|--------------------------------|----------------|--------|-------------------|--------------------------------|----------------|--------|-------------------|
| Radius        | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                            |                | Feed   | Spindle Speed     | Depth of Cut                   |                | Feed   | Spindle Speed     | Depth of Cut                   |                | Feed   | Spindle Speed     |
|               | $\bar{a}_p$ mm                                                                                                                                                                                                                                                                                                                                                                                                          | $\bar{a}_e$ mm | mm/min | min <sup>-1</sup> | $\bar{a}_p$ mm                 | $\bar{a}_e$ mm | mm/min | min <sup>-1</sup> | $\bar{a}_p$ mm                 | $\bar{a}_e$ mm | mm/min | min <sup>-1</sup> |
| 0.5           | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.3            | 2,500  | 30,000            | 0.1                            | 0.2            | 2,500  | 30,000            | 0.08                           | 0.1            | 2,000  | 30,000            |
| 1             | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.6            | 3,000  | 20,000            | 0.2                            | 0.6            | 3,000  | 20,000            | 0.15                           | 0.3            | 2,500  | 20,000            |
| 1.5           | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                     | 1              | 3,000  | 18,000            | 0.2                            | 0.8            | 3,000  | 16,000            | 0.2                            | 0.5            | 2,000  | 14,000            |
| 2             | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                     | 1.5            | 3,000  | 15,000            | 0.2                            | 1              | 3,000  | 12,000            | 0.2                            | 0.6            | 2,000  | 10,000            |
| 2.5           | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                     | 2              | 3,000  | 12,000            | 0.2                            | 1.2            | 3,000  | 10,000            | 0.2                            | 0.7            | 2,000  | 8,000             |
| 3             | 0.4                                                                                                                                                                                                                                                                                                                                                                                                                     | 2              | 3,000  | 9,000             | 0.3                            | 1.2            | 3,000  | 7,200             | 0.2                            | 1              | 2,000  | 6,800             |
| Notes         | ※1 Depth of Cut: $\bar{a}_p$ =Axial Depth of Cut / $\bar{a}_e$ =Radial Depth of Cut.<br>※2 We recommend using oil mist coolant.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of depth of cut and rigidity of machine.<br>※5 Length of overhang is 4 to 5 times Dia. When it is longer than 4 to 5 times Dia., adjust the conditions listed above. |                |        |                   |                                |                |        |                   |                                |                |        |                   |

 Titanium Alloy  
Heat Resistant Alloy

S

 ∼ 55 HRC  
 ∼ 65 HRC

H

 Coating  
 Ball

 Titanium Alloy  
Heat Resistant Alloy

S

 ∼ 55 HRC  
 ∼ 65 HRC

H

 Coating  
 Ball

# MHDH445R

Size  $\phi 3 \times R0.2 \sim \phi 4 \times R0.5$

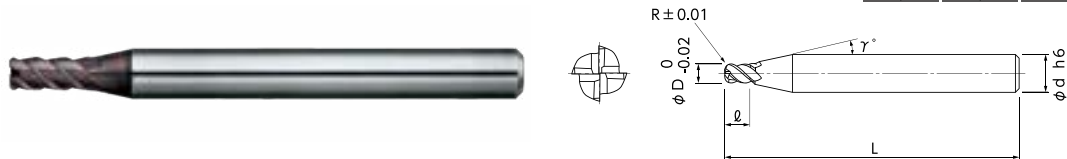


# MHDH445R

MUGEN COATING PREMIUM 4-Flute Corner Radius End Mill for Hardened Steel

Recommended Milling Conditions

4-flute high helix angle corner radius end mill for prehardened steels and hardened steels up to 65HRC

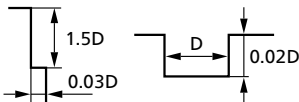
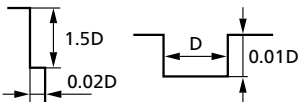
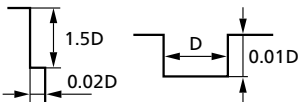


- Realized stably long tool life against high hardened steels (48~65HRC).
- Corner radius to prevent flute chipping, and high helix angle for cutting sharpness.

| Unit : mm      |          |                   |                   |                      |                |                    |
|----------------|----------|-------------------|-------------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Corner Radius (R) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 08-00437-03002 | 3        | R0.2              | 6                 | 12°                  | 6              | 60                 |
| 08-00437-03003 |          | R0.3              | 6                 | 12°                  | 6              | 60                 |
| 08-00437-03005 |          | R0.5              | 6                 | 12°                  | 6              | 60                 |
| 08-00437-04002 | 4        | R0.2              | 8                 | 12°                  | 6              | 60                 |
| 08-00437-04003 |          | R0.3              | 8                 | 12°                  | 6              | 60                 |
| 08-00437-04005 |          | R0.5              | 8                 | 12°                  | 6              | 60                 |

How to Order

When you order, indicate MHDH445R (D)×(R).    ※ (γ) is reference value.

| Work Material                 | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC)                                                                                                                                                                                                           |        |                   |        | Hardened Steels<br>SKD11<br>(~62HRC)                                                                                    |        |                   |        | High Speed Steels<br>SKH<br>(~65HRC)                                                                                    |        |                   |        |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Dia.                          | Side Milling                                                                                                                                                                                                                                                |        | Slotting          |        | Side Milling                                                                                                            |        | Slotting          |        | Side Milling                                                                                                            |        | Slotting          |        |
|                               | Spindle Speed                                                                                                                                                                                                                                               | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                           | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                           | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                           | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                       | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                       | mm/min | min <sup>-1</sup> | mm/min |
| 3                             | 10,000                                                                                                                                                                                                                                                      | 1,000  | 8,000             | 580    | 8,000                                                                                                                   | 700    | 7,500             | 500    | 7,000                                                                                                                   | 560    | 6,000             | 280    |
| 4                             | 8,500                                                                                                                                                                                                                                                       | 1,200  | 7,500             | 620    | 7,000                                                                                                                   | 800    | 6,000             | 540    | 6,000                                                                                                                   | 600    | 5,000             | 300    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling    Slotting</div>                                                                                                                                      |        |                   |        | <div>Side Milling    Slotting</div>  |        |                   |        | <div>Side Milling    Slotting</div>  |        |                   |        |
| Notes                         | ※1 Use a rigid and precise machine and chuck holder.<br>※2 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Use oilmist coolant or air blow. |        |                   |        |                                                                                                                         |        |                   |        |                                                                                                                         |        |                   |        |



# MHDH645R

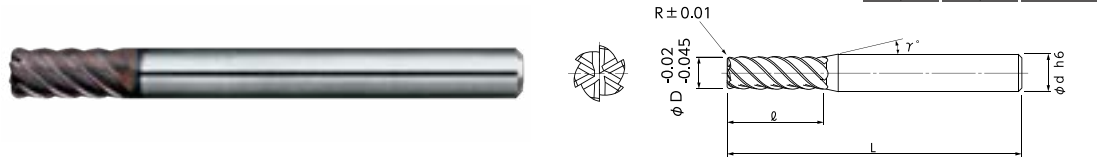
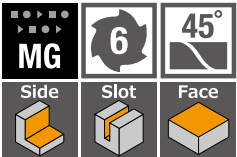
Size  $\phi 5 \times R0.2 \sim \phi 12 \times R2$



MUGEN COATING PREMIUM 6-Flute Corner Radius End Mill for Hardened Steel

Recommended Milling Conditions

6-flute high helix angle corner radius end mill for prehardened steels and hardened steels up to 65HRC

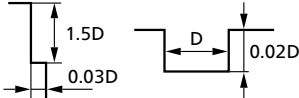
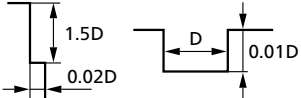
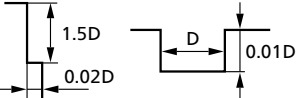


- Realized stably long tool life against high hardened steels (48~65HRC).
- Corner radius to prevent flute chipping, and high helix angle for cutting sharpness.

| Unit : mm      |          |                   |                   |                      |                |                    |
|----------------|----------|-------------------|-------------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Corner Radius (R) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 08-00438-05002 | 5        | R0.2              | 10                | 12°                  | 6              | 60                 |
| 08-00438-05003 |          | R0.3              | 10                | 12°                  | 6              | 60                 |
| 08-00438-05005 |          | R0.5              | 10                | 12°                  | 6              | 60                 |
| 08-00438-05010 |          | R1                | 10                | 12°                  | 6              | 60                 |
| 08-00438-06002 | 6        | R0.2              | 12                | —                    | 6              | 60                 |
| 08-00438-06003 |          | R0.3              | 12                | —                    | 6              | 60                 |
| 08-00438-06005 |          | R0.5              | 12                | —                    | 6              | 60                 |
| 08-00438-06010 |          | R1                | 12                | —                    | 6              | 60                 |
| 08-00438-08003 | 8        | R0.3              | 16                | —                    | 8              | 65                 |
| 08-00438-08005 |          | R0.5              | 16                | —                    | 8              | 65                 |
| 08-00438-08010 |          | R1                | 16                | —                    | 8              | 65                 |
| 08-00438-08015 |          | R1.5              | 16                | —                    | 8              | 65                 |
| 08-00438-10003 | 10       | R0.3              | 20                | —                    | 10             | 75                 |
| 08-00438-10005 |          | R0.5              | 20                | —                    | 10             | 75                 |
| 08-00438-10010 |          | R1                | 20                | —                    | 10             | 75                 |
| 08-00438-10015 |          | R1.5              | 20                | —                    | 10             | 75                 |
| 08-00438-10020 | 12       | R2                | 20                | —                    | 10             | 75                 |
| 08-00438-12005 |          | R0.5              | 24                | —                    | 12             | 80                 |
| 08-00438-12010 |          | R1                | 24                | —                    | 12             | 80                 |
| 08-00438-12015 |          | R1.5              | 24                | —                    | 12             | 80                 |
| 08-00438-12020 |          | R2                | 24                | —                    | 12             | 80                 |

## How to Order

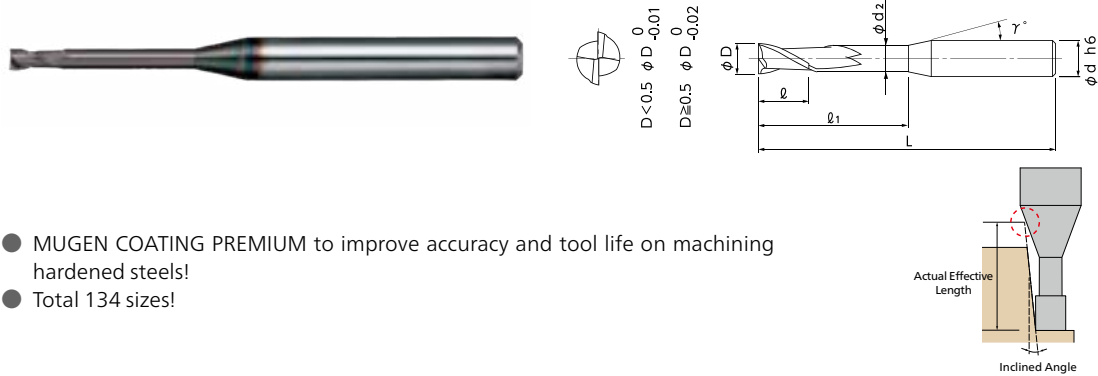
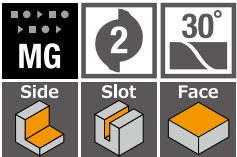
When you order, indicate MHDH645R (D)×(R). ※ (γ) is reference value.

| Work Material                 | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC)                                                                                                                                                                                                            |        |                   |        | Hardened Steels<br>SKD11<br>(~62HRC)                                                                                    |        |                   |        | High Speed Tool Steels<br>SKH<br>(~65HRC)                                                                               |        |                   |        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Dia.                          | Side Milling                                                                                                                                                                                                                                                 |        | Slotting          |        | Side Milling                                                                                                            |        | Slotting          |        | Side Milling                                                                                                            |        | Slotting          |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                           | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                           | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                            | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                       | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                       | mm/min | min <sup>-1</sup> | mm/min |
| 5                             | 7,600                                                                                                                                                                                                                                                        | 1,600  | 6,800             | 900    | 6,200                                                                                                                   | 1,200  | 5,600             | 600    | 5,300                                                                                                                   | 800    | 4,800             | 350    |
| 6                             | 6,400                                                                                                                                                                                                                                                        | 1,800  | 5,800             | 950    | 5,300                                                                                                                   | 1,200  | 4,800             | 600    | 4,600                                                                                                                   | 800    | 4,200             | 350    |
| 8                             | 4,800                                                                                                                                                                                                                                                        | 2,000  | 4,300             | 1,000  | 4,000                                                                                                                   | 1,400  | 3,600             | 700    | 3,400                                                                                                                   | 1,000  | 3,000             | 400    |
| 10                            | 3,800                                                                                                                                                                                                                                                        | 2,000  | 3,400             | 1,000  | 3,200                                                                                                                   | 1,600  | 2,800             | 800    | 2,600                                                                                                                   | 1,000  | 2,300             | 500    |
| 12                            | 3,200                                                                                                                                                                                                                                                        | 2,000  | 2,800             | 1,000  | 2,600                                                                                                                   | 1,600  | 2,300             | 800    | 2,200                                                                                                                   | 1,000  | 2,000             | 500    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling    Slotting</div>                                                                                                                                       |        |                   |        | <div>Side Milling    Slotting</div>  |        |                   |        | <div>Side Milling    Slotting</div>  |        |                   |        |
| Notes                         | ※1 Use a rigid and precise machine and chuck holder.<br>※2 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Use oil mist coolant or air blow. |        |                   |        |                                                                                                                         |        |                   |        |                                                                                                                         |        |                   |        |

| Model | Size | Maximum Cutting Depth | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                |        |       |          |                       |                          |                |  |  | Number of Sizes | Page |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|       |      |                       |         |                 |             |              |              |              |            | P             | P           | M                 | N               | N              | N      | N     | S        | H                     |                          |                |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      |                       |         |                 |             |              |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      |                       |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

| Model | Size | Maximum Cutting Depth | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |  |  | Number of Sizes | Page |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|       |      |                       |         |                 |             |              |              |              |            | P             | P           | M                 | N               | N               | N      | N     | S        | H                     |                          |                |  |  |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      |                       |         |                 |             |              |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |  |  |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|       |      |                       |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Long neck square end mill for hardened steels up to 65HRC.  
Maximum L/D=25



- MUGEN COATING PREMIUM to improve accuracy and tool life on machining hardened steels!
- Total 134 sizes!

Titanium Alloy  
Heat Resistant Alloy

~ 55  
HRC

~ 65  
HRC

S

H

Coating  
Long Neck  
Square

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|-------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                   |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00207-01003 | 0.1         | 0.3                          | 0.08                    | 0.085             | 12°                        | 4                    | 45                       | 0.35                                                                | 0.37  | 0.38  | 0.40  | 0.45  |
| 08-00207-01005 |             | 0.5                          |                         |                   |                            |                      | 45                       | 0.56                                                                | 0.58  | 0.61  | 0.64  | 0.71  |
| 08-00207-01007 |             | 0.75                         |                         |                   |                            |                      | 45                       | 0.82                                                                | 0.86  | 0.90  | 0.94  | 1.05  |
| 08-00207-01010 |             | 1                            |                         |                   |                            |                      | 45                       | 1.08                                                                | 1.13  | 1.18  | 1.24  | 1.38  |
| 08-00207-01503 | 0.15        | 0.3                          | 0.12                    | 0.13              | 12°                        | 4                    | 45                       | 0.36                                                                | 0.38  | 0.40  | 0.42  | 0.46  |
| 08-00207-01505 |             | 0.5                          |                         |                   |                            |                      | 45                       | 0.57                                                                | 0.60  | 0.62  | 0.66  | 0.73  |
| 08-00207-01507 |             | 0.75                         |                         |                   |                            |                      | 45                       | 0.83                                                                | 0.87  | 0.91  | 0.96  | 1.06  |
| 08-00207-01510 |             | 1                            |                         |                   |                            |                      | 45                       | 1.09                                                                | 1.14  | 1.20  | 1.25  | 1.39  |
| 08-00207-01515 | 0.2         | 1.5                          | 0.15                    | 0.18              | 12°                        | 4                    | 45                       | 1.61                                                                | 1.69  | 1.77  | 1.85  | 2.06  |
| 08-00207-02005 |             | 0.5                          |                         |                   |                            |                      | 45                       | 0.57                                                                | 0.60  | 0.62  | 0.66  | 0.73  |
| 08-00207-02007 |             | 0.75                         |                         |                   |                            |                      | 45                       | 0.83                                                                | 0.87  | 0.91  | 0.96  | 1.06  |
| 08-00207-02010 |             | 1                            |                         |                   |                            |                      | 45                       | 1.09                                                                | 1.14  | 1.20  | 1.25  | 1.39  |
| 08-00207-02015 | 0.3         | 1.5                          | 0.25                    | 0.28              | 12°                        | 4                    | 45                       | 1.61                                                                | 1.69  | 1.77  | 1.85  | 2.06  |
| 08-00207-02020 |             | 2                            |                         |                   |                            |                      | 45                       | 2.13                                                                | 2.23  | 2.34  | 2.45  | 2.72  |
| 08-00207-02025 |             | 2.5                          |                         |                   |                            |                      | 45                       | 2.66                                                                | 2.78  | 2.91  | 3.05  | 3.39  |
| 08-00207-02030 |             | 3                            |                         |                   |                            |                      | 45                       | 3.18                                                                | 3.32  | 3.48  | 3.65  | 4.06  |
| 08-00207-03010 | 0.4         | 1                            | 0.3                     | 0.37              | 12°                        | 4                    | 45                       | 1.09                                                                | 1.14  | 1.20  | 1.25  | 1.39  |
| 08-00207-03015 |             | 1.5                          |                         |                   |                            |                      | 45                       | 1.61                                                                | 1.69  | 1.77  | 1.85  | 2.06  |
| 08-00207-03020 |             | 2                            |                         |                   |                            |                      | 45                       | 2.13                                                                | 2.23  | 2.34  | 2.45  | 2.72  |
| 08-00207-03025 |             | 2.5                          |                         |                   |                            |                      | 45                       | 2.66                                                                | 2.78  | 2.91  | 3.05  | 3.39  |
| 08-00207-04010 | 0.5         | 1                            | 0.4                     | 0.46              | 12°                        | 4                    | 45                       | 1.12                                                                | 1.17  | 1.22  | 1.28  | 1.43  |
| 08-00207-04015 |             | 1.5                          |                         |                   |                            |                      | 45                       | 1.64                                                                | 1.71  | 1.79  | 1.88  | 2.09  |
| 08-00207-04020 |             | 2                            |                         |                   |                            |                      | 45                       | 2.16                                                                | 2.26  | 2.36  | 2.48  | 2.76  |
| 08-00207-04025 |             | 2.5                          |                         |                   |                            |                      | 45                       | 2.68                                                                | 2.80  | 2.93  | 3.08  | 3.42  |
| 08-00207-04030 | 0.6         | 3                            | 0.5                     | 0.58              | 12°                        | 4                    | 45                       | 3.20                                                                | 3.35  | 3.50  | 3.68  | 4.09  |
| 08-00207-04035 |             | 3.5                          |                         |                   |                            |                      | 45                       | 3.72                                                                | 3.89  | 4.08  | 4.28  | 4.75  |
| 08-00207-04040 |             | 4                            |                         |                   |                            |                      | 45                       | 4.25                                                                | 4.44  | 4.65  | 4.88  | 5.42  |
| 08-00207-04050 |             | 5                            |                         |                   |                            |                      | 45                       | 5.29                                                                | 5.53  | 5.79  | 6.08  | 6.75  |
| 08-00207-04060 | 0.7         | 6                            | 0.6                     | 0.66              | 12°                        | 4                    | 45                       | 6.33                                                                | 6.62  | 6.93  | 7.27  | 8.08  |
| 08-00207-04080 |             | 8                            |                         |                   |                            |                      | 45                       | 8.42                                                                | 8.80  | 9.21  | 9.67  | 10.74 |
| 08-00207-04100 |             | 10                           |                         |                   |                            |                      | 45                       | 10.50                                                               | 10.98 | 11.49 | 12.07 | 13.40 |
| 08-00207-05010 |             | 1                            | 0.4                     | 0.46              | 12°                        | 4                    | 45                       | 1.14                                                                | 1.19  | 1.25  | 1.31  | 1.46  |
| 08-00207-05015 | 0.8         | 1.5                          |                         |                   |                            |                      | 45                       | 1.66                                                                | 1.74  | 1.82  | 1.91  | 2.12  |
| 08-00207-05020 |             | 2                            |                         |                   |                            |                      | 45                       | 2.18                                                                | 2.28  | 2.39  | 2.51  | 2.79  |
| 08-00207-05025 |             | 2.5                          |                         |                   |                            |                      | 45                       | 2.71                                                                | 2.83  | 2.96  | 3.11  | 3.45  |

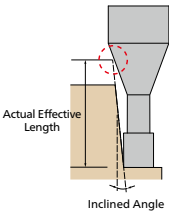
How to Order

When you order, indicate MHRH230 (D)×(ℓ1). ※( γ ) is reference value.

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|-------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                   |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00207-05030 | 0.5         | 3                            | 0.4                     | 0.46              | 12°                        | 4                    | 45                       | 3.23                                                                | 3.37  | 3.53  | 3.71  | 4.12  |
| 08-00207-05035 |             | 3.5                          |                         |                   |                            |                      | 45                       | 3.75                                                                | 3.92  | 4.10  | 4.31  | 4.78  |
| 08-00207-05040 |             | 4                            |                         |                   |                            |                      | 45                       | 4.27                                                                | 4.46  | 4.67  | 4.91  | 5.45  |
| 08-00207-05045 |             | 4.5                          |                         |                   |                            |                      | 45                       | 4.79                                                                | 5.01  | 5.24  | 5.50  | 6.12  |
| 08-00207-05050 |             | 5                            |                         |                   |                            |                      | 45                       | 5.31                                                                | 5.55  | 5.81  | 6.10  | 6.78  |
| 08-00207-05060 |             | 6                            |                         |                   |                            |                      | 45                       | 6.36                                                                | 6.64  | 6.96  | 7.30  | 8.11  |
| 08-00207-05070 |             | 7                            |                         |                   |                            |                      | 45                       | 7.40                                                                | 7.73  | 8.10  | 8.50  | 9.44  |
| 08-00207-05080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.44                                                                | 8.82  | 9.24  | 9.70  | 10.77 |
| 08-00207-05090 |             | 9                            |                         |                   |                            |                      | 50                       | 9.48                                                                | 9.91  | 10.38 | 10.90 | 12.10 |
| 08-00207-05100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.53                                                               | 11.00 | 11.52 | 12.09 | 13.44 |
| 08-00207-06015 | 0.6         | 1.5                          | 0.5                     | 0.56              | 12°                        | 4                    | 45                       | 1.66                                                                | 1.74  | 1.82  | 1.91  | 2.12  |
| 08-00207-06020 |             | 2                            |                         |                   |                            |                      | 45                       | 2.18                                                                | 2.28  | 2.39  | 2.51  | 2.79  |
| 08-00207-06030 |             | 3                            |                         |                   |                            |                      | 45                       | 3.23                                                                | 3.37  | 3.53  | 3.71  | 4.12  |
| 08-00207-06040 |             | 4                            |                         |                   |                            |                      | 45                       | 4.27                                                                | 4.46  | 4.67  | 4.91  | 5.45  |
| 08-00207-06050 |             | 5                            |                         |                   |                            |                      | 45                       | 5.31                                                                | 5.55  | 5.81  | 6.10  | 6.78  |
| 08-00207-06060 |             | 6                            |                         |                   |                            |                      | 45                       | 6.36                                                                | 6.64  | 6.96  | 7.30  | 8.11  |
| 08-00207-07020 | 0.7         | 2                            | 0.55                    | 0.66              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.28  | 2.39  | 2.51  | 2.79  |
| 08-00207-07040 |             | 4                            |                         |                   |                            |                      | 45                       | 4.27                                                                | 4.46  | 4.67  | 4.91  | 5.45  |
| 08-00207-07060 |             | 6                            |                         |                   |                            |                      | 45                       | 6.36                                                                | 6.64  | 6.96  | 7.30  | 8.11  |
| 08-00207-07080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.44                                                                | 8.82  | 9.24  | 9.70  | 10.77 |
| 08-00207-07100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.53                                                               | 11.00 | 11.52 | 12.09 | 13.44 |
| 08-00207-08030 |             | 3                            |                         |                   |                            |                      | 45                       | 3.23                                                                | 3.37  | 3.53  | 3.71  | 4.12  |
| 08-00207-08040 | 0.8         | 4                            | 0.65                    | 0.76              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.46  | 4.67  | 4.91  | 5.45  |
| 08-00207-08050 |             | 5                            |                         |                   |                            |                      | 45                       | 5.31                                                                | 5.55  | 5.81  | 6.10  | 6.78  |
| 08-00207-08060 |             | 6                            |                         |                   |                            |                      | 45                       | 6.36                                                                | 6.64  | 6.96  | 7.30  | 8.11  |
| 08-00207-08080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.44                                                                | 8.82  | 9.24  | 9.70  | 10.77 |
| 08-00207-08100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.53                                                               | 11.00 | 11.52 | 12.09 | 13.44 |
| 08-00207-08120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.61                                                               | 13.18 | 13.80 | 14.49 | 16.10 |
| 08-00207-10020 |             | 2                            |                         |                   |                            |                      | 50                       | 2.21                                                                | 2.31  | 2.42  | 2.54  | 2.82  |
| 08-00207-10030 | 1           | 3                            | 0.8                     | 0.95              | 12°                        | 4                    | 50                       | 3.25                                                                | 3.40  | 3.56  | 3.74  | 4.15  |
| 08-00207-10040 |             | 4                            |                         |                   |                            |                      | 50                       | 4.29                                                                | 4.49  | 4.70  | 4.93  | 5.48  |
| 08-00207-10050 |             | 5                            |                         |                   |                            |                      | 50                       | 5.34                                                                | 5.58  | 5.84  | 6.13  | 6.81  |
| 08-00207-10060 |             | 6                            |                         |                   |                            |                      | 50                       | 6.38                                                                | 6.67  | 6.98  | 7.33  | 8.14  |
| 08-00207-10070 |             | 7                            |                         |                   |                            |                      | 50                       | 7.42                                                                | 7.76  | 8.12  | 8.53  | 9.47  |
| 08-00207-10080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.85  | 9.27  | 9.73  | 10.80 |
| 08-00207-10090 |             | 9                            |                         |                   |                            |                      | 50                       | 9.51                                                                | 9.94  | 10.41 | 10.92 | 12.14 |
| 08-00207-10100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.55                                                               | 11.03 | 11.55 | 12.12 | 13.47 |
| 08-00207-10120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.64                                                               | 13.21 | 13.83 | 14.52 | 16.13 |
| 08-00207-10140 |             | 14                           |                         |                   |                            |                      | 50                       | 14.72                                                               | 15.39 | 16.11 | 16.91 | 18.79 |
| 08-00207-10160 |             | 16                           |                         |                   |                            |                      | 60                       | 16.81                                                               | 17.57 | 18.40 | 19.31 | 21.45 |
| 08-00207-10180 |             | 18                           |                         |                   |                            |                      | 60                       | 18.89                                                               | 19.74 | 20.68 | 21.71 | 24.11 |
| 08-00207-10200 |             | 20                           |                         |                   |                            |                      | 60                       | 20.98                                                               | 21.92 | 22.96 | 24.10 | 26.78 |
| 08-00207-10220 |             | 22                           |                         |                   |                            |                      | 60                       | 23.07                                                               | 24.10 | 25.24 | 26.50 | Free  |
| 08-00207-12060 |             | 1.2                          |                         |                   |                            |                      | 6                        | 1                                                                   | 1.15  | 12°   | 4     | 50    |
| 08-00207-12080 | 8           |                              | 50                      | 8.47              | 8.85                       | 9.27                 | 9.73                     |                                                                     |       |       |       | 10.80 |
| 08-00207-12100 | 10          |                              | 50                      | 10.55             | 11.03                      | 11.55                | 12.12                    |                                                                     |       |       |       | 13.47 |
| 08-00207-12120 | 12          |                              | 50                      | 12.64             | 13.21                      | 13.83                | 14.52                    |                                                                     |       |       |       | 16.13 |
| 08-00207-12160 | 16          |                              | 60                      | 16.81             | 17.57                      | 18.40                | 19.31                    |                                                                     |       |       |       | 21.45 |
| 08-00207-14060 | 1.4         | 6                            | 1.1                     | 1.35              | 12°                        | 4                    | 50                       | 6.38                                                                | 6.67  | 6.98  | 7.33  | 8.14  |
| 08-00207-14120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.64                                                               | 13.21 | 13.83 | 14.52 | 16.13 |

MHRH230

MUGEN COATING PREMIUM 2-Flute Long Neck End Mill for Hardened Steel



Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|-------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                   |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
|                |             |                              |                         |                   |                            |                      |                          |                                                                     |       |       |       |       |
| 08-00207-15040 | 1.5         | 4                            | 1.2                     | 1.45              | 12°                        | 4                    | 50                       | 4.29                                                                | 4.49  | 4.70  | 4.93  | 5.48  |
| 08-00207-15060 |             | 6                            |                         |                   |                            |                      | 50                       | 6.38                                                                | 6.67  | 6.98  | 7.33  | 8.14  |
| 08-00207-15080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.85  | 9.27  | 9.73  | 10.80 |
| 08-00207-15100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.55                                                               | 11.03 | 11.55 | 12.12 | 13.47 |
| 08-00207-15120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.64                                                               | 13.21 | 13.83 | 14.52 | 16.13 |
| 08-00207-15140 |             | 14                           |                         |                   |                            |                      | 60                       | 14.72                                                               | 15.39 | 16.11 | 16.91 | 18.79 |
| 08-00207-15160 |             | 16                           |                         |                   |                            |                      | 60                       | 16.81                                                               | 17.57 | 18.40 | 19.31 | 21.45 |
| 08-00207-15180 |             | 18                           |                         |                   |                            |                      | 60                       | 18.89                                                               | 19.74 | 20.68 | 21.71 | 24.11 |
| 08-00207-15200 |             | 20                           |                         |                   |                            |                      | 60                       | 20.98                                                               | 21.92 | 22.96 | 24.10 | Free  |
| 08-00207-15250 |             | 25                           |                         |                   |                            |                      | 70                       | 26.20                                                               | 27.37 | 28.67 | 30.09 | Free  |
| 08-00207-15300 | 1.6         | 30                           | 1.3                     | 1.55              | 12°                        | 4                    | 70                       | 31.41                                                               | 32.82 | 34.37 | 36.08 | Free  |
| 08-00207-15350 |             | 35                           |                         |                   |                            |                      | 80                       | 36.62                                                               | 38.27 | 40.08 | Free  | Free  |
| 08-00207-16060 |             | 6                            |                         |                   |                            |                      | 50                       | 6.38                                                                | 6.67  | 6.98  | 7.33  | 8.14  |
| 08-00207-16080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.85  | 9.27  | 9.73  | 10.80 |
| 08-00207-18060 | 1.8         | 6                            | 1.4                     | 1.75              | 12°                        | 4                    | 50                       | 6.38                                                                | 6.67  | 6.98  | 7.33  | 8.14  |
| 08-00207-18080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.85  | 9.27  | 9.73  | 10.80 |
| 08-00207-18100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.55                                                               | 11.03 | 11.55 | 12.12 | 13.47 |
| 08-00207-18120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.64                                                               | 13.21 | 13.83 | 14.52 | 16.13 |
| 08-00207-18140 |             | 14                           |                         |                   |                            |                      | 50                       | 14.72                                                               | 15.39 | 16.11 | 16.91 | 18.79 |
| 08-00207-18160 |             | 16                           |                         |                   |                            |                      | 60                       | 16.81                                                               | 17.57 | 18.40 | 19.31 | 21.45 |
| 08-00207-18180 |             | 18                           |                         |                   |                            |                      | 60                       | 18.89                                                               | 19.74 | 20.68 | 21.71 | 24.11 |
| 08-00207-20040 | 2           | 4                            | 1.6                     | 1.94              | 12°                        | 4                    | 50                       | 4.32                                                                | 4.51  | 4.73  | 4.96  | 5.51  |
| 08-00207-20060 |             | 6                            |                         |                   |                            |                      | 50                       | 6.40                                                                | 6.69  | 7.01  | 7.36  | 8.17  |
| 08-00207-20080 |             | 8                            |                         |                   |                            |                      | 50                       | 8.49                                                                | 8.87  | 9.29  | 9.75  | 10.84 |
| 08-00207-20100 |             | 10                           |                         |                   |                            |                      | 50                       | 10.58                                                               | 11.05 | 11.57 | 12.15 | 13.50 |
| 08-00207-20120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.66                                                               | 13.23 | 13.86 | 14.55 | 16.16 |
| 08-00207-20140 |             | 14                           |                         |                   |                            |                      | 60                       | 14.75                                                               | 15.41 | 16.14 | 16.94 | 18.82 |
| 08-00207-20160 |             | 16                           |                         |                   |                            |                      | 60                       | 16.83                                                               | 17.59 | 18.42 | 19.34 | Free  |
| 08-00207-20180 |             | 18                           |                         |                   |                            |                      | 60                       | 18.92                                                               | 19.77 | 20.71 | 21.73 | Free  |
| 08-00207-20200 |             | 20                           |                         |                   |                            |                      | 60                       | 21.01                                                               | 21.95 | 22.99 | 24.13 | Free  |
| 08-00207-20250 |             | 25                           |                         |                   |                            |                      | 70                       | 26.22                                                               | 27.40 | 28.69 | Free  | Free  |
| 08-00207-20300 |             | 30                           |                         |                   |                            |                      | 70                       | 31.43                                                               | 32.85 | 34.40 | Free  | Free  |
| 08-00207-20350 |             | 35                           |                         |                   |                            |                      | 80                       | 36.65                                                               | 38.30 | Free  | Free  | Free  |
| 08-00207-20400 |             | 40                           |                         |                   |                            |                      | 90                       | 41.86                                                               | 43.75 | Free  | Free  | Free  |
| 08-00207-20500 |             | 50                           |                         |                   |                            |                      | 100                      | 52.29                                                               | 54.64 | Free  | Free  | Free  |
| 08-00207-25080 | 2.5         | 8                            | 2                       | 2.4               | 12°                        | 4                    | 50                       | 8.59                                                                | 8.98  | 9.40  | 9.87  | 10.96 |
| 08-00207-25120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.76                                                               | 13.33 | 13.97 | 14.66 | Free  |
| 08-00207-25160 |             | 16                           |                         |                   |                            |                      | 60                       | 16.93                                                               | 17.69 | 18.53 | 19.45 | Free  |
| 08-00207-25200 |             | 20                           |                         |                   |                            |                      | 60                       | 21.10                                                               | 22.05 | 23.10 | Free  | Free  |
| 08-00207-25300 |             | 30                           |                         |                   |                            |                      | 70                       | 31.53                                                               | 32.95 | Free  | Free  | Free  |
| 08-00207-25400 |             | 40                           |                         |                   |                            |                      | 90                       | 41.96                                                               | 43.85 | Free  | Free  | Free  |
| 08-00207-25500 |             | 50                           |                         |                   |                            |                      | 100                      | 52.39                                                               | 54.75 | Free  | Free  | Free  |
| 08-00207-30080 | 3           | 8                            | 4.5                     | 2.85              | 12°                        | 6                    | 50                       | 8.71                                                                | 9.10  | 9.53  | 10.01 | 11.12 |
| 08-00207-30120 |             | 12                           |                         |                   |                            |                      | 50                       | 12.88                                                               | 13.46 | 14.10 | 14.80 | 16.44 |
| 08-00207-30160 |             | 16                           |                         |                   |                            |                      | 60                       | 17.05                                                               | 17.82 | 18.67 | 19.59 | 21.77 |
| 08-00207-30200 |             | 20                           |                         |                   |                            |                      | 60                       | 21.23                                                               | 22.18 | 23.23 | 24.39 | 27.09 |
| 08-00207-30250 |             | 25                           |                         |                   |                            |                      | 70                       | 26.44                                                               | 27.63 | 28.94 | 30.38 | Free  |
| 08-00207-30300 |             | 30                           |                         |                   |                            |                      | 70                       | 31.66                                                               | 33.08 | 34.64 | 36.37 | Free  |

How to Order

When you order, indicate MHRH230 (D)×(ℓ1). ※( γ ) is reference value.

MHRH230

Recommended Milling Conditions

| Work Material |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(~43HRC) |        |              |        | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |        | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |              |        | High Speed Steels<br>SKH<br>(~65HRC) |        |              |       |
|---------------|-------------------|-----------------------------------------------------------------------|--------|--------------|--------|---------------------------------------------------|--------|--------------|--------|--------------------------------------------|--------|--------------|--------|--------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                         | Feed   | Depth of Cut |        | Spindle Speed                                     | Feed   | Depth of Cut |        | Spindle Speed                              | Feed   | Depth of Cut |        | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm  | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm  | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm  | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 0.1           | 0.3               | 40,000                                                                | 150    | 0.005        | 0.06   | 40,000                                            | 120    | 0.003        | 0.05   | 40,000                                     | 100    | 0.002        | 0.04   | 40,000                               | 70     | 0.002        | 0.03  |
|               | 0.5               | 40,000                                                                | 100    | 0.005        | 0.06   | 40,000                                            | 80     | 0.003        | 0.05   | 40,000                                     | 60     | 0.002        | 0.04   | 40,000                               | 50     | 0.002        | 0.03  |
|               | 0.75              | 40,000                                                                | 80     | 0.003        | 0.06   | 40,000                                            | 70     | 0.002        | 0.05   | 40,000                                     | 50     | 0.001        | 0.04   | 40,000                               | 30     | 0.001        | 0.03  |
|               | 1                 | 40,000                                                                | 60     | 0.002        | 0.06   | 40,000                                            | 50     | 0.001        | 0.05   | 40,000                                     | 40     | 0.001        | 0.04   | 40,000                               | 20     | 0.001        | 0.03  |
| 0.15          | 0.3               | 40,000                                                                | 180    | 0.005        | 0.09   | 40,000                                            | 150    | 0.003        | 0.07   | 40,000                                     | 120    | 0.002        | 0.06   | 40,000                               | 100    | 0.002        | 0.04  |
|               | 0.5               | 40,000                                                                | 150    | 0.005        | 0.09   | 40,000                                            | 120    | 0.003        | 0.07   | 40,000                                     | 100    | 0.002        | 0.06   | 40,000                               | 80     | 0.002        | 0.04  |
|               | 0.75              | 40,000                                                                | 120    | 0.003        | 0.09   | 40,000                                            | 100    | 0.002        | 0.07   | 40,000                                     | 80     | 0.001        | 0.06   | 40,000                               | 60     | 0.001        | 0.04  |
|               | 1                 | 40,000                                                                | 100    | 0.002        | 0.09   | 40,000                                            | 80     | 0.001        | 0.07   | 40,000                                     | 60     | 0.001        | 0.06   | 40,000                               | 40     | 0.001        | 0.04  |
|               | 1.5               | 40,000                                                                | 80     | 0.002        | 0.09   | 40,000                                            | 60     | 0.001        | 0.07   | 40,000                                     | 40     | 0.001        | 0.06   | 40,000                               | 20     | 0.001        | 0.04  |
| 0.2           | 0.5               | 30,000                                                                | 240    | 0.005        | 0.12   | 30,000                                            | 200    | 0.003        | 0.1    | 30,000                                     | 160    | 0.003        | 0.08   | 30,000                               | 120    | 0.003        | 0.06  |
|               | 0.75              | 30,000                                                                | 200    | 0.005        | 0.12   | 30,000                                            | 180    | 0.003        | 0.1    | 30,000                                     | 140    | 0.003        | 0.08   | 30,000                               | 100    | 0.003        | 0.06  |
|               | 1                 | 30,000                                                                | 180    | 0.005        | 0.12   | 30,000                                            | 150    | 0.003        | 0.1    | 30,000                                     | 120    | 0.003        | 0.08   | 30,000                               | 80     | 0.003        | 0.06  |
|               | 1.5               | 30,000                                                                | 120    | 0.003        | 0.12   | 30,000                                            | 100    | 0.002        | 0.1    | 30,000                                     | 80     | 0.002        | 0.08   | 30,000                               | 60     | 0.002        | 0.06  |
|               | 2                 | 30,000                                                                | 80     | 0.003        | 0.12   | 30,000                                            | 50     | 0.002        | 0.1    | 30,000                                     | 40     | 0.002        | 0.08   | 30,000                               | 30     | 0.002        | 0.06  |
|               | 2.5               | 30,000                                                                | 60     | 0.002        | 0.12   | 30,000                                            | 50     | 0.001        | 0.1    | 25,000                                     | 40     | 0.001        | 0.08   | 25,000                               | 30     | 0.001        | 0.06  |
|               | 3                 | 30,000                                                                | 40     | 0.002        | 0.12   | 25,000                                            | 40     | 0.001        | 0.1    | 25,000                                     | 30     | 0.001        | 0.08   | 22,000                               | 20     | 0.001        | 0.06  |
| 0.3           | 1                 | 30,000                                                                | 350    | 0.007        | 0.18   | 30,000                                            | 300    | 0.003        | 0.15   | 30,000                                     | 250    | 0.003        | 0.12   | 30,000                               | 200    | 0.003        | 0.09  |
|               | 1.5               | 30,000                                                                | 260    | 0.007        | 0.18   | 30,000                                            | 200    | 0.003        | 0.15   | 30,000                                     | 160    | 0.003        | 0.12   | 30,000                               | 120    | 0.003        | 0.09  |
|               | 2                 | 30,000                                                                | 180    | 0.005        | 0.18   | 30,000                                            | 150    | 0.003        | 0.15   | 30,000                                     | 120    | 0.003        | 0.12   | 25,000                               | 100    | 0.003        | 0.09  |
|               | 2.5               | 30,000                                                                | 150    | 0.004        | 0.18   | 25,000                                            | 100    | 0.002        | 0.15   | 25,000                                     | 80     | 0.002        | 0.12   | 20,000                               | 60     | 0.002        | 0.09  |
|               | 3                 | 30,000                                                                | 70     | 0.004        | 0.18   | 25,000                                            | 50     | 0.002        | 0.15   | 25,000                                     | 40     | 0.002        | 0.12   | 20,000                               | 30     | 0.002        | 0.09  |
| 0.4           | 1                 | 30,000                                                                | 450    | 0.01         | 0.24   | 30,000                                            | 400    | 0.005        | 0.2    | 30,000                                     | 350    | 0.005        | 0.16   | 25,000                               | 300    | 0.005        | 0.12  |
|               | 1.5               | 30,000                                                                | 400    | 0.01         | 0.24   | 30,000                                            | 360    | 0.005        | 0.2    | 30,000                                     | 330    | 0.005        | 0.16   | 25,000                               | 250    | 0.005        | 0.12  |
|               | 2                 | 30,000                                                                | 360    | 0.01         | 0.24   | 30,000                                            | 320    | 0.005        | 0.2    | 25,000                                     | 280    | 0.005        | 0.16   | 25,000                               | 220    | 0.005        | 0.12  |
|               | 2.5               | 30,000                                                                | 340    | 0.008        | 0.24   | 25,000                                            | 280    | 0.005        | 0.2    | 25,000                                     | 250    | 0.004        | 0.16   | 20,000                               | 200    | 0.004        | 0.12  |
|               | 3                 | 30,000                                                                | 320    | 0.008        | 0.24   | 25,000                                            | 260    | 0.004        | 0.2    | 20,000                                     | 220    | 0.003        | 0.16   | 18,000                               | 180    | 0.003        | 0.12  |
|               | 3.5               | 30,000                                                                | 280    | 0.007        | 0.24   | 25,000                                            | 220    | 0.004        | 0.2    | 20,000                                     | 180    | 0.003        | 0.16   | 18,000                               | 150    | 0.002        | 0.12  |
|               | 4                 | 30,000                                                                | 250    | 0.006        | 0.24   | 25,000                                            | 200    | 0.003        | 0.2    | 20,000                                     | 160    | 0.002        | 0.16   | 18,000                               | 120    | 0.002        | 0.12  |
|               | 5                 | 25,000                                                                | 250    | 0.005        | 0.24   | 22,000                                            | 180    | 0.003        | 0.2    | 20,000                                     | 150    | 0.002        | 0.16   | 18,000                               | 90     | 0.002        | 0.12  |
|               | 6                 | 25,000                                                                | 200    | 0.004        | 0.24   | 22,000                                            | 150    | 0.002        | 0.2    | 18,000                                     | 130    | 0.002        | 0.16   | 16,000                               | 70     | 0.001        | 0.12  |
|               | 8                 | 20,000                                                                | 150    | 0.002        | 0.24   | 16,000                                            | 120    | 0.001        | 0.2    | 14,000                                     | 90     | 0.001        | 0.16   | 12,000                               | 40     | 0.001        | 0.12  |
| 0.5           | 10                | 16,000                                                                | 100    | 0.002        | 0.24   | 13,000                                            | 80     | 0.001        | 0.2    | 12,000                                     | 50     | 0.001        | 0.16   | 10,000                               | 20     | 0.001        | 0.12  |
|               | 1                 | 30,000                                                                | 550    | 0.02         | 0.3    | 25,000                                            | 500    | 0.01         | 0.25   | 23,000                                     | 450    | 0.007        | 0.2    | 20,000                               | 400    | 0.005        | 0.15  |
|               | 1.5               | 30,000                                                                | 520    | 0.02         | 0.3    | 25,000                                            | 450    | 0.01         | 0.25   | 23,000                                     | 400    | 0.007        | 0.2    | 20,000                               | 360    | 0.005        | 0.15  |
|               | 2                 | 30,000                                                                | 500    | 0.02         | 0.3    | 25,000                                            | 420    | 0.01         | 0.25   | 23,000                                     | 380    | 0.007        | 0.2    | 20,000                               | 320    | 0.005        | 0.15  |
|               | 2.5               | 30,000                                                                | 480    | 0.015        | 0.3    | 25,000                                            | 400    | 0.008        | 0.25   | 23,000                                     | 360    | 0.006        | 0.2    | 20,000                               | 300    | 0.004        | 0.15  |
|               | 3                 | 30,000                                                                | 420    | 0.015        | 0.3    | 25,000                                            | 350    | 0.007        | 0.25   | 23,000                                     | 320    | 0.005        | 0.2    | 20,000                               | 280    | 0.003        | 0.15  |
|               | 3.5               | 25,000                                                                | 400    | 0.012        | 0.3    | 25,000                                            | 320    | 0.006        | 0.25   | 23,000                                     | 280    | 0.003        | 0.2    | 20,000                               | 240    | 0.003        | 0.15  |
|               | 4                 | 25,000                                                                | 380    | 0.01         | 0.3    | 25,000                                            | 280    | 0.005        | 0.25   | 23,000                                     | 240    | 0.003        | 0.2    | 20,000                               | 200    | 0.002        | 0.15  |
|               | 4.5               | 25,000                                                                | 350    | 0.008        | 0.3    | 25,000                                            | 230    | 0.004        | 0.25   | 20,000                                     | 200    | 0.003        | 0.2    | 18,000                               | 160    | 0.002        | 0.15  |
|               | 5                 | 25,000                                                                | 320    | 0.007        | 0.3    | 20,000                                            | 200    | 0.003        | 0.25   | 18,000                                     | 150    | 0.003        | 0.2    | 16,000                               | 100    | 0.002        | 0.15  |
|               | 6                 | 25,000                                                                | 300    | 0.005        | 0.3    | 20,000                                            | 200    | 0.003        | 0.25   | 18,000                                     | 150    | 0.002        | 0.2    | 16,000                               | 100    | 0.002        | 0.15  |
|               | 7                 | 20,000                                                                | 250    | 0.005        | 0.3    | 16,000                                            | 180    | 0.003        | 0.25   | 14,000                                     | 140    | 0.002        | 0.2    | 14,000                               | 80     | 0.002        | 0.15  |
| 0.6           | 8                 | 20,000                                                                | 200    | 0.005        | 0.3    | 16,000                                            | 160    | 0.002        | 0.25   | 14,000                                     | 130    | 0.002        | 0.2    | 12,000                               | 60     | 0.001        | 0.15  |
|               | 9                 | 20,000                                                                | 200    | 0.003        | 0.3    | 16,000                                            | 150    | 0.002        | 0.25   | 14,000                                     | 120    | 0.001        | 0.2    | 12,000                               | 50     | 0.001        | 0.15  |
|               | 10                | 16,000                                                                | 170    | 0.003        | 0.3    | 13,000                                            | 130    | 0.002        | 0.25   | 12,000                                     | 110    | 0.001        | 0.2    | 10,000                               | 40     | 0.001        | 0.15  |
|               | 1.5               | 30,000                                                                | 650    | 0.02         | 0.35   | 25,000                                            | 550    | 0.01         | 0.3    | 23,000                                     | 450    | 0.007        | 0.25   | 20,000                               | 400    | 0.005        | 0.18  |
|               | 2                 | 30,000                                                                | 550    | 0.02         | 0.35   | 25,000                                            | 500    | 0.01         | 0.3    | 23,000                                     | 400    | 0.007        | 0.25   | 20,000                               | 350    | 0.005        | 0.18  |
|               | 3                 | 30,000                                                                | 500    | 0.015        | 0.35   | 25,000                                            | 450    | 0.007        | 0.3    | 23,000                                     | 350    | 0.005        | 0.25   | 20,000                               | 300    | 0.003        | 0.18  |
| 4             | 25,000            | 450                                                                   | 0.01   | 0.35         | 25,000 | 400                                               | 0.005  | 0.3          | 23,000 | 300                                        | 0.003  | 0.25         | 20,000 | 250                                  | 0.002  | 0.18         |       |



| Work Material |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>（～43HRC） |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>（～55HRC） |        |              |       | Hardened Steels<br>SKD11・PD613<br>（～62HRC） |        |              |       | High Speed Steels<br>SKH<br>（～65HRC） |        |              |       |
|---------------|-------------------|-----------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                         | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 0.6           | 5                 | 25,000                                                                | 400    | 0.007        | 0.35  | 20,000                                            | 350    | 0.003        | 0.3   | 18,000                                     | 250    | 0.003        | 0.25  | 16,000                               | 200    | 0.002        | 0.18  |
|               | 6                 | 25,000                                                                | 350    | 0.005        | 0.35  | 20,000                                            | 300    | 0.002        | 0.3   | 18,000                                     | 200    | 0.002        | 0.25  | 16,000                               | 150    | 0.001        | 0.18  |
| 0.7           | 2                 | 30,000                                                                | 750    | 0.04         | 0.4   | 25,000                                            | 600    | 0.03         | 0.35  | 23,000                                     | 450    | 0.02         | 0.28  | 20,000                               | 400    | 0.012        | 0.21  |
|               | 4                 | 25,000                                                                | 690    | 0.03         | 0.4   | 25,000                                            | 560    | 0.02         | 0.35  | 23,000                                     | 400    | 0.015        | 0.28  | 20,000                               | 320    | 0.007        | 0.21  |
|               | 6                 | 25,000                                                                | 550    | 0.02         | 0.4   | 20,000                                            | 410    | 0.015        | 0.35  | 18,000                                     | 300    | 0.012        | 0.28  | 16,000                               | 240    | 0.007        | 0.21  |
|               | 8                 | 20,000                                                                | 430    | 0.012        | 0.4   | 16,000                                            | 330    | 0.01         | 0.35  | 14,000                                     | 230    | 0.007        | 0.28  | 12,000                               | 180    | 0.005        | 0.21  |
|               | 10                | 16,000                                                                | 300    | 0.008        | 0.4   | 13,000                                            | 200    | 0.005        | 0.35  | 12,000                                     | 180    | 0.003        | 0.28  | 10,000                               | 120    | 0.002        | 0.21  |
| 0.8           | 3                 | 25,000                                                                | 850    | 0.04         | 0.45  | 25,000                                            | 780    | 0.03         | 0.4   | 23,000                                     | 650    | 0.02         | 0.32  | 20,000                               | 550    | 0.012        | 0.24  |
|               | 4                 | 25,000                                                                | 800    | 0.03         | 0.45  | 25,000                                            | 700    | 0.025        | 0.4   | 23,000                                     | 600    | 0.015        | 0.32  | 20,000                               | 500    | 0.007        | 0.24  |
|               | 5                 | 25,000                                                                | 700    | 0.03         | 0.45  | 23,000                                            | 630    | 0.02         | 0.4   | 20,000                                     | 530    | 0.012        | 0.32  | 18,000                               | 450    | 0.006        | 0.24  |
|               | 6                 | 20,000                                                                | 620    | 0.025        | 0.45  | 20,000                                            | 550    | 0.02         | 0.4   | 18,000                                     | 450    | 0.01         | 0.32  | 16,000                               | 350    | 0.005        | 0.24  |
|               | 8                 | 16,000                                                                | 500    | 0.015        | 0.45  | 16,000                                            | 400    | 0.007        | 0.4   | 14,000                                     | 300    | 0.005        | 0.32  | 12,000                               | 200    | 0.003        | 0.24  |
|               | 10                | 16,000                                                                | 400    | 0.012        | 0.45  | 16,000                                            | 350    | 0.007        | 0.4   | 12,000                                     | 180    | 0.005        | 0.32  | 10,000                               | 150    | 0.003        | 0.24  |
|               | 12                | 16,000                                                                | 300    | 0.007        | 0.45  | 13,000                                            | 220    | 0.005        | 0.4   | 12,000                                     | 120    | 0.003        | 0.32  | 10,000                               | 120    | 0.002        | 0.24  |
| 1             | 2                 | 25,000                                                                | 1,200  | 0.07         | 0.6   | 23,000                                            | 1,000  | 0.06         | 0.5   | 18,000                                     | 900    | 0.05         | 0.4   | 14,000                               | 600    | 0.035        | 0.3   |
|               | 3                 | 25,000                                                                | 1,200  | 0.06         | 0.6   | 23,000                                            | 1,000  | 0.05         | 0.5   | 18,000                                     | 900    | 0.04         | 0.4   | 14,000                               | 600    | 0.03         | 0.3   |
|               | 4                 | 25,000                                                                | 1,000  | 0.05         | 0.6   | 23,000                                            | 900    | 0.04         | 0.5   | 18,000                                     | 800    | 0.03         | 0.4   | 14,000                               | 500    | 0.02         | 0.3   |
|               | 5                 | 22,000                                                                | 1,000  | 0.04         | 0.6   | 20,000                                            | 800    | 0.03         | 0.5   | 16,000                                     | 700    | 0.02         | 0.4   | 12,000                               | 450    | 0.012        | 0.3   |
|               | 6                 | 20,000                                                                | 900    | 0.03         | 0.6   | 18,000                                            | 700    | 0.02         | 0.5   | 14,000                                     | 600    | 0.01         | 0.4   | 10,000                               | 400    | 0.007        | 0.3   |
|               | 7                 | 20,000                                                                | 900    | 0.03         | 0.6   | 18,000                                            | 650    | 0.02         | 0.5   | 14,000                                     | 550    | 0.01         | 0.4   | 10,000                               | 370    | 0.006        | 0.3   |
|               | 8                 | 18,000                                                                | 800    | 0.03         | 0.6   | 16,000                                            | 600    | 0.02         | 0.5   | 12,000                                     | 500    | 0.01         | 0.4   | 8,000                                | 340    | 0.005        | 0.3   |
|               | 9                 | 18,000                                                                | 700    | 0.02         | 0.6   | 16,000                                            | 550    | 0.015        | 0.5   | 12,000                                     | 450    | 0.007        | 0.4   | 8,000                                | 300    | 0.005        | 0.3   |
|               | 10                | 16,000                                                                | 600    | 0.02         | 0.6   | 14,000                                            | 500    | 0.01         | 0.5   | 10,000                                     | 400    | 0.007        | 0.4   | 6,000                                | 250    | 0.005        | 0.3   |
|               | 12                | 16,000                                                                | 500    | 0.02         | 0.6   | 13,000                                            | 400    | 0.01         | 0.5   | 10,000                                     | 300    | 0.005        | 0.4   | 6,000                                | 180    | 0.004        | 0.3   |
|               | 14                | 16,000                                                                | 450    | 0.015        | 0.6   | 13,000                                            | 360    | 0.008        | 0.5   | 10,000                                     | 280    | 0.005        | 0.4   | 5,500                                | 160    | 0.004        | 0.3   |
|               | 16                | 14,000                                                                | 400    | 0.012        | 0.6   | 12,000                                            | 320    | 0.006        | 0.5   | 9,000                                      | 250    | 0.004        | 0.4   | 5,500                                | 150    | 0.003        | 0.3   |
|               | 18                | 14,000                                                                | 300    | 0.01         | 0.6   | 12,000                                            | 240    | 0.006        | 0.5   | 8,000                                      | 200    | 0.004        | 0.4   | 5,000                                | 120    | 0.002        | 0.3   |
|               | 20                | 12,000                                                                | 200    | 0.007        | 0.6   | 10,000                                            | 160    | 0.005        | 0.5   | 7,000                                      | 130    | 0.003        | 0.4   | 4,500                                | 90     | 0.001        | 0.3   |
|               | 22                | 12,000                                                                | 180    | 0.005        | 0.6   | 10,000                                            | 150    | 0.003        | 0.5   | 6,000                                      | 100    | 0.002        | 0.4   | 4,200                                | 60     | 0.001        | 0.3   |
|               | 6                 | 20,000                                                                | 900    | 0.04         | 0.7   | 18,000                                            | 700    | 0.03         | 0.6   | 14,000                                     | 600    | 0.02         | 0.5   | 10,000                               | 400    | 0.01         | 0.4   |
|               | 8                 | 18,000                                                                | 800    | 0.04         | 0.7   | 16,000                                            | 600    | 0.02         | 0.6   | 12,000                                     | 500    | 0.01         | 0.5   | 8,000                                | 340    | 0.007        | 0.4   |
|               | 10                | 16,000                                                                | 600    | 0.03         | 0.7   | 12,000                                            | 500    | 0.02         | 0.6   | 10,000                                     | 430    | 0.01         | 0.5   | 8,000                                | 300    | 0.005        | 0.4   |
|               | 12                | 14,000                                                                | 600    | 0.02         | 0.7   | 10,000                                            | 500    | 0.01         | 0.6   | 9,000                                      | 400    | 0.007        | 0.5   | 7,000                                | 250    | 0.005        | 0.4   |
| 1.2           | 16                | 12,000                                                                | 400    | 0.018        | 0.7   | 9,000                                             | 300    | 0.01         | 0.6   | 8,000                                      | 260    | 0.005        | 0.5   | 6,000                                | 180    | 0.003        | 0.4   |
|               | 6                 | 22,000                                                                | 1,000  | 0.06         | 0.8   | 20,000                                            | 800    | 0.04         | 0.7   | 18,000                                     | 700    | 0.03         | 0.56  | 12,000                               | 450    | 0.02         | 0.42  |
| 1.4           | 12                | 16,000                                                                | 700    | 0.03         | 0.8   | 13,000                                            | 500    | 0.01         | 0.7   | 11,000                                     | 400    | 0.007        | 0.56  | 8,000                                | 280    | 0.005        | 0.42  |
| 1.5           | 4                 | 23,000                                                                | 1,200  | 0.07         | 0.9   | 20,000                                            | 900    | 0.05         | 0.75  | 18,000                                     | 800    | 0.04         | 0.6   | 14,000                               | 600    | 0.03         | 0.45  |
|               | 6                 | 23,000                                                                | 1,000  | 0.06         | 0.9   | 20,000                                            | 800    | 0.04         | 0.75  | 18,000                                     | 700    | 0.03         | 0.6   | 14,000                               | 500    | 0.02         | 0.45  |
|               | 8                 | 20,000                                                                | 900    | 0.06         | 0.9   | 18,000                                            | 600    | 0.03         | 0.75  | 14,000                                     | 600    | 0.03         | 0.6   | 10,000                               | 380    | 0.01         | 0.45  |
|               | 10                | 20,000                                                                | 800    | 0.04         | 0.9   | 16,000                                            | 500    | 0.03         | 0.75  | 14,000                                     | 500    | 0.02         | 0.6   | 10,000                               | 350    | 0.01         | 0.45  |
|               | 12                | 16,000                                                                | 700    | 0.04         | 0.9   | 14,000                                            | 500    | 0.02         | 0.75  | 12,000                                     | 430    | 0.02         | 0.6   | 8,000                                | 310    | 0.007        | 0.45  |
|               | 14                | 14,000                                                                | 600    | 0.03         | 0.9   | 12,000                                            | 400    | 0.02         | 0.75  | 10,000                                     | 380    | 0.01         | 0.6   | 7,500                                | 250    | 0.007        | 0.45  |
|               | 16                | 12,000                                                                | 500    | 0.02         | 0.9   | 10,000                                            | 360    | 0.01         | 0.75  | 9,000                                      | 300    | 0.007        | 0.6   | 6,800                                | 200    | 0.005        | 0.45  |
|               | 18                | 10,000                                                                | 400    | 0.02         | 0.9   | 9,000                                             | 330    | 0.008        | 0.75  | 8,000                                      | 260    | 0.005        | 0.6   | 6,000                                | 170    | 0.004        | 0.45  |
|               | 20                | 9,000                                                                 | 320    | 0.014        | 0.9   | 8,000                                             | 280    | 0.005        | 0.75  | 7,000                                      | 200    | 0.004        | 0.6   | 5,500                                | 150    | 0.003        | 0.45  |
|               | 25                | 8,000                                                                 | 250    | 0.01         | 0.9   | 7,000                                             | 200    | 0.004        | 0.75  | 6,000                                      | 150    | 0.003        | 0.6   | 4,500                                | 100    | 0.002        | 0.45  |
|               | 30                | 7,000                                                                 | 200    | 0.005        | 0.9   | 6,000                                             | 150    | 0.003        | 0.75  | 5,000                                      | 110    | 0.002        | 0.6   | 4,000                                | 80     | 0.002        | 0.45  |
| 1.6           | 35                | 6,000                                                                 | 150    | 0.003        | 0.9   | 5,000                                             | 110    | 0.002        | 0.75  | 4,500                                      | 90     | 0.002        | 0.6   | 3,500                                | 60     | 0.002        | 0.45  |
|               | 6                 | 22,000                                                                | 1,000  | 0.06         | 0.96  | 19,000                                            | 850    | 0.04         | 0.8   | 17,000                                     | 750    | 0.03         | 0.64  | 13,000                               | 600    | 0.025        | 0.48  |
|               | 8                 | 20,000                                                                | 900    | 0.06         | 0.96  | 17,000                                            | 750    | 0.03         | 0.8   | 14,000                                     | 600    | 0.03         | 0.64  | 10,000                               | 430    | 0.015        | 0.48  |

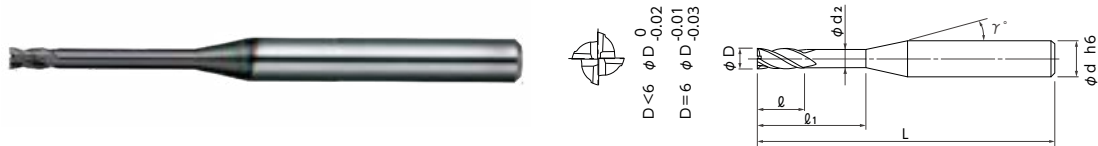
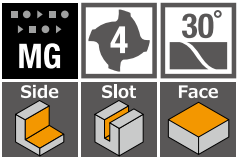
| Work Material |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>（～43HRC）                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>（～55HRC） |        |              |       | Hardened Steels<br>SKD11・PD613<br>（～62HRC） |        |              |       | High Speed Steels<br>SKH<br>（～65HRC） |        |              |       |
|---------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 1.8           | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,000  | 0.07         | 1     | 18,000                                            | 900    | 0.05         | 0.9   | 15,000                                     | 750    | 0.04         | 0.7   | 12,000                               | 600    | 0.03         | 0.5   |
|               | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 900    | 0.06         | 1     | 16,000                                            | 800    | 0.04         | 0.9   | 12,000                                     | 600    | 0.03         | 0.7   | 9,500                                | 500    | 0.02         | 0.5   |
|               | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 0.06         | 1     | 14,000                                            | 700    | 0.04         | 0.9   | 12,000                                     | 500    | 0.03         | 0.7   | 9,500                                | 450    | 0.02         | 0.5   |
|               | 12                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 0.05         | 1     | 12,000                                            | 600    | 0.03         | 0.9   | 10,000                                     | 500    | 0.02         | 0.7   | 8,200                                | 400    | 0.01         | 0.5   |
|               | 14                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 0.05         | 1     | 12,000                                            | 600    | 0.03         | 0.9   | 10,000                                     | 430    | 0.02         | 0.7   | 8,200                                | 360    | 0.01         | 0.5   |
|               | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 600    | 0.04         | 1     | 10,000                                            | 500    | 0.02         | 0.9   | 9,200                                      | 400    | 0.01         | 0.7   | 7,500                                | 340    | 0.007        | 0.5   |
|               | 18                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500    | 0.04         | 1     | 9,200                                             | 410    | 0.02         | 0.9   | 8,500                                      | 370    | 0.01         | 0.7   | 6,000                                | 320    | 0.007        | 0.5   |
| 2             | 4                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,200  | 0.1          | 1.2   | 18,000                                            | 1,000  | 0.08         | 1     | 15,000                                     | 800    | 0.06         | 0.8   | 12,000                               | 600    | 0.04         | 0.6   |
|               | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,000  | 0.08         | 1.2   | 18,000                                            | 900    | 0.06         | 1     | 15,000                                     | 750    | 0.05         | 0.8   | 12,000                               | 600    | 0.03         | 0.6   |
|               | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 900    | 0.07         | 1.2   | 16,000                                            | 800    | 0.05         | 1     | 12,000                                     | 600    | 0.04         | 0.8   | 9,500                                | 500    | 0.02         | 0.6   |
|               | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 0.06         | 1.2   | 14,000                                            | 700    | 0.05         | 1     | 12,000                                     | 500    | 0.04         | 0.8   | 9,500                                | 450    | 0.02         | 0.6   |
|               | 12                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 0.05         | 1.2   | 12,000                                            | 600    | 0.04         | 1     | 10,000                                     | 500    | 0.03         | 0.8   | 8,200                                | 400    | 0.01         | 0.6   |
|               | 14                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 0.04         | 1.2   | 12,000                                            | 600    | 0.03         | 1     | 10,000                                     | 430    | 0.02         | 0.8   | 8,200                                | 360    | 0.007        | 0.6   |
|               | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 600    | 0.04         | 1.2   | 10,000                                            | 500    | 0.03         | 1     | 9,200                                      | 400    | 0.02         | 0.8   | 7,500                                | 340    | 0.007        | 0.6   |
|               | 18                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500    | 0.03         | 1.2   | 9,200                                             | 410    | 0.02         | 1     | 8,500                                      | 370    | 0.01         | 0.8   | 6,000                                | 320    | 0.005        | 0.6   |
|               | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 400    | 0.03         | 1.2   | 9,200                                             | 380    | 0.02         | 1     | 8,500                                      | 340    | 0.01         | 0.8   | 6,000                                | 280    | 0.005        | 0.6   |
|               | 25                | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 350    | 0.02         | 1.2   | 8,500                                             | 330    | 0.015        | 1     | 8,000                                      | 300    | 0.008        | 0.8   | 5,000                                | 180    | 0.004        | 0.6   |
|               | 30                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 300    | 0.015        | 1.2   | 7,500                                             | 280    | 0.01         | 1     | 7,000                                      | 250    | 0.006        | 0.8   | 4,500                                | 150    | 0.004        | 0.6   |
|               | 35                | 7,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 250    | 0.012        | 1.2   | 6,500                                             | 230    | 0.008        | 1     | 6,000                                      | 200    | 0.005        | 0.8   | 4,000                                | 120    | 0.003        | 0.6   |
|               | 40                | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 200    | 0.008        | 1.2   | 5,500                                             | 180    | 0.005        | 1     | 5,000                                      | 150    | 0.004        | 0.8   | 3,500                                | 100    | 0.003        | 0.6   |
| 50            | 5,000             | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.005  | 1.2          | 4,500 | 100                                               | 0.004  | 1            | 4,000 | 80                                         | 0.003  | 0.8          | 3,000 | 55                                   | 0.002  | 0.6          |       |
| 2.5           | 8                 | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,000  | 0.08         | 1.5   | 14,000                                            | 800    | 0.07         | 1.25  | 10,000                                     | 700    | 0.05         | 1     | 8,000                                | 500    | 0.03         | 0.75  |
|               | 12                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 0.07         | 1.5   | 12,000                                            | 700    | 0.06         | 1.25  | 9,600                                      | 600    | 0.04         | 1     | 7,500                                | 480    | 0.02         | 0.75  |
|               | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 0.06         | 1.5   | 10,000                                            | 600    | 0.05         | 1.25  | 8,500                                      | 500    | 0.02         | 1     | 7,000                                | 400    | 0.01         | 0.75  |
|               | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 600    | 0.06         | 1.5   | 8,200                                             | 500    | 0.05         | 1.25  | 7,500                                      | 500    | 0.02         | 1     | 5,000                                | 400    | 0.01         | 0.75  |
|               | 30                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 400    | 0.03         | 1.5   | 7,000                                             | 300    | 0.025        | 1.25  | 6,000                                      | 250    | 0.015        | 1     | 4,000                                | 150    | 0.008        | 0.75  |
|               | 40                | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 250    | 0.015        | 1.5   | 5,500                                             | 200    | 0.012        | 1.25  | 5,000                                      | 180    | 0.01         | 1     | 3,500                                | 110    | 0.005        | 0.75  |
|               | 50                | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 150    | 0.01         | 1.5   | 4,500                                             | 120    | 0.008        | 1.25  | 4,000                                      | 100    | 0.005        | 1     | 3,000                                | 70     | 0.004        | 0.75  |
| 3             | 8                 | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,000  | 0.15         | 1.8   | 14,000                                            | 900    | 0.1          | 1.5   | 10,000                                     | 800    | 0.07         | 1.2   | 8,000                                | 600    | 0.05         | 0.9   |
|               | 12                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 900    | 0.1          | 1.8   | 12,000                                            | 800    | 0.08         | 1.5   | 9,200                                      | 700    | 0.06         | 1.2   | 7,200                                | 500    | 0.04         | 0.9   |
|               | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 0.08         | 1.8   | 10,000                                            | 700    | 0.07         | 1.5   | 8,500                                      | 600    | 0.05         | 1.2   | 6,500                                | 400    | 0.03         | 0.9   |
|               | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 0.08         | 1.8   | 9,000                                             | 700    | 0.07         | 1.5   | 7,800                                      | 600    | 0.04         | 1.2   | 5,800                                | 400    | 0.02         | 0.9   |
|               | 25                | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 700    | 0.07         | 1.8   | 8,200                                             | 600    | 0.06         | 1.5   | 7,000                                      | 500    | 0.03         | 1.2   | 5,000                                | 360    | 0.01         | 0.9   |
| 30            | 8,000             | 700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.05   | 1.8          | 7,000 | 600                                               | 0.03   | 1.5          | 6,500 | 500                                        | 0.02   | 1.2          | 4,500 | 330                                  | 0.007  | 0.9          |       |
| Notes         |                   | ※1 These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.<br>※2 ap:Axial Depth of Cut, ae:Radial Depth of Cut.<br>※3 Recommend to use oil mist coolant for machining hardened steel.<br>※4 Recommend to apply herical or ramping for approaching into axial direction.<br>※5 Adjust feed rate 50% lower and cutting depth(ae) 30% lower for milling deep wall area. When L/D exceeds 8 for stable milling.<br>※6 For slotting, recommend reciprocating milling by adjusting feed & ap in below 50% of recommended milling condition.<br>※7 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※8 Recommend guide slotting process with short neck tool before milling with L/D 5 time or longer neck tool.<br>※9 Major adjustment of milling conditions appropriately on milling profile, machine tool and etc. required for the tools smaller than Dia. 0.5mm, or L/D 15 times longer. |        |              |       |                                                   |        |              |       |                                            |        |              |       |                                      |        |              |       |



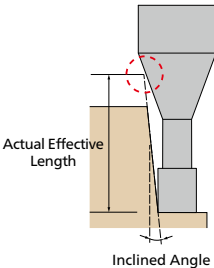
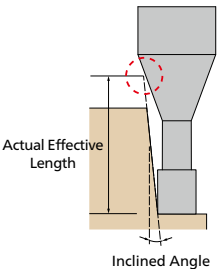
MUGEN COATING PREMIUM 4 -Flute Long Neck End Mill for Hardened Steel

MUGEN COATING PREMIUM 4 -Flute Long Neck End Mill for Hardened Steel

4-flute long neck square end mill for prehardened steels and hardened steels up to 65HRC  
Maximum L/D=10



- MUGEN COATING PREMIUM to improve accuracy and tool life on machining hardened steels!
- Improve tool rigidity for precision machining!
- Total 55 sizes!



 Prehardened Steel **P**

 Stainless Steel **M**

 Prehardened Steel **P**

 Stainless Steel **M**

 Titanium Alloy Heat Resistant Alloy **S**

 Hardened Steel **H**

 Titanium Alloy Heat Resistant Alloy **S**

 Hardened Steel **H**

 Long Neck Square Coating

 Long Neck Square Coating

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(l1) | Length of<br>Cut<br>(l) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|-------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
|                |             |                              |                         |                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00217-01004 | 1           | 4                            | 0.8                     | 0.95              | 12°                        | 4                    | 50                       | 4.29                                                                | 4.49  | 4.70  | 4.93  | 5.47  |
| 08-00217-01006 |             | 6                            |                         |                   |                            |                      | 50                       | 6.38                                                                | 6.66  | 6.98  | 7.32  | 8.12  |
| 08-00217-01008 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.84  | 9.26  | 9.71  | 10.77 |
| 08-00217-01010 |             | 10                           |                         |                   |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.54 | 12.11 | 13.43 |
| 08-00217-01206 | 1.2         | 6                            | 1                       | 1.15              | 12°                        | 4                    | 50                       | 6.38                                                                | 6.66  | 6.98  | 7.32  | 8.12  |
| 08-00217-01208 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.84  | 9.26  | 9.71  | 10.77 |
| 08-00217-01210 |             | 10                           |                         |                   |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.54 | 12.11 | 13.43 |
| 08-00217-01212 |             | 12                           |                         |                   |                            |                      | 50                       | 12.64                                                               | 13.20 | 13.82 | 14.50 | 16.08 |
| 08-00217-01506 | 1.5         | 6                            | 1.2                     | 1.45              | 12°                        | 4                    | 50                       | 6.38                                                                | 6.66  | 6.98  | 7.32  | 8.12  |
| 08-00217-01508 |             | 8                            |                         |                   |                            |                      | 50                       | 8.47                                                                | 8.84  | 9.26  | 9.71  | 10.77 |
| 08-00217-01510 |             | 10                           |                         |                   |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.54 | 12.11 | 13.43 |
| 08-00217-01512 |             | 12                           |                         |                   |                            |                      | 50                       | 12.64                                                               | 13.20 | 13.82 | 14.50 | 16.08 |
| 08-00217-01514 |             | 14                           |                         |                   |                            |                      | 60                       | 14.72                                                               | 15.38 | 16.10 | 16.89 | 18.74 |
| 08-00217-01516 |             | 16                           |                         |                   |                            |                      | 60                       | 16.81                                                               | 17.56 | 18.38 | 19.29 | 21.39 |
| 08-00217-01806 | 1.8         | 6                            | 1.4                     | 1.74              | 12°                        | 4                    | 50                       | 6.40                                                                | 6.69  | 7.00  | 7.35  | 8.15  |
| 08-00217-01808 |             | 8                            |                         |                   |                            |                      | 50                       | 8.49                                                                | 8.87  | 9.29  | 9.74  | 10.81 |
| 08-00217-01810 |             | 10                           |                         |                   |                            |                      | 50                       | 10.58                                                               | 11.05 | 11.57 | 12.13 | 13.46 |
| 08-00217-01812 |             | 12                           |                         |                   |                            |                      | 50                       | 12.66                                                               | 13.23 | 13.85 | 14.53 | 16.11 |
| 08-00217-01814 |             | 14                           |                         |                   |                            |                      | 60                       | 14.75                                                               | 15.41 | 16.13 | 16.92 | 18.77 |
| 08-00217-01816 |             | 16                           |                         |                   |                            |                      | 60                       | 16.83                                                               | 17.59 | 18.41 | 19.31 | Free  |
| 08-00217-01818 |             | 18                           |                         |                   |                            |                      | 60                       | 18.92                                                               | 19.76 | 20.69 | 21.71 | Free  |

How to Order

When you order, indicate MHRH430 (D)×(l1). ※(γ) is reference value.

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(l1) | Length of<br>Cut<br>(l) | Neck Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|-------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
|                |             |                              |                         |                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00217-02006 | 2           | 6                            | 1.6                     | 1.94              | 12°                        | 4                    | 50                       | 6.40                                                                | 6.69  | 7.00  | 7.35  | 8.15  |
| 08-00217-02008 |             | 8                            |                         |                   |                            |                      | 50                       | 8.49                                                                | 8.87  | 9.29  | 9.74  | 10.81 |
| 08-00217-02010 |             | 10                           |                         |                   |                            |                      | 50                       | 10.58                                                               | 11.05 | 11.57 | 12.13 | 13.46 |
| 08-00217-02012 |             | 12                           |                         |                   |                            |                      | 50                       | 12.66                                                               | 13.23 | 13.85 | 14.53 | 16.11 |
| 08-00217-02014 |             | 14                           |                         |                   |                            |                      | 60                       | 14.75                                                               | 15.41 | 16.13 | 16.92 | 18.77 |
| 08-00217-02016 |             | 16                           |                         |                   |                            |                      | 60                       | 16.83                                                               | 17.59 | 18.41 | 19.31 | Free  |
| 08-00217-02018 |             | 18                           |                         |                   |                            |                      | 60                       | 18.92                                                               | 19.76 | 20.69 | 21.71 | Free  |
| 08-00217-02020 |             | 20                           |                         |                   |                            |                      | 60                       | 21.00                                                               | 21.94 | 22.97 | 24.10 | Free  |
| 08-00217-02508 | 2.5         | 8                            | 2                       | 2.4               | 12°                        | 4                    | 50                       | 8.59                                                                | 8.97  | 9.39  | 9.85  | 10.93 |
| 08-00217-02512 |             | 12                           |                         |                   |                            |                      | 50                       | 12.76                                                               | 13.33 | 13.95 | 14.64 | Free  |
| 08-00217-02516 |             | 16                           |                         |                   |                            |                      | 60                       | 16.93                                                               | 17.69 | 18.52 | 19.43 | Free  |
| 08-00217-02520 |             | 20                           |                         |                   |                            |                      | 60                       | 21.10                                                               | 22.05 | 23.08 | Free  | Free  |
| 08-00217-02525 |             | 25                           |                         |                   |                            |                      | 70                       | 26.32                                                               | 27.49 | Free  | Free  | Free  |
| 08-00217-03008 | 3           | 8                            | 4.5                     | 2.85              | 12°                        | 6                    | 50                       | 8.71                                                                | 9.10  | 9.53  | 9.99  | 11.09 |
| 08-00217-03012 |             | 12                           |                         |                   |                            |                      | 50                       | 12.88                                                               | 13.46 | 14.09 | 14.78 | 16.40 |
| 08-00217-03016 |             | 16                           |                         |                   |                            |                      | 60                       | 17.05                                                               | 17.82 | 18.65 | 19.57 | 21.70 |
| 08-00217-03020 |             | 20                           |                         |                   |                            |                      | 60                       | 21.22                                                               | 22.17 | 23.21 | 24.35 | 27.01 |
| 08-00217-03025 |             | 25                           |                         |                   |                            |                      | 70                       | 26.44                                                               | 27.62 | 28.92 | 30.34 | Free  |
| 08-00217-03030 |             | 30                           |                         |                   |                            |                      | 70                       | 31.65                                                               | 33.07 | 34.62 | 36.32 | Free  |
| 08-00217-04012 | 4           | 12                           | 6                       | 3.8               | 12°                        | 6                    | 50                       | 13.00                                                               | 13.59 | 14.22 | 14.92 | 16.55 |
| 08-00217-04016 |             | 16                           |                         |                   |                            |                      | 60                       | 17.18                                                               | 17.94 | 18.78 | 19.71 | Free  |
| 08-00217-04020 |             | 20                           |                         |                   |                            |                      | 60                       | 21.35                                                               | 22.30 | 23.35 | 24.49 | Free  |
| 08-00217-04025 |             | 25                           |                         |                   |                            |                      | 70                       | 26.56                                                               | 27.75 | 29.05 | Free  | Free  |
| 08-00217-04030 |             | 30                           |                         |                   |                            |                      | 70                       | 31.78                                                               | 33.20 | 34.75 | Free  | Free  |
| 08-00217-04035 |             | 35                           |                         |                   |                            |                      | 80                       | 36.99                                                               | 38.64 | Free  | Free  | Free  |
| 08-00217-04040 | 5           | 40                           | 7.5                     | 4.8               | 12°                        | 6                    | 90                       | 42.20                                                               | 44.09 | Free  | Free  | Free  |
| 08-00217-05016 |             | 16                           |                         |                   |                            |                      | 60                       | 17.18                                                               | 17.94 | 18.78 | Free  | Free  |
| 08-00217-05025 |             | 25                           |                         |                   |                            |                      | 70                       | 26.56                                                               | 27.75 | Free  | Free  | Free  |
| 08-00217-05035 |             | 35                           |                         |                   |                            |                      | 80                       | 36.99                                                               | Free  | Free  | Free  | Free  |
| 08-00217-05050 |             | 50                           |                         |                   |                            |                      | 110                      | 52.63                                                               | Free  | Free  | Free  | Free  |
| 08-00217-06020 | 6           | 20                           | 9                       | 5.8               | -                          | 6                    | 80                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00217-06030 |             | 30                           |                         |                   |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00217-06040 |             | 40                           |                         |                   |                            |                      | 100                      | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00217-06050 |             | 50                           |                         |                   |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free  |

Prehardened Steel

Stainless Steel

P

M

Titanium Alloy  
Heat Resistant Alloy

Hardened Steel

S

H



| Work Material |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |              |       | High Speed Steels<br>SKH<br>(~65HRC) |        |              |       |
|---------------|-------------------|-----------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                         | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 1             | 4                 | 25,000                                                                | 2,000  | 0.05         | 0.6   | 23,000                                            | 1,800  | 0.04         | 0.5   | 18,000                                     | 1,600  | 0.03         | 0.4   | 14,000                               | 1,000  | 0.02         | 0.3   |
|               | 6                 | 20,000                                                                | 1,800  | 0.03         | 0.6   | 18,000                                            | 1,400  | 0.02         | 0.5   | 14,000                                     | 1,200  | 0.01         | 0.4   | 10,000                               | 800    | 0.007        | 0.3   |
|               | 8                 | 18,000                                                                | 1,600  | 0.03         | 0.6   | 16,000                                            | 1,200  | 0.02         | 0.5   | 12,000                                     | 1,000  | 0.01         | 0.4   | 8,000                                | 680    | 0.005        | 0.3   |
|               | 10                | 16,000                                                                | 1,200  | 0.02         | 0.6   | 14,000                                            | 1,000  | 0.01         | 0.5   | 10,000                                     | 800    | 0.007        | 0.4   | 6,000                                | 500    | 0.005        | 0.3   |
| 1.2           | 6                 | 20,000                                                                | 1,800  | 0.04         | 0.7   | 18,000                                            | 1,400  | 0.03         | 0.6   | 14,000                                     | 1,200  | 0.02         | 0.5   | 10,000                               | 800    | 0.01         | 0.4   |
|               | 8                 | 18,000                                                                | 1,600  | 0.04         | 0.7   | 16,000                                            | 1,200  | 0.02         | 0.6   | 12,000                                     | 1,000  | 0.01         | 0.5   | 8,000                                | 680    | 0.007        | 0.4   |
|               | 10                | 16,000                                                                | 1,200  | 0.03         | 0.7   | 12,000                                            | 1,000  | 0.02         | 0.6   | 10,000                                     | 850    | 0.01         | 0.5   | 8,000                                | 600    | 0.005        | 0.4   |
|               | 12                | 14,000                                                                | 1,200  | 0.02         | 0.7   | 10,000                                            | 1,000  | 0.01         | 0.6   | 9,000                                      | 800    | 0.007        | 0.5   | 7,000                                | 500    | 0.005        | 0.4   |
| 1.5           | 6                 | 23,000                                                                | 2,000  | 0.06         | 0.9   | 20,000                                            | 1,600  | 0.04         | 0.75  | 18,000                                     | 1,400  | 0.03         | 0.6   | 14,000                               | 1,000  | 0.02         | 0.45  |
|               | 8                 | 20,000                                                                | 1,800  | 0.06         | 0.9   | 18,000                                            | 1,200  | 0.03         | 0.75  | 14,000                                     | 1,200  | 0.03         | 0.6   | 10,000                               | 750    | 0.01         | 0.45  |
|               | 10                | 20,000                                                                | 1,600  | 0.04         | 0.9   | 16,000                                            | 1,000  | 0.03         | 0.75  | 14,000                                     | 1,000  | 0.02         | 0.6   | 10,000                               | 700    | 0.01         | 0.45  |
|               | 12                | 16,000                                                                | 1,400  | 0.04         | 0.9   | 14,000                                            | 1,000  | 0.02         | 0.75  | 12,000                                     | 850    | 0.02         | 0.6   | 8,000                                | 620    | 0.007        | 0.45  |
|               | 14                | 14,000                                                                | 1,200  | 0.03         | 0.9   | 12,000                                            | 800    | 0.02         | 0.75  | 10,000                                     | 750    | 0.01         | 0.6   | 7,500                                | 500    | 0.007        | 0.45  |
|               | 16                | 12,000                                                                | 1,000  | 0.02         | 0.9   | 10,000                                            | 720    | 0.01         | 0.75  | 9,000                                      | 600    | 0.007        | 0.6   | 6,800                                | 400    | 0.005        | 0.45  |
| 1.8           | 6                 | 20,000                                                                | 2,000  | 0.07         | 1     | 18,000                                            | 1,800  | 0.05         | 0.9   | 15,000                                     | 1,500  | 0.04         | 0.7   | 12,000                               | 1,200  | 0.03         | 0.5   |
|               | 8                 | 18,000                                                                | 1,800  | 0.06         | 1     | 16,000                                            | 1,600  | 0.04         | 0.9   | 12,000                                     | 1,200  | 0.03         | 0.7   | 9,500                                | 1,000  | 0.02         | 0.5   |
|               | 10                | 16,000                                                                | 1,600  | 0.06         | 1     | 14,000                                            | 1,400  | 0.04         | 0.9   | 12,000                                     | 1,000  | 0.03         | 0.7   | 9,500                                | 900    | 0.02         | 0.5   |
|               | 12                | 14,000                                                                | 1,400  | 0.05         | 1     | 12,000                                            | 1,200  | 0.03         | 0.9   | 10,000                                     | 1,000  | 0.02         | 0.7   | 8,200                                | 800    | 0.01         | 0.5   |
|               | 14                | 14,000                                                                | 1,400  | 0.05         | 1     | 12,000                                            | 1,200  | 0.03         | 0.9   | 10,000                                     | 860    | 0.02         | 0.7   | 8,200                                | 720    | 0.01         | 0.5   |
|               | 16                | 12,000                                                                | 1,200  | 0.04         | 1     | 10,000                                            | 1,000  | 0.02         | 0.9   | 9,200                                      | 800    | 0.01         | 0.7   | 7,500                                | 680    | 0.007        | 0.5   |
|               | 18                | 10,000                                                                | 1,000  | 0.04         | 1     | 9,200                                             | 820    | 0.02         | 0.9   | 8,500                                      | 740    | 0.01         | 0.7   | 6,000                                | 640    | 0.007        | 0.5   |
| 2             | 6                 | 20,000                                                                | 2,000  | 0.08         | 1.2   | 18,000                                            | 1,800  | 0.06         | 1     | 15,000                                     | 1,500  | 0.05         | 0.8   | 12,000                               | 1,200  | 0.03         | 0.6   |
|               | 8                 | 18,000                                                                | 1,800  | 0.07         | 1.2   | 16,000                                            | 1,600  | 0.05         | 1     | 12,000                                     | 1,200  | 0.04         | 0.8   | 9,500                                | 1,000  | 0.02         | 0.6   |
|               | 10                | 16,000                                                                | 1,600  | 0.06         | 1.2   | 14,000                                            | 1,400  | 0.05         | 1     | 12,000                                     | 1,000  | 0.04         | 0.8   | 9,500                                | 900    | 0.02         | 0.6   |
|               | 12                | 14,000                                                                | 1,400  | 0.05         | 1.2   | 12,000                                            | 1,200  | 0.04         | 1     | 10,000                                     | 1,000  | 0.03         | 0.8   | 8,200                                | 800    | 0.01         | 0.6   |
|               | 14                | 14,000                                                                | 1,400  | 0.04         | 1.2   | 12,000                                            | 1,200  | 0.03         | 1     | 10,000                                     | 860    | 0.02         | 0.8   | 8,200                                | 720    | 0.007        | 0.6   |
|               | 16                | 12,000                                                                | 1,200  | 0.04         | 1.2   | 10,000                                            | 1,000  | 0.03         | 1     | 9,200                                      | 800    | 0.02         | 0.8   | 7,500                                | 680    | 0.007        | 0.6   |
|               | 18                | 10,000                                                                | 1,000  | 0.03         | 1.2   | 9,200                                             | 820    | 0.02         | 1     | 8,500                                      | 740    | 0.01         | 0.8   | 6,000                                | 640    | 0.005        | 0.6   |
| 2.5           | 20                | 10,000                                                                | 800    | 0.03         | 1.2   | 9,200                                             | 760    | 0.02         | 1     | 8,500                                      | 680    | 0.01         | 0.8   | 6,000                                | 520    | 0.005        | 0.6   |
|               | 8                 | 16,000                                                                | 2,000  | 0.08         | 1.5   | 14,000                                            | 1,600  | 0.07         | 1.25  | 10,000                                     | 1,400  | 0.05         | 1     | 8,000                                | 1,000  | 0.03         | 0.75  |
|               | 12                | 14,000                                                                | 1,600  | 0.07         | 1.5   | 12,000                                            | 1,400  | 0.06         | 1.25  | 9,600                                      | 1,200  | 0.04         | 1     | 7,500                                | 960    | 0.02         | 0.75  |
|               | 16                | 12,000                                                                | 1,400  | 0.06         | 1.5   | 10,000                                            | 1,200  | 0.05         | 1.25  | 8,500                                      | 1,000  | 0.02         | 1     | 7,000                                | 800    | 0.01         | 0.75  |
|               | 20                | 10,000                                                                | 1,200  | 0.06         | 1.5   | 8,200                                             | 1,000  | 0.05         | 1.25  | 7,500                                      | 1,000  | 0.02         | 1     | 5,000                                | 800    | 0.01         | 0.75  |
| 2.5           | 25                | 8,000                                                                 | 1,000  | 0.05         | 1.5   | 7,000                                             | 800    | 0.03         | 1.25  | 6,500                                      | 680    | 0.01         | 1     | 4,500                                | 550    | 0.005        | 0.75  |

| Work Material |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80 HPM1<br>(~43HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |              |       | High Speed Steels<br>SKH<br>(~65HRC) |        |              |       |
|---------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 3             | 8                 | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2,000  | 0.15         | 1.8   | 14,000                                            | 1,800  | 0.1          | 1.5   | 10,000                                     | 1,600  | 0.07         | 1.2   | 8,000                                | 1,200  | 0.05         | 0.9   |
|               | 12                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1,800  | 0.1          | 1.8   | 12,000                                            | 1,600  | 0.08         | 1.5   | 9,200                                      | 1,400  | 0.06         | 1.2   | 7,200                                | 1,000  | 0.04         | 0.9   |
|               | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1,600  | 0.08         | 1.8   | 10,000                                            | 1,400  | 0.07         | 1.5   | 8,500                                      | 1,200  | 0.05         | 1.2   | 6,500                                | 800    | 0.03         | 0.9   |
|               | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1,600  | 0.08         | 1.8   | 9,000                                             | 1,400  | 0.07         | 1.5   | 7,800                                      | 1,200  | 0.04         | 1.2   | 5,800                                | 800    | 0.02         | 0.9   |
|               | 25                | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.07         | 1.8   | 8,200                                             | 1,200  | 0.06         | 1.5   | 7,000                                      | 1,000  | 0.03         | 1.2   | 5,000                                | 720    | 0.01         | 0.9   |
|               | 30                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.05         | 1.8   | 7,000                                             | 1,200  | 0.03         | 1.5   | 6,500                                      | 1,000  | 0.02         | 1.2   | 4,500                                | 650    | 0.007        | 0.9   |
| 4             | 12                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2,000  | 0.2          | 2.5   | 9,500                                             | 2,000  | 0.15         | 2     | 8,000                                      | 1,600  | 0.08         | 1.6   | 7,000                                | 1,000  | 0.06         | 1.2   |
|               | 16                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2,000  | 0.15         | 2.5   | 8,000                                             | 1,800  | 0.1          | 2     | 7,000                                      | 1,400  | 0.06         | 1.6   | 6,000                                | 1,200  | 0.05         | 1.2   |
|               | 20                | 8,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,800  | 0.12         | 2.5   | 7,000                                             | 1,600  | 0.08         | 2     | 6,500                                      | 1,200  | 0.05         | 1.6   | 5,500                                | 1,000  | 0.04         | 1.2   |
|               | 25                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,600  | 0.1          | 2.5   | 6,000                                             | 1,400  | 0.07         | 2     | 5,200                                      | 1,200  | 0.04         | 1.6   | 4,500                                | 1,000  | 0.03         | 1.2   |
|               | 30                | 6,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.08         | 2.5   | 4,800                                             | 1,000  | 0.05         | 2     | 4,200                                      | 850    | 0.03         | 1.6   | 3,500                                | 620    | 0.02         | 1.2   |
|               | 35                | 5,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,000  | 0.07         | 2.5   | 4,200                                             | 880    | 0.04         | 2     | 3,800                                      | 720    | 0.02         | 1.6   | 3,000                                | 550    | 0.01         | 1.2   |
| 5             | 40                | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 860    | 0.05         | 2.5   | 3,600                                             | 720    | 0.03         | 2     | 3,000                                      | 600    | 0.01         | 1.6   | 2,500                                | 400    | 0.007        | 1.2   |
|               | 16                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2,000  | 0.2          | 3     | 7,000                                             | 1,800  | 0.12         | 2.5   | 5,500                                      | 1,600  | 0.08         | 2     | 4,500                                | 1,000  | 0.06         | 1.5   |
|               | 25                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,600  | 0.15         | 3     | 5,800                                             | 1,400  | 0.07         | 2.5   | 4,200                                      | 1,200  | 0.05         | 2     | 3,000                                | 800    | 0.03         | 1.5   |
|               | 35                | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,200  | 0.1          | 3     | 4,200                                             | 900    | 0.05         | 2.5   | 3,500                                      | 800    | 0.03         | 2     | 2,500                                | 600    | 0.02         | 1.5   |
|               | 50                | 3,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 750    | 0.07         | 3     | 2,800                                             | 620    | 0.03         | 2.5   | 2,500                                      | 500    | 0.02         | 2     | 1,500                                | 350    | 0.01         | 1.5   |
| 6             | 20                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,000  | 0.25         | 4     | 6,500                                             | 1,600  | 0.18         | 3     | 4,500                                      | 1,400  | 0.08         | 2.4   | 3,500                                | 920    | 0.06         | 1.8   |
|               | 30                | 7,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,600  | 0.2          | 4     | 4,500                                             | 1,200  | 0.12         | 3     | 3,500                                      | 1,000  | 0.06         | 2.4   | 2,500                                | 660    | 0.04         | 1.8   |
|               | 40                | 4,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,200  | 0.15         | 4     | 3,000                                             | 1,000  | 0.08         | 3     | 2,500                                      | 800    | 0.03         | 2.4   | 2,000                                | 550    | 0.02         | 1.8   |
|               | 50                | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 850    | 0.1          | 4     | 2,500                                             | 700    | 0.05         | 3     | 2,000                                      | 500    | 0.02         | 2.4   | 1,500                                | 380    | 0.01         | 1.8   |
| Notes         |                   | ※1 These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.<br>※2 ap:Axial Depth of Cut, ae:Radial Depth of Cut.<br>※3 Recommend to use oil mist coolant for machining hardened steel.<br>※4 Recommend to apply herical or ramping for approaching into axial direction.<br>※5 Adjust feed rate 50% lower and cutting depth (ae) 30% lower for milling deep wall area. When L/D exceeds 8 for stable milling.<br>※6 For slotting, recommend reciprocating milling by adjusting feed & ap in below 50% of recommended milling condition.<br>※7 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine. |        |              |       |                                                   |        |              |       |                                            |        |              |       |                                      |        |              |       |

Prehardened Steel

Stainless Steel

P

M

Titanium Alloy  
Heat Resistant Alloy

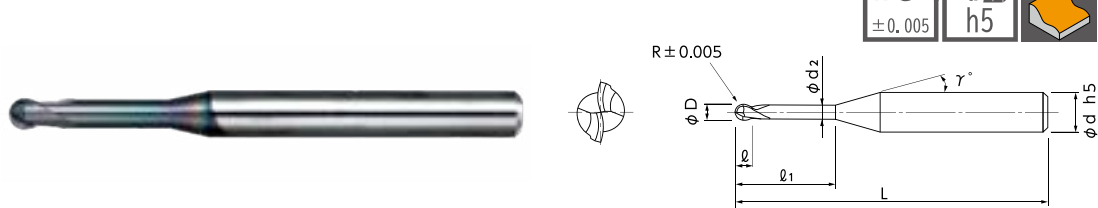
Hardened Steel

S

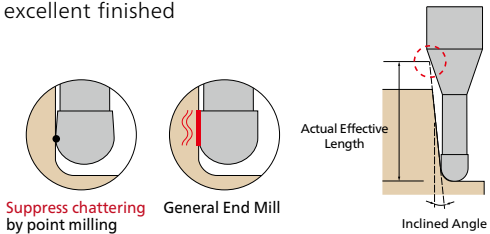
H



Long neck ball end mill for prehardened steels and hardened steels( ~ 65HRC). Maximum L/D=22



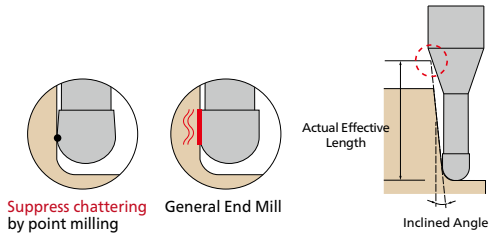
- MUGEN COATING PREMIUM for hardened steels and unique new design excel in chipping prevention and resolves chattering to realize excellent finished surface.
- Applicable for hardened steels up to 65HRC.
- Total 224 sizes!



| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|------|-------|------|------|
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°   | 1°30′ | 2°   | 3°   |
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°   | 1°30′ | 2°   | 3°   |
| 08-00527-00050 | R0.05      | 0.2                    | 0.07              | 0.1      | 0.085          | 12°                  | 4              | 45                 | 0.24                                                             | 0.25 | 0.26  | 0.27 | 0.29 |
| 08-00527-00051 |            | 0.3                    | 0.07              | 0.1      | 0.085          | 12°                  | 4              | 45                 | 0.34                                                             | 0.36 | 0.37  | 0.39 | 0.42 |
| 08-00527-00053 |            | 0.5                    | 0.07              | 0.1      | 0.085          | 12°                  | 4              | 45                 | 0.55                                                             | 0.57 | 0.60  | 0.63 | 0.69 |
| 08-00527-00071 | R0.075     | 0.3                    | 0.1               | 0.15     | 0.13           | 12°                  | 4              | 45                 | 0.36                                                             | 0.37 | 0.39  | 0.40 | 0.44 |
| 08-00527-00073 |            | 0.5                    | 0.1               | 0.15     | 0.13           | 12°                  | 4              | 45                 | 0.57                                                             | 0.59 | 0.61  | 0.64 | 0.70 |
| 08-00527-00075 |            | 1                      | 0.1               | 0.15     | 0.13           | 12°                  | 4              | 45                 | 1.09                                                             | 1.13 | 1.18  | 1.24 | 1.37 |
| 08-00527-00100 | R0.1       | 0.3                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.35                                                             | 0.36 | 0.38  | 0.39 | 0.42 |
| 08-00527-00101 |            | 0.5                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.61  | 0.63 | 0.69 |
| 08-00527-00102 |            | 0.75                   | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.82                                                             | 0.85 | 0.89  | 0.93 | 1.02 |
| 08-00527-00103 |            | 1                      | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 1.08                                                             | 1.13 | 1.18  | 1.23 | 1.35 |
| 08-00528-00103 |            | 1                      | 0.15              | 0.2      | 0.18           | 12°                  | 6              | 50                 | 1.08                                                             | 1.13 | 1.18  | 1.23 | 1.35 |
| 08-00527-00104 |            | 1.25                   | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 1.34                                                             | 1.40 | 1.46  | 1.53 | 1.68 |
| 08-00527-00105 |            | 1.5                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 1.60                                                             | 1.67 | 1.75  | 1.83 | 2.02 |
| 08-00527-00106 |            | 1.75                   | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 1.86                                                             | 1.94 | 2.03  | 2.13 | 2.35 |
| 08-00527-00107 |            | 2                      | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 2.13                                                             | 2.22 | 2.32  | 2.43 | 2.68 |
| 08-00527-00108 | R0.15      | 2.5                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 2.65                                                             | 2.76 | 2.89  | 3.02 | 3.34 |
| 08-00527-00109 |            | 3                      | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 3.17                                                             | 3.31 | 3.46  | 3.62 | 4.01 |
| 08-00527-00162 |            | 0.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.60  | 0.63 | 0.68 |
| 08-00527-00150 |            | 0.6                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.66                                                             | 0.69 | 0.71  | 0.74 | 0.81 |
| 08-00527-00163 |            | 0.75                   | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.82                                                             | 0.86 | 0.89  | 0.93 | 1.01 |
| 08-00527-00151 |            | 1                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.08                                                             | 1.12 | 1.17  | 1.22 | 1.34 |
| 08-00527-00152 |            | 1.25                   | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.34                                                             | 1.39 | 1.45  | 1.52 | 1.67 |
| 08-00527-00153 |            | 1.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.60                                                             | 1.67 | 1.74  | 1.82 | 2.00 |
| 08-00528-00153 |            | 1.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 6              | 50                 | 1.60                                                             | 1.67 | 1.74  | 1.82 | 2.00 |
| 08-00527-00154 | R0.2       | 1.75                   | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.86                                                             | 1.94 | 2.02  | 2.12 | 2.33 |
| 08-00527-00155 |            | 2                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 2.12                                                             | 2.21 | 2.31  | 2.42 | 2.66 |
| 08-00527-00156 |            | 2.25                   | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 2.38                                                             | 2.48 | 2.59  | 2.71 | 3.00 |
| 08-00527-00157 |            | 2.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 2.64                                                             | 2.76 | 2.88  | 3.01 | 3.33 |
| 08-00527-00159 |            | 3                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 3.17                                                             | 3.30 | 3.45  | 3.61 | 3.99 |
| 08-00527-00160 |            | 3.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 3.69                                                             | 3.85 | 4.02  | 4.21 | 4.65 |
| 08-00527-00161 |            | 4                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 4.21                                                             | 4.39 | 4.59  | 4.81 | 5.32 |

How to Order

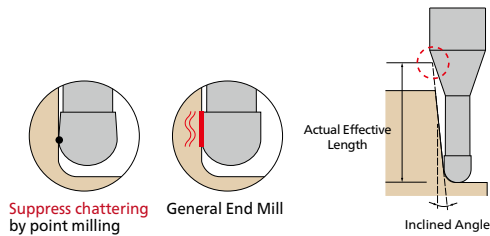
When you order, indicate MRBH230 (R)×(ℓ1)×(d). ※(γ) is reference value.



| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00527-00211 | R0.2       | 0.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 0.59                                                             | 0.60  | 0.62  | 0.64  | 0.69  |
| 08-00527-00201 |            | 0.8                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 0.89                                                             | 0.93  | 0.96  | 1.00  | 1.09  |
| 08-00527-00202 |            | 1                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 1.10                                                             | 1.14  | 1.19  | 1.24  | 1.35  |
| 08-00528-00202 |            | 1                      | 0.3               | 0.4      | 0.37           | 12°                  | 6              | 50                 | 1.10                                                             | 1.14  | 1.19  | 1.24  | 1.35  |
| 08-00527-00203 |            | 1.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 1.62                                                             | 1.69  | 1.76  | 1.84  | 2.02  |
| 08-00527-00204 |            | 2                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 2.15                                                             | 2.23  | 2.33  | 2.43  | 2.68  |
| 08-00528-00204 |            | 2                      | 0.3               | 0.4      | 0.37           | 12°                  | 6              | 50                 | 2.15                                                             | 2.23  | 2.33  | 2.43  | 2.68  |
| 08-00527-00205 |            | 2.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 2.67                                                             | 2.78  | 2.90  | 3.03  | 3.34  |
| 08-00527-00206 |            | 3                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 3.19                                                             | 3.32  | 3.47  | 3.63  | 4.01  |
| 08-00527-00207 |            | 3.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 3.71                                                             | 3.87  | 4.04  | 4.23  | 4.67  |
| 08-00527-00208 |            | 4                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 4.23                                                             | 4.41  | 4.61  | 4.83  | 5.33  |
| 08-00527-00209 |            | 4.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 4.75                                                             | 4.96  | 5.18  | 5.43  | 6.00  |
| 08-00527-00210 |            | 5                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 5.27                                                             | 5.50  | 5.75  | 6.02  | 6.66  |
| 08-00527-00212 |            | 6                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 6.33                                                             | 6.60  | 6.90  | 7.23  | 8.00  |
| 08-00527-00250 | R0.25      | 1                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 1.13                                                             | 1.16  | 1.21  | 1.26  | 1.37  |
| 08-00527-00251 |            | 1.5                    | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 1.65                                                             | 1.71  | 1.78  | 1.85  | 2.03  |
| 08-00527-00252 |            | 2                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 2.17                                                             | 2.25  | 2.35  | 2.45  | 2.69  |
| 08-00527-00253 |            | 2.5                    | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 2.69                                                             | 2.80  | 2.92  | 3.05  | 3.36  |
| 08-00527-00254 |            | 3                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 3.21                                                             | 3.34  | 3.49  | 3.65  | 4.02  |
| 08-00527-00255 |            | 3.5                    | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 3.73                                                             | 3.89  | 4.06  | 4.25  | 4.69  |
| 08-00527-00256 |            | 4                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 4.25                                                             | 4.43  | 4.63  | 4.85  | 5.35  |
| 08-00527-00257 |            | 4.5                    | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 4.78                                                             | 4.98  | 5.20  | 5.44  | 6.01  |
| 08-00527-00258 |            | 5                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 5.30                                                             | 5.52  | 5.77  | 6.04  | 6.68  |
| 08-00527-00259 |            | 5.5                    | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 5.82                                                             | 6.07  | 6.34  | 6.64  | 7.34  |
| 08-00527-00260 |            | 6                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 6.34                                                             | 6.61  | 6.91  | 7.24  | 8.00  |
| 08-00527-00262 |            | 8                      | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 8.42                                                             | 8.79  | 9.19  | 9.63  | 10.66 |
| 08-00527-00264 |            | 10                     | 0.35              | 0.5      | 0.46           | 12°                  | 4              | 45                 | 10.52                                                            | 10.98 | 11.49 | 12.04 | 13.35 |
| 08-00527-00300 | R0.3       | 1                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 1.12                                                             | 1.16  | 1.20  | 1.25  | 1.35  |
| 08-00527-00301 |            | 1.5                    | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 1.64                                                             | 1.71  | 1.77  | 1.84  | 2.02  |
| 08-00527-00302 |            | 2                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 2.17                                                             | 2.25  | 2.34  | 2.44  | 2.68  |
| 08-00528-00302 |            | 2                      | 0.45              | 0.6      | 0.56           | 12°                  | 6              | 50                 | 2.17                                                             | 2.25  | 2.34  | 2.44  | 2.68  |
| 08-00527-00303 |            | 2.5                    | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 2.69                                                             | 2.79  | 2.91  | 3.04  | 3.34  |
| 08-00527-00304 |            | 3                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 3.21                                                             | 3.34  | 3.48  | 3.64  | 4.01  |
| 08-00528-00304 |            | 3                      | 0.45              | 0.6      | 0.56           | 12°                  | 6              | 50                 | 3.21                                                             | 3.34  | 3.48  | 3.64  | 4.01  |
| 08-00527-00305 |            | 3.5                    | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 3.73                                                             | 3.88  | 4.05  | 4.24  | 4.67  |
| 08-00527-00306 |            | 4                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 4.25                                                             | 4.43  | 4.62  | 4.84  | 5.33  |
| 08-00528-00306 |            | 4                      | 0.45              | 0.6      | 0.56           | 12°                  | 6              | 50                 | 4.25                                                             | 4.43  | 4.62  | 4.84  | 5.33  |
| 08-00527-00321 |            | 4.5                    | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 4.78                                                             | 4.98  | 5.20  | 5.45  | 6.02  |
| 08-00527-00308 |            | 5                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 5.29                                                             | 5.52  | 5.76  | 6.03  | 6.66  |
| 08-00527-00322 |            | 5.5                    | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 5.82                                                             | 6.07  | 6.34  | 6.64  | 7.35  |
| 08-00527-00310 |            | 6                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 6.34                                                             | 6.61  | 6.90  | 7.23  | 7.99  |

MRBH230

MUGEN COATING PREMIUM 2-Flute Long Neck Ball End Mill for Hardened Steel



Unit : mm

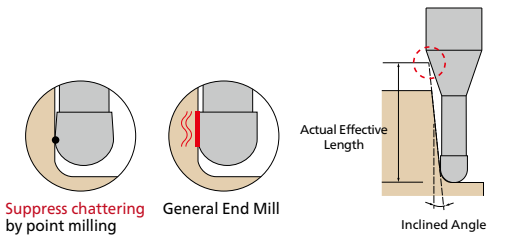
| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|-------------------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                                     |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00527-00312 | R0.3       | 7                                   | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 7.38                                                             | 7.70  | 8.04  | 8.43  | 9.31  |
| 08-00527-00314 |            | 8                                   | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 8.42                                                             | 8.79  | 9.18  | 9.62  | 10.64 |
| 08-00527-00316 |            | 9                                   | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 9.47                                                             | 9.88  | 10.33 | 10.82 | 11.97 |
| 08-00527-00318 |            | 10                                  | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 10.51                                                            | 10.97 | 11.47 | 12.02 | 13.30 |
| 08-00527-00320 |            | 12                                  | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 | 12.59                                                            | 13.14 | 13.75 | 14.41 | 15.95 |
| 08-00527-00350 | R0.35      | 2                                   | 0.5               | 0.7      | 0.66           | 12°                  | 4              | 45                 | 2.17                                                             | 2.25  | 2.34  | 2.44  | 2.67  |
| 08-00527-00351 |            | 4                                   | 0.5               | 0.7      | 0.66           | 12°                  | 4              | 45                 | 4.25                                                             | 4.43  | 4.62  | 4.84  | 5.33  |
| 08-00527-00352 |            | 6                                   | 0.5               | 0.7      | 0.66           | 12°                  | 4              | 45                 | 6.34                                                             | 6.61  | 6.91  | 7.23  | 8.00  |
| 08-00527-00353 |            | 8                                   | 0.5               | 0.7      | 0.66           | 12°                  | 4              | 45                 | 8.43                                                             | 8.79  | 9.19  | 9.63  | 10.66 |
| 08-00527-00401 | R0.4       | 2                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 2.16                                                             | 2.24  | 2.33  | 2.42  | 2.65  |
| 08-00528-00401 |            | 2                                   | 0.6               | 0.8      | 0.76           | 12°                  | 6              | 50                 | 2.16                                                             | 2.24  | 2.33  | 2.42  | 2.65  |
| 08-00527-00402 |            | 3                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 3.20                                                             | 3.33  | 3.47  | 3.62  | 3.97  |
| 08-00527-00403 |            | 4                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 4.25                                                             | 4.42  | 4.61  | 4.82  | 5.30  |
| 08-00527-00404 |            | 5                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 5.29                                                             | 5.51  | 5.75  | 6.01  | 6.63  |
| 08-00527-00405 |            | 6                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 6.33                                                             | 6.60  | 6.89  | 7.21  | 7.96  |
| 08-00527-00406 |            | 7                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 7.38                                                             | 7.69  | 8.03  | 8.41  | 9.28  |
| 08-00527-00407 |            | 8                                   | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 8.42                                                             | 8.78  | 9.17  | 9.60  | 10.61 |
| 08-00527-00409 |            | 10                                  | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 10.50                                                            | 10.96 | 11.45 | 12.00 | 13.26 |
| 08-00527-00410 |            | 12                                  | 0.6               | 0.8      | 0.76           | 12°                  | 4              | 45                 | 12.59                                                            | 13.14 | 13.73 | 14.39 | 15.92 |
| 08-00527-00450 | R0.45      | 2                                   | 0.65              | 0.9      | 0.86           | 12°                  | 4              | 45                 | 2.16                                                             | 2.24  | 2.33  | 2.42  | 2.64  |
| 08-00527-00451 |            | 4                                   | 0.65              | 0.9      | 0.86           | 12°                  | 4              | 45                 | 4.25                                                             | 4.42  | 4.61  | 4.82  | 5.30  |
| 08-00527-00452 |            | 6                                   | 0.65              | 0.9      | 0.86           | 12°                  | 4              | 45                 | 6.34                                                             | 6.60  | 6.89  | 7.21  | 7.96  |
| 08-00527-00453 |            | 8                                   | 0.65              | 0.9      | 0.86           | 12°                  | 4              | 45                 | 8.42                                                             | 8.78  | 9.17  | 9.61  | 10.62 |
| 08-00527-00500 | R0.5       | 2                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 2.18                                                             | 2.26  | 2.34  | 2.43  | 2.65  |
| 08-00527-00514 |            | 2.5                                 | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 2.71                                                             | 2.81  | 2.92  | 3.04  | 3.32  |
| 08-00527-00501 |            | 3                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 3.22                                                             | 3.35  | 3.48  | 3.63  | 3.97  |
| 08-00528-00501 |            | 3                                   | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 3.22                                                             | 3.35  | 3.48  | 3.63  | 3.97  |
| 08-00527-00502 |            | 4                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 4.27                                                             | 4.44  | 4.62  | 4.83  | 5.30  |
| 08-00528-00502 |            | 4                                   | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 4.27                                                             | 4.44  | 4.62  | 4.83  | 5.30  |
| 08-00527-00503 |            | 5                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 5.31                                                             | 5.53  | 5.76  | 6.02  | 6.63  |
| 08-00528-00503 |            | 5                                   | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 5.31                                                             | 5.53  | 5.76  | 6.02  | 6.63  |
| 08-00527-00504 |            | 6                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 6.35                                                             | 6.62  | 6.90  | 7.22  | 7.96  |
| 08-00528-00504 |            | 6                                   | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 6.35                                                             | 6.62  | 6.90  | 7.22  | 7.96  |
| 08-00527-00505 |            | 7                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 7.40                                                             | 7.71  | 8.04  | 8.42  | 9.28  |
| 08-00528-00505 |            | 7                                   | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 7.40                                                             | 7.71  | 8.04  | 8.42  | 9.28  |
| 08-00527-00506 |            | 8                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 8.44                                                             | 8.79  | 9.18  | 9.61  | 10.61 |
| 08-00528-00506 |            | 8                                   | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 8.44                                                             | 8.79  | 9.18  | 9.61  | 10.61 |
| 08-00527-00507 |            | 9                                   | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 9.48                                                             | 9.88  | 10.32 | 10.81 | 11.94 |

How to Order

When you order, indicate MRBH230 (R)×(ℓ<sub>1</sub>)×(d). ※(γ) is reference value.

MRBH230

MUGEN COATING PREMIUM 2-Flute Long Neck Ball End Mill for Hardened Steel



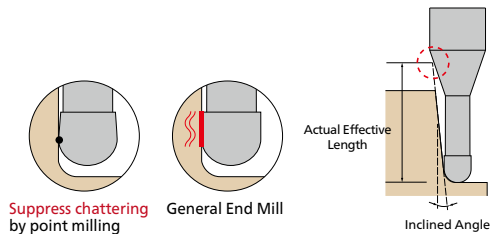
Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|-------------------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                                     |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00527-00508 | R0.5       | 10                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 10.52                                                            | 10.97 | 11.46 | 12.01 | 13.26 |
| 08-00528-00508 |            | 10                                  | 0.75              | 1        | 0.95           | 12°                  | 6              | 50                 | 10.52                                                            | 10.97 | 11.46 | 12.01 | 13.26 |
| 08-00527-00509 |            | 12                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 12.61                                                            | 13.15 | 13.75 | 14.40 | 15.92 |
| 08-00527-00515 |            | 13                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 | 13.66                                                            | 14.25 | 14.90 | 15.62 | 17.29 |
| 08-00527-00510 |            | 14                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 50                 | 14.70                                                            | 15.33 | 16.03 | 16.79 | 18.57 |
| 08-00527-00511 |            | 16                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 50                 | 16.78                                                            | 17.51 | 18.31 | 19.18 | 21.23 |
| 08-00527-00512 |            | 18                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 55                 | 18.87                                                            | 19.69 | 20.59 | 21.58 | 23.88 |
| 08-00527-00513 |            | 20                                  | 0.75              | 1        | 0.95           | 12°                  | 4              | 55                 | 20.95                                                            | 21.87 | 22.87 | 23.97 | 26.54 |
| 08-00528-00516 |            | 22                                  | 0.75              | 1        | 0.95           | 12°                  | 6              | 60                 | 22.82                                                            | 23.59 | 24.43 | 25.33 | 27.34 |
| 08-00527-00600 | R0.6       | 2.4                                 | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 45                 | 2.59                                                             | 2.68  | 2.78  | 2.89  | 3.15  |
| 08-00527-00601 |            | 4                                   | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 45                 | 4.26                                                             | 4.43  | 4.61  | 4.81  | 5.27  |
| 08-00527-00602 |            | 6                                   | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 45                 | 6.35                                                             | 6.61  | 6.89  | 7.20  | 7.92  |
| 08-00527-00603 |            | 8                                   | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 45                 | 8.43                                                             | 8.79  | 9.17  | 9.59  | 10.58 |
| 08-00527-00604 |            | 10                                  | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 45                 | 10.52                                                            | 10.96 | 11.45 | 11.99 | 13.23 |
| 08-00527-00605 |            | 12                                  | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 45                 | 12.61                                                            | 13.14 | 13.73 | 14.38 | 15.89 |
| 08-00527-00606 |            | 14                                  | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 50                 | 14.69                                                            | 15.32 | 16.01 | 16.77 | 18.54 |
| 08-00527-00607 | R0.7       | 16                                  | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 50                 | 16.78                                                            | 17.50 | 18.29 | 19.17 | 21.20 |
| 08-00527-00700 |            | 8                                   | 1                 | 1.4      | 1.35           | 12°                  | 4              | 45                 | 8.44                                                             | 8.78  | 9.17  | 9.59  | 10.57 |
| 08-00527-00701 |            | 12                                  | 1                 | 1.4      | 1.35           | 12°                  | 4              | 50                 | 12.61                                                            | 13.14 | 13.73 | 14.38 | 15.90 |
| 08-00527-00702 | R0.75      | 16                                  | 1                 | 1.4      | 1.35           | 12°                  | 4              | 50                 | 16.78                                                            | 17.50 | 18.30 | 19.17 | 21.22 |
| 08-00527-00750 |            | 3                                   | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 3.21                                                             | 3.33  | 3.45  | 3.58  | 3.89  |
| 08-00527-00751 |            | 4                                   | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 4.26                                                             | 4.41  | 4.59  | 4.78  | 5.22  |
| 08-00527-00753 |            | 6                                   | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 6.34                                                             | 6.59  | 6.87  | 7.17  | 7.88  |
| 08-00528-00753 | R0.75      | 6                                   | 1.1               | 1.5      | 1.45           | 12°                  | 6              | 50                 | 6.34                                                             | 6.59  | 6.87  | 7.17  | 7.88  |
| 08-00527-00755 |            | 8                                   | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 8.43                                                             | 8.77  | 9.15  | 9.56  | 10.53 |
| 08-00528-00755 |            | 8                                   | 1.1               | 1.5      | 1.45           | 12°                  | 6              | 50                 | 8.43                                                             | 8.77  | 9.15  | 9.56  | 10.53 |
| 08-00527-00757 |            | 10                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 10.51                                                            | 10.95 | 11.43 | 11.96 | 13.18 |
| 08-00527-00758 |            | 12                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 12.60                                                            | 13.13 | 13.71 | 14.35 | 15.84 |
| 08-00527-00759 |            | 14                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 50                 | 14.69                                                            | 15.31 | 15.99 | 16.74 | 18.49 |
| 08-00527-00760 |            | 16                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 50                 | 16.77                                                            | 17.49 | 18.27 | 19.14 | 21.15 |
| 08-00527-00761 |            | 18                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 55                 | 18.86                                                            | 19.68 | 20.57 | 21.56 | 23.87 |
| 08-00527-00762 |            | 20                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 55                 | 20.94                                                            | 21.85 | 22.84 | 23.92 | Free  |
| 08-00527-00763 |            | 22                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 60                 | 23.03                                                            | 24.02 | 25.12 | 26.32 | Free  |
| 08-00527-00764 |            | 30                                  | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 70                 | 31.37                                                            | 32.74 | 34.24 | 35.89 | Free  |
| 08-00527-00803 | R0.8       | 8                                   | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 45                 | 8.43                                                             | 8.77  | 9.14  | 9.55  | 10.51 |
| 08-00527-00805 |            | 12                                  | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 45                 | 12.60                                                            | 13.13 | 13.70 | 14.34 | 15.82 |
| 08-00527-00807 |            | 16                                  | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 50                 | 16.77                                                            | 17.48 | 18.27 | 19.13 | 21.13 |
| 08-00527-00809 |            | 20                                  | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 55                 | 20.94                                                            | 21.84 | 22.83 | 23.91 | Free  |



MRBH230

MUGEN COATING PREMIUM 2-Flute Long Neck Ball End Mill for Hardened Steel



Unit : mm

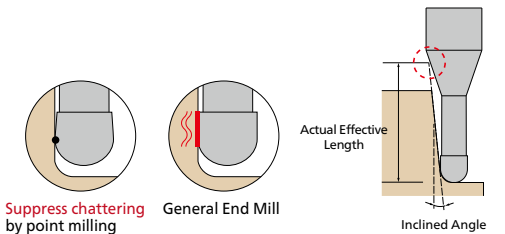
| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00527-01001 | R1         | 3                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 3.23                                                             | 3.33  | 3.44  | 3.56  | 3.85  |
| 08-00527-01002 |            | 4                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 4.27                                                             | 4.42  | 4.58  | 4.76  | 5.17  |
| 08-00528-01002 |            | 4                      | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 4.27                                                             | 4.42  | 4.58  | 4.76  | 5.17  |
| 08-00527-01004 |            | 6                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 6.36                                                             | 6.60  | 6.86  | 7.15  | 7.83  |
| 08-00528-01004 |            | 6                      | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 6.36                                                             | 6.60  | 6.86  | 7.15  | 7.83  |
| 08-00527-01006 |            | 8                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 8.44                                                             | 8.78  | 9.14  | 9.54  | 10.48 |
| 08-00528-01006 |            | 8                      | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 8.44                                                             | 8.78  | 9.14  | 9.54  | 10.48 |
| 08-00527-01008 |            | 10                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 10.53                                                            | 10.95 | 11.42 | 11.94 | 13.14 |
| 08-00528-01008 |            | 10                     | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 10.53                                                            | 10.95 | 11.42 | 11.94 | 13.14 |
| 08-00527-01010 |            | 12                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 12.61                                                            | 13.13 | 13.70 | 14.33 | 15.79 |
| 08-00527-01020 |            | 13                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 13.66                                                            | 14.23 | 14.86 | 15.55 | 17.16 |
| 08-00527-01011 |            | 14                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 50                 | 14.70                                                            | 15.31 | 15.98 | 16.72 | 18.45 |
| 08-00527-01012 |            | 16                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 50                 | 16.78                                                            | 17.49 | 18.27 | 19.12 | Free  |
| 08-00528-01012 |            | 16                     | 1.5               | 2        | 1.94           | 12°                  | 6              | 60                 | 16.78                                                            | 17.49 | 18.27 | 19.12 | Free  |
| 08-00527-01013 |            | 18                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 55                 | 18.87                                                            | 19.67 | 20.55 | 21.51 | Free  |
| 08-00527-01014 |            | 20                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 55                 | 20.96                                                            | 21.85 | 22.83 | 23.90 | Free  |
| 08-00527-01015 |            | 22                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 60                 | 23.04                                                            | 24.03 | 25.11 | 26.30 | Free  |
| 08-00527-01016 |            | 25                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 65                 | 26.17                                                            | 27.30 | 28.53 | 29.89 | Free  |
| 08-00528-01016 |            | 25                     | 1.5               | 2        | 1.94           | 12°                  | 6              | 65                 | 26.17                                                            | 27.30 | 28.53 | 29.89 | Free  |
| 08-00527-01017 |            | 30                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 70                 | 31.38                                                            | 32.74 | 34.23 | Free  | Free  |
| 08-00527-01018 |            | 35                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 70                 | 36.60                                                            | 38.19 | 39.93 | Free  | Free  |
| 08-00527-01019 |            | 40                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 90                 | 41.81                                                            | 43.64 | Free  | Free  | Free  |
| 08-00527-01250 | R1.25      | 6                      | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 45                 | 6.45                                                             | 6.68  | 6.94  | 7.22  | 7.89  |
| 08-00527-01251 |            | 8                      | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 45                 | 8.54                                                             | 8.86  | 9.22  | 9.62  | 10.55 |
| 08-00527-01252 |            | 10                     | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 45                 | 10.62                                                            | 11.04 | 11.49 | 12.00 | 13.18 |
| 08-00527-01253 |            | 15                     | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 50                 | 15.83                                                            | 16.48 | 17.20 | 17.98 | Free  |
| 08-00527-01254 |            | 20                     | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 55                 | 21.04                                                            | 21.93 | 22.90 | Free  | Free  |
| 08-00527-01255 |            | 25                     | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 65                 | 26.26                                                            | 27.38 | 28.60 | Free  | Free  |
| 08-00527-01256 |            | 30                     | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 70                 | 31.47                                                            | 32.82 | Free  | Free  | Free  |
| 08-00527-01257 |            | 35                     | 2.3               | 2.5      | 2.4            | 12°                  | 4              | 70                 | 36.69                                                            | 38.27 | Free  | Free  | Free  |
| 08-00527-01501 | R1.5       | 6                      | 2.5               | 3        | 2.85           | 12°                  | 6              | 60                 | 6.56                                                             | 6.78  | 7.03  | 7.31  | 7.95  |
| 08-00527-01502 |            | 8                      | 2.5               | 3        | 2.85           | 12°                  | 6              | 60                 | 8.64                                                             | 8.96  | 9.31  | 9.70  | 10.60 |
| 08-00527-01503 |            | 10                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 60                 | 10.73                                                            | 11.14 | 11.59 | 12.09 | 13.26 |
| 08-00527-01504 |            | 12                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 60                 | 12.81                                                            | 13.32 | 13.88 | 14.49 | 15.91 |
| 08-00527-01505 |            | 14                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 60                 | 14.90                                                            | 15.50 | 16.16 | 16.88 | 18.57 |
| 08-00527-01506 |            | 16                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 60                 | 16.98                                                            | 17.68 | 18.44 | 19.27 | 21.22 |
| 08-00527-01508 |            | 20                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 65                 | 21.16                                                            | 22.04 | 23.00 | 24.06 | 26.53 |
| 08-00527-01509 |            | 25                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 65                 | 26.37                                                            | 27.48 | 28.70 | 30.04 | Free  |
| 08-00527-01510 |            | 30                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 70                 | 31.58                                                            | 32.93 | 34.40 | 36.03 | Free  |
| 08-00527-01511 |            | 35                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 80                 | 36.80                                                            | 38.38 | 40.11 | 42.01 | Free  |
| 08-00527-01512 |            | 40                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 90                 | 42.01                                                            | 43.83 | 45.81 | Free  | Free  |

How to Order

When you order, indicate MRBH230 (R)×(ℓ1)×(d). ※(γ) is reference value.

MRBH230

MUGEN COATING PREMIUM 2-Flute Long Neck Ball End Mill for Hardened Steel



Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00527-01750 | R1.75      | 15                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 60                 | 15.94                                                            | 16.58 | 17.28 | 18.05 | 19.86 |
| 08-00527-01754 |            | 20                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 65                 | 21.14                                                            | 22.01 | 22.96 | 24.01 | Free  |
| 08-00527-01751 |            | 25                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 65                 | 26.37                                                            | 27.47 | 28.69 | 30.03 | Free  |
| 08-00527-01755 |            | 30                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 70                 | 31.57                                                            | 32.91 | 34.37 | 35.98 | Free  |
| 08-00527-01752 |            | 35                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 80                 | 36.79                                                            | 38.37 | 40.10 | Free  | Free  |
| 08-00527-01756 |            | 40                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 90                 | 42.00                                                            | 43.80 | 45.77 | Free  | Free  |
| 08-00527-01753 |            | 45                     | 2.8               | 3.5      | 3.35           | 12°                  | 6              | 90                 | 47.22                                                            | 49.27 | Free  | Free  | Free  |
| 08-00527-02000 | R2         | 8                      | 3                 | 4        | 3.8            | —                    | 4              | 65                 | 8.74                                                             | 9.05  | 9.38  | 9.74  | 10.60 |
| 08-00527-02001 |            | 8                      | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 | 8.74                                                             | 9.05  | 9.38  | 9.74  | 10.60 |
| 08-00527-02002 |            | 10                     | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 | 10.83                                                            | 11.22 | 11.66 | 12.14 | 13.25 |
| 08-00527-02003 |            | 12                     | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 | 12.91                                                            | 13.40 | 13.94 | 14.53 | 15.91 |
| 08-00527-02101 |            | 14                     | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 | 15.00                                                            | 15.58 | 16.22 | 16.92 | 18.56 |
| 08-00527-02004 |            | 15                     | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 | 16.04                                                            | 16.67 | 17.36 | 18.12 | 19.89 |
| 08-00527-02006 |            | 20                     | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 | 21.26                                                            | 22.12 | 23.06 | 24.10 | Free  |
| 08-00527-02008 |            | 25                     | 3                 | 4        | 3.8            | 12°                  | 6              | 70                 | 26.47                                                            | 27.57 | 28.77 | 30.09 | Free  |
| 08-00527-02010 |            | 30                     | 3                 | 4        | 3.8            | 12°                  | 6              | 70                 | 31.68                                                            | 33.01 | 34.47 | Free  | Free  |
| 08-00527-02011 |            | 35                     | 3                 | 4        | 3.8            | 12°                  | 6              | 80                 | 36.90                                                            | 38.46 | 40.17 | Free  | Free  |
| 08-00527-02012 |            | 40                     | 3                 | 4        | 3.8            | 12°                  | 6              | 85                 | 42.11                                                            | 43.91 | Free  | Free  | Free  |
| 08-00527-02013 |            | 45                     | 3                 | 4        | 3.8            | 12°                  | 6              | 90                 | 47.33                                                            | 49.36 | Free  | Free  | Free  |
| 08-00527-02014 |            | 50                     | 3                 | 4        | 3.8            | 12°                  | 6              | 100                | 52.54                                                            | 54.80 | Free  | Free  | Free  |
| 08-00527-02500 | R2.5       | 10                     | 3.5               | 5        | 4.8            | 12°                  | 6              | 70                 | 10.81                                                            | 11.18 | 11.59 | 12.04 | Free  |
| 08-00527-02501 |            | 15                     | 3.5               | 5        | 4.8            | 12°                  | 6              | 70                 | 16.02                                                            | 16.63 | 17.29 | Free  | Free  |
| 08-00527-02502 |            | 20                     | 3.5               | 5        | 4.8            | 12°                  | 6              | 70                 | 21.24                                                            | 22.08 | Free  | Free  | Free  |
| 08-00527-02503 |            | 25                     | 3.5               | 5        | 4.8            | 12°                  | 6              | 70                 | 26.45                                                            | 27.52 | Free  | Free  | Free  |
| 08-00527-02504 |            | 30                     | 3.5               | 5        | 4.8            | 12°                  | 6              | 80                 | 31.66                                                            | Free  | Free  | Free  | Free  |
| 08-00527-02506 |            | 40                     | 3.5               | 5        | 4.8            | 12°                  | 6              | 90                 | 42.09                                                            | Free  | Free  | Free  | Free  |
| 08-00527-03000 | R3         | 10                     | 6                 | 6        | 5.7            | —                    | 6              | 70                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03001 |            | 15                     | 6                 | 6        | 5.7            | —                    | 6              | 70                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03002 |            | 20                     | 6                 | 6        | 5.7            | —                    | 6              | 70                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03003 |            | 25                     | 6                 | 6        | 5.7            | —                    | 6              | 70                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03004 |            | 30                     | 6                 | 6        | 5.7            | —                    | 6              | 80                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03007 |            | 35                     | 6                 | 6        | 5.7            | —                    | 6              | 85                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03005 |            | 40                     | 6                 | 6        | 5.7            | —                    | 6              | 90                 | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03006 |            | 50                     | 6                 | 6        | 5.7            | —                    | 6              | 120                | Free                                                             | Free  | Free  | Free  | Free  |
| 08-00527-03008 |            | 60                     | 6                 | 6        | 5.7            | —                    | 6              | 120                | Free                                                             | Free  | Free  | Free  | Free  |



 Prehardened Steel

 Stainless Steel

P

M

 Titanium Alloy  
Heat Resistant Alloy

 ~ 55 HRC  
~ 65 HRC

S

H



Coating

Long Neck  
Ball

| Work Material |                   |      | Hardened Steels<br>SKD61・STAVAX・HPM38 (～52HRC) |       |       |               | Hardened Steels<br>SKD11 (～62HRC) |       |      |               | High Speed Steels<br>SKH (～65HRC) |       |      |               |
|---------------|-------------------|------|------------------------------------------------|-------|-------|---------------|-----------------------------------|-------|------|---------------|-----------------------------------|-------|------|---------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                   |       | Feed  | Spindle Speed | Depth of Cut                      |       | Feed | Spindle Speed | Depth of Cut                      |       | Feed | Spindle Speed |
|               |                   |      | ap mm                                          | ae mm |       |               | ap mm                             | ae mm |      |               | ap mm                             | ae mm |      |               |
| 0.05          | 0.2               | 2.0  | 0.003                                          | 0.005 | 120   | 40,000        | 0.002                             | 0.005 | 100  | 40,000        | 0.002                             | 0.003 | 70   | 40,000        |
|               | 0.3               | 3.0  | 0.003                                          | 0.005 | 100   | 40,000        | 0.002                             | 0.005 | 70   | 40,000        | 0.002                             | 0.003 | 50   | 40,000        |
|               | 0.5               | 5.0  | 0.002                                          | 0.003 | 70    | 40,000        | 0.001                             | 0.003 | 50   | 40,000        | 0.001                             | 0.002 | 30   | 40,000        |
| 0.075         | 0.3               | 2.0  | 0.003                                          | 0.005 | 180   | 40,000        | 0.002                             | 0.005 | 150  | 40,000        | 0.002                             | 0.003 | 100  | 40,000        |
|               | 0.5               | 3.3  | 0.003                                          | 0.005 | 150   | 40,000        | 0.002                             | 0.005 | 120  | 40,000        | 0.002                             | 0.003 | 70   | 40,000        |
|               | 1                 | 6.7  | 0.002                                          | 0.003 | 70    | 40,000        | 0.001                             | 0.003 | 50   | 40,000        | 0.001                             | 0.002 | 30   | 40,000        |
| 0.1           | 0.3               | 1.5  | 0.01                                           | 0.01  | 350   | 40,000        | 0.006                             | 0.005 | 300  | 40,000        | 0.003                             | 0.003 | 200  | 40,000        |
|               | 0.5               | 2.5  | 0.008                                          | 0.01  | 320   | 40,000        | 0.005                             | 0.005 | 280  | 40,000        | 0.003                             | 0.003 | 180  | 40,000        |
|               | 0.75              | 3.8  | 0.005                                          | 0.01  | 280   | 40,000        | 0.003                             | 0.005 | 200  | 40,000        | 0.002                             | 0.003 | 150  | 40,000        |
|               | 1                 | 5.0  | 0.003                                          | 0.005 | 250   | 40,000        | 0.002                             | 0.003 | 160  | 40,000        | 0.001                             | 0.002 | 120  | 40,000        |
|               | 1.25              | 6.3  | 0.003                                          | 0.005 | 180   | 40,000        | 0.002                             | 0.003 | 140  | 40,000        | 0.001                             | 0.002 | 100  | 40,000        |
|               | 1.5               | 7.5  | 0.003                                          | 0.005 | 150   | 40,000        | 0.002                             | 0.003 | 120  | 40,000        | 0.001                             | 0.002 | 80   | 40,000        |
|               | 1.75              | 8.8  | 0.002                                          | 0.003 | 120   | 40,000        | 0.001                             | 0.002 | 100  | 40,000        | 0.001                             | 0.002 | 60   | 40,000        |
|               | 2                 | 10.0 | 0.002                                          | 0.003 | 100   | 40,000        | 0.001                             | 0.002 | 80   | 40,000        | 0.001                             | 0.001 | 50   | 40,000        |
|               | 2.5               | 12.5 | 0.001                                          | 0.002 | 70    | 40,000        | 0.001                             | 0.001 | 60   | 40,000        | 0.001                             | 0.001 | 40   | 40,000        |
|               | 3                 | 15.0 | 0.001                                          | 0.001 | 50    | 40,000        | 0.001                             | 0.001 | 40   | 40,000        | 0.001                             | 0.001 | 30   | 40,000        |
|               | 0.5               | 1.7  | 0.01                                           | 0.015 | 350   | 40,000        | 0.007                             | 0.01  | 300  | 40,000        | 0.003                             | 0.005 | 280  | 40,000        |
|               | 0.6               | 2.0  | 0.007                                          | 0.01  | 350   | 40,000        | 0.005                             | 0.007 | 300  | 40,000        | 0.003                             | 0.005 | 250  | 40,000        |
| 0.15          | 0.75              | 2.5  | 0.007                                          | 0.01  | 330   | 40,000        | 0.005                             | 0.007 | 280  | 40,000        | 0.003                             | 0.005 | 230  | 40,000        |
|               | 1                 | 3.3  | 0.007                                          | 0.01  | 320   | 40,000        | 0.005                             | 0.007 | 250  | 40,000        | 0.003                             | 0.005 | 200  | 40,000        |
|               | 1.25              | 4.2  | 0.005                                          | 0.007 | 280   | 40,000        | 0.003                             | 0.005 | 200  | 40,000        | 0.002                             | 0.003 | 160  | 40,000        |
|               | 1.5               | 5.0  | 0.005                                          | 0.007 | 230   | 40,000        | 0.003                             | 0.005 | 180  | 40,000        | 0.002                             | 0.003 | 120  | 40,000        |
|               | 1.75              | 5.8  | 0.003                                          | 0.005 | 180   | 40,000        | 0.002                             | 0.003 | 150  | 40,000        | 0.002                             | 0.002 | 100  | 40,000        |
|               | 2                 | 6.7  | 0.003                                          | 0.005 | 150   | 40,000        | 0.002                             | 0.003 | 120  | 40,000        | 0.002                             | 0.002 | 90   | 40,000        |
|               | 2.25              | 7.5  | 0.002                                          | 0.003 | 120   | 40,000        | 0.001                             | 0.002 | 100  | 40,000        | 0.001                             | 0.001 | 80   | 40,000        |
|               | 2.5               | 8.3  | 0.002                                          | 0.003 | 100   | 40,000        | 0.001                             | 0.002 | 80   | 40,000        | 0.001                             | 0.001 | 70   | 40,000        |
|               | 3                 | 10.0 | 0.001                                          | 0.003 | 80    | 40,000        | 0.001                             | 0.002 | 70   | 40,000        | 0.001                             | 0.001 | 60   | 40,000        |
|               | 3.5               | 11.7 | 0.001                                          | 0.002 | 70    | 40,000        | 0.001                             | 0.001 | 60   | 40,000        | 0.001                             | 0.001 | 50   | 40,000        |
|               | 4                 | 13.3 | 0.001                                          | 0.002 | 60    | 40,000        | 0.001                             | 0.001 | 50   | 40,000        | 0.001                             | 0.001 | 40   | 40,000        |
|               | 0.5               | 1.3  | 0.03                                           | 0.05  | 800   | 40,000        | 0.03                              | 0.03  | 720  | 40,000        | 0.009                             | 0.02  | 580  | 40,000        |
| 0.2           | 0.8               | 2.0  | 0.02                                           | 0.05  | 800   | 40,000        | 0.02                              | 0.03  | 720  | 40,000        | 0.008                             | 0.02  | 580  | 40,000        |
|               | 1                 | 2.5  | 0.02                                           | 0.05  | 800   | 40,000        | 0.02                              | 0.03  | 720  | 40,000        | 0.008                             | 0.02  | 580  | 40,000        |
|               | 1.5               | 3.8  | 0.01                                           | 0.03  | 620   | 40,000        | 0.01                              | 0.02  | 500  | 40,000        | 0.005                             | 0.01  | 400  | 40,000        |
|               | 2                 | 5.0  | 0.01                                           | 0.02  | 500   | 40,000        | 0.01                              | 0.01  | 380  | 40,000        | 0.005                             | 0.007 | 300  | 40,000        |
|               | 2.5               | 6.3  | 0.007                                          | 0.01  | 420   | 40,000        | 0.005                             | 0.007 | 300  | 40,000        | 0.003                             | 0.005 | 260  | 40,000        |
|               | 3                 | 7.5  | 0.007                                          | 0.01  | 300   | 40,000        | 0.005                             | 0.007 | 240  | 40,000        | 0.003                             | 0.005 | 200  | 40,000        |
|               | 3.5               | 8.8  | 0.005                                          | 0.007 | 230   | 40,000        | 0.003                             | 0.005 | 160  | 40,000        | 0.002                             | 0.003 | 120  | 40,000        |
|               | 4                 | 10.0 | 0.005                                          | 0.005 | 160   | 30,000        | 0.003                             | 0.003 | 120  | 30,000        | 0.002                             | 0.003 | 90   | 30,000        |
|               | 4.5               | 11.3 | 0.003                                          | 0.005 | 100   | 30,000        | 0.002                             | 0.003 | 80   | 30,000        | 0.001                             | 0.002 | 60   | 30,000        |
|               | 5                 | 12.5 | 0.002                                          | 0.003 | 70    | 30,000        | 0.001                             | 0.002 | 50   | 30,000        | 0.001                             | 0.002 | 40   | 30,000        |
|               | 6                 | 15.0 | 0.001                                          | 0.002 | 50    | 30,000        | 0.001                             | 0.001 | 40   | 30,000        | 0.001                             | 0.001 | 30   | 30,000        |
|               | 1                 | 2.0  | 0.03                                           | 0.05  | 1,000 | 40,000        | 0.02                              | 0.03  | 860  | 40,000        | 0.01                              | 0.02  | 650  | 40,000        |
| 0.25          | 1.5               | 3.0  | 0.02                                           | 0.05  | 850   | 40,000        | 0.01                              | 0.03  | 720  | 40,000        | 0.007                             | 0.02  | 520  | 40,000        |
|               | 2                 | 4.0  | 0.02                                           | 0.03  | 720   | 40,000        | 0.01                              | 0.02  | 650  | 40,000        | 0.007                             | 0.01  | 400  | 40,000        |
|               | 2.5               | 5.0  | 0.01                                           | 0.02  | 600   | 40,000        | 0.007                             | 0.01  | 530  | 40,000        | 0.005                             | 0.007 | 360  | 40,000        |
|               | 3                 | 6.0  | 0.01                                           | 0.02  | 500   | 40,000        | 0.007                             | 0.01  | 420  | 40,000        | 0.005                             | 0.007 | 320  | 40,000        |
|               | 3.5               | 7.0  | 0.007                                          | 0.01  | 420   | 40,000        | 0.005                             | 0.007 | 360  | 40,000        | 0.003                             | 0.005 | 280  | 40,000        |
|               | 4                 | 8.0  | 0.007                                          | 0.01  | 350   | 40,000        | 0.005                             | 0.007 | 300  | 40,000        | 0.003                             | 0.005 | 260  | 40,000        |
|               | 4.5               | 9.0  | 0.005                                          | 0.005 | 300   | 40,000        | 0.003                             | 0.003 | 260  | 40,000        | 0.002                             | 0.003 | 220  | 40,000        |
|               | 5                 | 10.0 | 0.005                                          | 0.005 | 240   | 33,000        | 0.003                             | 0.003 | 200  | 33,000        | 0.002                             | 0.003 | 180  | 33,000        |
|               | 5.5               | 11.0 | 0.003                                          | 0.005 | 200   | 30,000        | 0.002                             | 0.003 | 160  | 30,000        | 0.001                             | 0.002 | 120  | 30,000        |
|               | 6                 | 12.0 | 0.002                                          | 0.003 | 120   | 30,000        | 0.001                             | 0.002 | 80   | 30,000        | 0.001                             | 0.002 | 70   | 30,000        |
|               | 8                 | 16.0 | 0.002                                          | 0.002 | 75    | 30,000        | 0.001                             | 0.002 | 60   | 30,000        | 0.001                             | 0.002 | 50   | 30,000        |
|               | 10                | 20.0 | 0.001                                          | 0.002 | 40    | 20,000        | 0.001                             | 0.002 | 30   | 20,000        | 0.001                             | 0.001 | 20   | 20,000        |

| Work Material |                   |       | Hardened Steels<br>SKD61・STAVAX・HPM38 (～52HRC) |       |        |               | Hardened Steels<br>SKD11 (～62HRC) |                   |        |               | High Speed Steels<br>SKH (～65HRC) |       |        |               |        |
|---------------|-------------------|-------|------------------------------------------------|-------|--------|---------------|-----------------------------------|-------------------|--------|---------------|-----------------------------------|-------|--------|---------------|--------|
| Radius        | Under Neck Length | L/D   | Depth of Cut                                   |       | Feed   | Spindle Speed | Depth of Cut                      |                   | Feed   | Spindle Speed | Depth of Cut                      |       | Feed   | Spindle Speed |        |
|               |                   |       | ap mm                                          | ae mm |        |               | mm/min                            | min <sup>-1</sup> |        |               | ap mm                             | ae mm |        |               | mm/min |
| 0.3           | 1                 | 1.7   | 0.05                                           | 0.1   | 1,400  | 40,000        | 0.03                              | 0.06              | 1,000  | 40,000        | 0.02                              | 0.05  | 720    | 30,000        |        |
|               | 1.5               | 2.5   | 0.05                                           | 0.1   | 1,400  | 40,000        | 0.03                              | 0.06              | 1,000  | 40,000        | 0.02                              | 0.05  | 720    | 30,000        |        |
|               | 2                 | 3.3   | 0.05                                           | 0.1   | 1,400  | 40,000        | 0.03                              | 0.06              | 1,000  | 40,000        | 0.02                              | 0.05  | 720    | 30,000        |        |
|               | 2.5               | 4.2   | 0.03                                           | 0.05  | 1,200  | 40,000        | 0.02                              | 0.04              | 840    | 40,000        | 0.02                              | 0.03  | 640    | 30,000        |        |
|               | 3                 | 5.0   | 0.03                                           | 0.05  | 1,200  | 40,000        | 0.02                              | 0.04              | 840    | 40,000        | 0.02                              | 0.03  | 640    | 30,000        |        |
|               | 3.5               | 5.8   | 0.02                                           | 0.03  | 1,000  | 40,000        | 0.01                              | 0.03              | 620    | 40,000        | 0.01                              | 0.02  | 480    | 30,000        |        |
|               | 4                 | 6.7   | 0.02                                           | 0.03  | 1,000  | 40,000        | 0.01                              | 0.03              | 620    | 40,000        | 0.01                              | 0.02  | 480    | 30,000        |        |
|               | 4.5               | 7.5   | 0.02                                           | 0.03  | 900    | 35,000        | 0.01                              | 0.02              | 580    | 35,000        | 0.008                             | 0.015 | 430    | 30,000        |        |
|               | 5                 | 8.3   | 0.01                                           | 0.02  | 720    | 30,000        | 0.007                             | 0.015             | 500    | 30,000        | 0.007                             | 0.01  | 400    | 30,000        |        |
|               | 5.5               | 9.2   | 0.01                                           | 0.015 | 700    | 30,000        | 0.007                             | 0.01              | 450    | 30,000        | 0.005                             | 0.008 | 360    | 30,000        |        |
|               | 6                 | 10.0  | 0.007                                          | 0.01  | 500    | 30,000        | 0.005                             | 0.007             | 380    | 30,000        | 0.004                             | 0.006 | 320    | 30,000        |        |
|               | 7                 | 11.7  | 0.005                                          | 0.007 | 400    | 25,000        | 0.003                             | 0.005             | 300    | 25,000        | 0.003                             | 0.003 | 260    | 20,000        |        |
| 0.35          | 8                 | 13.3  | 0.003                                          | 0.005 | 320    | 25,000        | 0.003                             | 0.003             | 260    | 25,000        | 0.002                             | 0.003 | 220    | 20,000        |        |
|               | 9                 | 15.0  | 0.003                                          | 0.003 | 280    | 25,000        | 0.003                             | 0.002             | 220    | 25,000        | 0.001                             | 0.002 | 160    | 20,000        |        |
|               | 10                | 16.7  | 0.002                                          | 0.003 | 150    | 20,000        | 0.002                             | 0.002             | 120    | 20,000        | 0.001                             | 0.002 | 100    | 18,000        |        |
|               | 12                | 20.0  | 0.002                                          | 0.002 | 80     | 20,000        | 0.002                             | 0.002             | 60     | 20,000        | 0.001                             | 0.002 | 50     | 18,000        |        |
|               | 2                 | 2.9   | 0.07                                           | 0.1   | 1,600  | 40,000        | 0.05                              | 0.08              | 1,300  | 40,000        | 0.03                              | 0.07  | 1,000  | 30,000        |        |
|               | 4                 | 5.7   | 0.04                                           | 0.06  | 1,300  | 40,000        | 0.03                              | 0.04              | 820    | 40,000        | 0.015                             | 0.02  | 600    | 30,000        |        |
|               | 6                 | 8.6   | 0.01                                           | 0.03  | 800    | 30,000        | 0.01                              | 0.015             | 500    | 30,000        | 0.006                             | 0.01  | 420    | 25,000        |        |
|               | 8                 | 11.4  | 0.006                                          | 0.01  | 520    | 25,000        | 0.005                             | 0.006             | 380    | 20,000        | 0.004                             | 0.006 | 250    | 20,000        |        |
|               | 0.4               | 2     | 2.5                                            | 0.1   | 0.15   | 2,000         | 40,000                            | 0.07              | 0.1    | 1,600         | 40,000                            | 0.05  | 0.1    | 1,200         | 30,000 |
|               |                   | 3     | 3.8                                            | 0.1   | 0.15   | 2,000         | 40,000                            | 0.07              | 0.1    | 1,600         | 40,000                            | 0.05  | 0.05   | 1,200         | 30,000 |
|               |                   | 4     | 5.0                                            | 0.05  | 0.1    | 1,600         | 40,000                            | 0.05              | 0.05   | 1,200         | 40,000                            | 0.03  | 0.05   | 860           | 30,000 |
|               |                   | 5     | 6.3                                            | 0.05  | 0.05   | 1,600         | 40,000                            | 0.03              | 0.05   | 1,000         | 40,000                            | 0.02  | 0.03   | 620           | 30,000 |
| 6             |                   | 7.5   | 0.03                                           | 0.05  | 1,200  | 30,000        | 0.02                              | 0.03              | 760    | 30,000        | 0.01                              | 0.02  | 560    | 25,000        |        |
| 7             |                   | 8.8   | 0.02                                           | 0.03  | 1,000  | 30,000        | 0.01                              | 0.02              | 680    | 30,000        | 0.007                             | 0.01  | 520    | 25,000        |        |
| 8             |                   | 10.0  | 0.01                                           | 0.02  | 820    | 30,000        | 0.007                             | 0.01              | 600    | 30,000        | 0.005                             | 0.01  | 480    | 25,000        |        |
| 10            |                   | 12.5  | 0.005                                          | 0.005 | 450    | 25,000        | 0.003                             | 0.003             | 380    | 25,000        | 0.002                             | 0.003 | 320    | 20,000        |        |
| 12            | 15.0              | 0.003 | 0.005                                          | 320   | 20,000 | 0.002         | 0.003                             | 260               | 20,000 | 0.002         | 0.002                             | 200   | 20,000 |               |        |
| 0.45          | 2                 | 2.2   | 0.1                                            | 0.2   | 2,200  | 40,000        | 0.08                              | 0.15              | 1,800  | 30,000        | 0.06                              | 0.1   | 1,300  | 30,000        |        |
|               | 4                 | 4.4   | 0.05                                           | 0.12  | 1,800  | 40,000        | 0.04                              | 0.08              | 1,400  | 30,000        | 0.03                              | 0.05  | 900    | 25,000        |        |
|               | 6                 | 6.7   | 0.035                                          | 0.05  | 1,200  | 30,000        | 0.025                             | 0.035             | 800    | 25,000        | 0.015                             | 0.025 | 600    | 20,000        |        |
|               | 8                 | 8.9   | 0.025                                          | 0.04  | 1,000  | 30,000        | 0.015                             | 0.025             | 700    | 23,000        | 0.008                             | 0.015 | 500    | 20,000        |        |
| 0.5           | 2                 | 2.0   | 0.1                                            | 0.3   | 2,500  | 40,000        | 0.1                               | 0.2               | 2,000  | 30,000        | 0.08                              | 0.1   | 1,400  | 25,000        |        |
|               | 2.5               | 2.5   | 0.1                                            | 0.3   | 2,500  | 40,000        | 0.1                               | 0.2               | 2,000  | 30,000        | 0.08                              | 0.1   | 1,400  | 25,000        |        |
|               | 3                 | 3.0   | 0.1                                            | 0.3   | 2,500  | 40,000        | 0.1                               | 0.2               | 2,000  | 30,000        | 0.08                              | 0.1   | 1,400  | 25,000        |        |
|               | 4                 | 4.0   | 0.1                                            | 0.2   | 2,500  | 40,000        | 0.05                              | 0.15              | 1,800  | 30,000        | 0.05                              | 0.1   | 1,200  | 25,000        |        |
|               | 5                 | 5.0   | 0.05                                           | 0.15  | 2,000  | 30,000        | 0.04                              | 0.1               | 1,600  | 25,000        | 0.03                              | 0.05  | 920    | 20,000        |        |
|               | 6                 | 6.0   | 0.05                                           | 0.1   | 1,800  | 30,000        | 0.04                              | 0.05              | 1,200  | 25,000        | 0.02                              | 0.05  | 740    | 20,000        |        |
|               | 7                 | 7.0   | 0.04                                           | 0.06  | 1,200  | 30,000        | 0.03                              | 0.04              | 950    | 25,000        | 0.02                              | 0.03  | 680    | 20,000        |        |
|               | 8                 | 8.0   | 0.04                                           | 0.06  | 1,000  | 30,000        | 0.03                              | 0.04              | 860    | 25,000        | 0.02                              | 0.03  | 560    | 20,000        |        |
|               | 9                 | 9.0   | 0.03                                           | 0.05  | 820    | 25,000        | 0.02                              | 0.03              | 750    | 20,000        | 0.01                              | 0.02  | 500    | 18,000        |        |
|               | 10                | 10.0  | 0.03                                           | 0.05  | 750    | 25,000        | 0.02                              | 0.03              | 620    | 20,000        | 0.01                              | 0.02  | 450    | 18,000        |        |
|               | 12                | 12.0  | 0.01                                           | 0.03  | 600    | 20,000        | 0.007                             | 0.02              | 520    | 18,000        | 0.005                             | 0.01  | 400    | 16,000        |        |
|               | 13                | 13.0  | 0.008                                          | 0.02  | 500    | 20,000        | 0.005                             | 0.01              | 420    | 18,000        | 0.003                             | 0.006 | 350    | 16,000        |        |
|               | 14                | 14.0  | 0.005                                          | 0.01  | 420    | 20,000        | 0.003                             | 0.007             | 360    | 18,000        | 0.002                             | 0.005 | 320    | 16,000        |        |
|               | 16                | 16.0  | 0.005                                          | 0.005 | 300    | 18,000        | 0.003                             | 0.005             | 250    | 16,000        | 0.002                             | 0.003 | 200    | 14,000        |        |
| 18            | 18.0              | 0.003 | 0.005                                          | 180   | 18,000 | 0.002         | 0.005                             | 120               | 16,000 | 0.002         | 0.002                             | 85    | 14,000 |               |        |
| 20            | 20.0              | 0.003 | 0.003                                          | 100   | 16,000 | 0.002         | 0.003                             | 75                | 14,000 | 0.002         | 0.002                             | 60    | 12,000 |               |        |
| 22            | 22.0              | 0.002 | 0.003                                          | 50    | 14,000 | 0.002         | 0.002                             | 40                | 12,000 | 0.001         | 0.002                             | 35    | 10,000 |               |        |

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Recommended Milling Conditions

| Work Material |                   |      | Hardened Steels<br>SKD61・STAVAX・HPM38 (～52HRC) |       |       |               | Hardened Steels<br>SKD11 (～62HRC) |       |       |               | High Speed Steels<br>SKH (～65HRC) |       |       |               |
|---------------|-------------------|------|------------------------------------------------|-------|-------|---------------|-----------------------------------|-------|-------|---------------|-----------------------------------|-------|-------|---------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                   |       | Feed  | Spindle Speed | Depth of Cut                      |       | Feed  | Spindle Speed | Depth of Cut                      |       | Feed  | Spindle Speed |
|               |                   |      | ap mm                                          | ae mm |       |               | ap mm                             | ae mm |       |               | ap mm                             | ae mm |       |               |
| 0.6           | 2.4               | 2.0  | 0.1                                            | 0.3   | 2,500 | 30,000        | 0.1                               | 0.2   | 2,000 | 30,000        | 0.05                              | 0.1   | 1,600 | 25,000        |
|               | 4                 | 3.3  | 0.1                                            | 0.2   | 2,500 | 30,000        | 0.07                              | 0.2   | 2,000 | 30,000        | 0.05                              | 0.1   | 1,600 | 25,000        |
|               | 6                 | 5.0  | 0.07                                           | 0.1   | 2,000 | 30,000        | 0.05                              | 0.1   | 1,600 | 25,000        | 0.03                              | 0.07  | 1,200 | 20,000        |
|               | 8                 | 6.7  | 0.05                                           | 0.1   | 1,600 | 30,000        | 0.03                              | 0.07  | 1,200 | 25,000        | 0.02                              | 0.05  | 920   | 20,000        |
|               | 10                | 8.3  | 0.03                                           | 0.07  | 1,200 | 20,000        | 0.02                              | 0.05  | 860   | 20,000        | 0.01                              | 0.03  | 680   | 18,000        |
|               | 12                | 10.0 | 0.02                                           | 0.05  | 860   | 20,000        | 0.01                              | 0.03  | 620   | 20,000        | 0.007                             | 0.02  | 480   | 18,000        |
|               | 14                | 11.7 | 0.02                                           | 0.03  | 600   | 18,000        | 0.01                              | 0.02  | 400   | 18,000        | 0.005                             | 0.01  | 300   | 16,000        |
|               | 16                | 13.3 | 0.01                                           | 0.02  | 350   | 16,000        | 0.005                             | 0.01  | 250   | 16,000        | 0.003                             | 0.007 | 130   | 14,000        |
| 0.7           | 8                 | 5.7  | 0.12                                           | 0.2   | 2,500 | 30,000        | 0.08                              | 0.15  | 1,800 | 20,000        | 0.03                              | 0.08  | 1,000 | 20,000        |
|               | 12                | 8.6  | 0.07                                           | 0.12  | 1,400 | 20,000        | 0.04                              | 0.08  | 1,100 | 18,000        | 0.015                             | 0.05  | 700   | 18,000        |
|               | 16                | 11.4 | 0.02                                           | 0.05  | 700   | 17,000        | 0.01                              | 0.03  | 600   | 17,000        | 0.008                             | 0.02  | 450   | 16,000        |
| 0.75          | 3                 | 2.0  | 0.15                                           | 0.3   | 3,000 | 30,000        | 0.1                               | 0.3   | 2,500 | 30,000        | 0.1                               | 0.2   | 2,000 | 25,000        |
|               | 4                 | 2.7  | 0.15                                           | 0.3   | 3,000 | 30,000        | 0.1                               | 0.3   | 2,500 | 30,000        | 0.1                               | 0.2   | 2,000 | 25,000        |
|               | 6                 | 4.0  | 0.15                                           | 0.2   | 3,000 | 30,000        | 0.1                               | 0.2   | 2,000 | 30,000        | 0.1                               | 0.1   | 1,600 | 25,000        |
|               | 8                 | 5.3  | 0.1                                            | 0.2   | 2,500 | 25,000        | 0.05                              | 0.2   | 1,600 | 25,000        | 0.05                              | 0.1   | 1,200 | 20,000        |
|               | 10                | 6.7  | 0.1                                            | 0.1   | 2,500 | 25,000        | 0.05                              | 0.1   | 1,200 | 25,000        | 0.05                              | 0.05  | 860   | 20,000        |
|               | 12                | 8.0  | 0.05                                           | 0.1   | 1,800 | 20,000        | 0.03                              | 0.1   | 920   | 20,000        | 0.02                              | 0.05  | 780   | 18,000        |
|               | 14                | 9.3  | 0.05                                           | 0.07  | 1,200 | 20,000        | 0.03                              | 0.05  | 820   | 20,000        | 0.02                              | 0.03  | 650   | 18,000        |
|               | 16                | 10.7 | 0.03                                           | 0.05  | 720   | 18,000        | 0.02                              | 0.03  | 650   | 18,000        | 0.01                              | 0.02  | 580   | 16,000        |
|               | 18                | 12.0 | 0.02                                           | 0.04  | 550   | 16,000        | 0.012                             | 0.025 | 400   | 16,000        | 0.008                             | 0.015 | 400   | 14,000        |
|               | 20                | 13.3 | 0.01                                           | 0.03  | 450   | 16,000        | 0.01                              | 0.02  | 360   | 16,000        | 0.007                             | 0.01  | 300   | 14,000        |
|               | 22                | 14.7 | 0.01                                           | 0.02  | 330   | 14,000        | 0.01                              | 0.01  | 250   | 14,000        | 0.007                             | 0.007 | 200   | 12,000        |
|               | 30                | 20.0 | 0.005                                          | 0.005 | 80    | 10,000        | 0.003                             | 0.005 | 60    | 10,000        | 0.003                             | 0.003 | 40    | 8,000         |
| 0.8           | 8                 | 5.0  | 0.1                                            | 0.2   | 2,500 | 25,000        | 0.07                              | 0.15  | 2,000 | 20,000        | 0.05                              | 0.1   | 1,600 | 18,000        |
|               | 12                | 7.5  | 0.07                                           | 0.1   | 1,800 | 20,000        | 0.05                              | 0.07  | 1,500 | 16,000        | 0.03                              | 0.05  | 1,200 | 14,000        |
|               | 16                | 10.0 | 0.03                                           | 0.05  | 720   | 16,000        | 0.02                              | 0.03  | 600   | 14,000        | 0.015                             | 0.02  | 480   | 12,000        |
|               | 20                | 12.5 | 0.01                                           | 0.03  | 500   | 14,000        | 0.01                              | 0.02  | 380   | 12,000        | 0.01                              | 0.01  | 300   | 10,000        |
|               |                   |      |                                                |       |       |               |                                   |       |       |               |                                   |       |       |               |
| 1             | 3                 | 1.5  | 0.2                                            | 0.5   | 3,000 | 25,000        | 0.2                               | 0.5   | 2,500 | 25,000        | 0.15                              | 0.3   | 2,000 | 20,000        |
|               | 4                 | 2.0  | 0.2                                            | 0.5   | 3,000 | 25,000        | 0.2                               | 0.5   | 2,500 | 25,000        | 0.15                              | 0.3   | 2,000 | 20,000        |
|               | 6                 | 3.0  | 0.2                                            | 0.5   | 2,500 | 25,000        | 0.2                               | 0.3   | 2,000 | 25,000        | 0.15                              | 0.3   | 1,600 | 20,000        |
|               | 8                 | 4.0  | 0.2                                            | 0.3   | 2,000 | 20,000        | 0.1                               | 0.2   | 1,600 | 18,000        | 0.1                               | 0.2   | 1,200 | 16,000        |
|               | 10                | 5.0  | 0.1                                            | 0.3   | 2,000 | 18,000        | 0.1                               | 0.2   | 1,600 | 16,000        | 0.1                               | 0.1   | 1,200 | 14,000        |
|               | 12                | 6.0  | 0.1                                            | 0.2   | 1,600 | 16,000        | 0.1                               | 0.1   | 1,200 | 14,000        | 0.05                              | 0.1   | 940   | 12,000        |
|               | 13                | 6.5  | 0.08                                           | 0.2   | 1,600 | 16,000        | 0.06                              | 0.1   | 1,200 | 14,000        | 0.04                              | 0.08  | 940   | 12,000        |
|               | 14                | 7.0  | 0.07                                           | 0.15  | 1,600 | 16,000        | 0.05                              | 0.08  | 1,200 | 14,000        | 0.03                              | 0.07  | 940   | 12,000        |
|               | 16                | 8.0  | 0.07                                           | 0.15  | 1,600 | 16,000        | 0.05                              | 0.08  | 1,200 | 14,000        | 0.03                              | 0.07  | 940   | 12,000        |
|               | 18                | 9.0  | 0.05                                           | 0.1   | 1,400 | 14,000        | 0.03                              | 0.05  | 1,000 | 12,000        | 0.02                              | 0.03  | 850   | 10,000        |
|               | 20                | 10.0 | 0.05                                           | 0.1   | 1,000 | 14,000        | 0.03                              | 0.05  | 820   | 12,000        | 0.02                              | 0.03  | 720   | 10,000        |
|               | 22                | 11.0 | 0.03                                           | 0.08  | 850   | 14,000        | 0.02                              | 0.06  | 700   | 12,000        | 0.02                              | 0.02  | 600   | 10,000        |
|               | 25                | 12.5 | 0.03                                           | 0.05  | 680   | 12,000        | 0.02                              | 0.03  | 560   | 10,000        | 0.01                              | 0.02  | 420   | 8,500         |
|               | 30                | 15.0 | 0.02                                           | 0.03  | 360   | 12,000        | 0.01                              | 0.02  | 300   | 10,000        | 0.008                             | 0.01  | 240   | 8,500         |
|               | 35                | 17.5 | 0.01                                           | 0.02  | 150   | 10,000        | 0.007                             | 0.01  | 120   | 8,000         | 0.005                             | 0.007 | 100   | 6,800         |
|               | 40                | 20.0 | 0.005                                          | 0.01  | 100   | 10,000        | 0.003                             | 0.005 | 80    | 8,000         | 0.002                             | 0.003 | 50    | 6,800         |
| 1.25          | 6                 | 2.4  | 0.3                                            | 0.4   | 2,800 | 20,000        | 0.2                               | 0.5   | 2,300 | 20,000        | 0.15                              | 0.4   | 2,000 | 18,000        |
|               | 8                 | 3.2  | 0.25                                           | 0.3   | 2,600 | 20,000        | 0.15                              | 0.3   | 2,100 | 20,000        | 0.12                              | 0.25  | 1,800 | 18,000        |
|               | 10                | 4.0  | 0.2                                            | 0.3   | 2,500 | 20,000        | 0.15                              | 0.2   | 2,000 | 20,000        | 0.1                               | 0.15  | 1,600 | 18,000        |
|               | 15                | 6.0  | 0.1                                            | 0.2   | 2,000 | 18,000        | 0.07                              | 0.15  | 1,600 | 16,000        | 0.05                              | 0.1   | 1,200 | 14,000        |
|               | 20                | 8.0  | 0.07                                           | 0.15  | 1,500 | 16,000        | 0.05                              | 0.1   | 1,200 | 14,000        | 0.03                              | 0.05  | 1,000 | 10,000        |
|               | 25                | 10.0 | 0.05                                           | 0.1   | 1,000 | 14,000        | 0.03                              | 0.07  | 850   | 12,000        | 0.02                              | 0.03  | 720   | 8,000         |
|               | 30                | 12.0 | 0.03                                           | 0.07  | 720   | 12,000        | 0.02                              | 0.05  | 640   | 10,000        | 0.01                              | 0.02  | 580   | 7,000         |
|               | 35                | 14.0 | 0.02                                           | 0.03  | 450   | 10,000        | 0.01                              | 0.02  | 400   | 8,500         | 0.007                             | 0.01  | 320   | 6,200         |

MRBH230

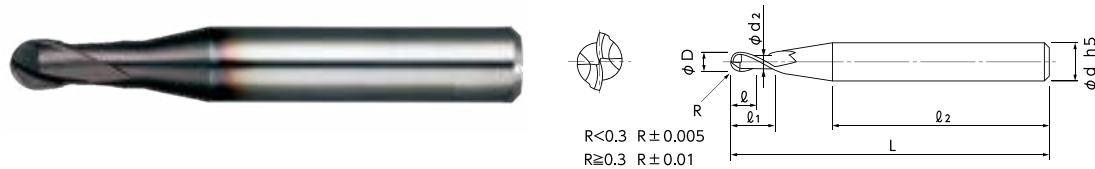
Recommended Milling Conditions

| Work Material |                   |      | Hardened Steels<br>SKD61・STAVAX・HPM38 (～52HRC)                                                                                                                                                                                                                                                                                      |       |        |                   | Hardened Steels<br>SKD11 (～62HRC) |       |        |                   | High Speed Steels<br>SKH (～65HRC) |       |        |                   |
|---------------|-------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|-----------------------------------|-------|--------|-------------------|-----------------------------------|-------|--------|-------------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                                                                                                                                                                                                                                                                                                        |       | Feed   | Spindle Speed     | Depth of Cut                      |       | Feed   | Spindle Speed     | Depth of Cut                      |       | Feed   | Spindle Speed     |
|               |                   |      | ap mm                                                                                                                                                                                                                                                                                                                               | ae mm | mm/min | min <sup>-1</sup> | ap mm                             | ae mm | mm/min | min <sup>-1</sup> | ap mm                             | ae mm | mm/min | min <sup>-1</sup> |
| 1.5           | 6                 | 2.0  | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.8   | 3,000  | 20,000            | 0.2                               | 0.6   | 2,500  | 18,000            | 0.2                               | 0.5   | 2,000  | 14,000            |
|               | 8                 | 2.7  | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.8   | 3,000  | 20,000            | 0.2                               | 0.6   | 2,500  | 18,000            | 0.2                               | 0.5   | 2,000  | 14,000            |
|               | 10                | 3.3  | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.6   | 2,500  | 20,000            | 0.2                               | 0.4   | 2,000  | 18,000            | 0.1                               | 0.3   | 1,500  | 14,000            |
|               | 12                | 4.0  | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.6   | 2,500  | 20,000            | 0.2                               | 0.4   | 2,000  | 18,000            | 0.1                               | 0.3   | 1,500  | 14,000            |
|               | 14                | 4.7  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.4   | 2,000  | 18,000            | 0.1                               | 0.3   | 1,600  | 16,000            | 0.1                               | 0.2   | 1,200  | 12,000            |
|               | 16                | 5.3  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.4   | 2,000  | 18,000            | 0.1                               | 0.3   | 1,600  | 16,000            | 0.1                               | 0.2   | 1,200  | 12,000            |
|               | 20                | 6.7  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.3   | 1,600  | 18,000            | 0.1                               | 0.2   | 1,200  | 16,000            | 0.1                               | 0.1   | 960    | 12,000            |
|               | 25                | 8.3  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.2   | 1,200  | 16,000            | 0.07                              | 0.15  | 920    | 14,000            | 0.05                              | 0.07  | 800    | 10,000            |
|               | 30                | 10.0 | 0.07                                                                                                                                                                                                                                                                                                                                | 0.1   | 750    | 14,000            | 0.05                              | 0.07  | 640    | 12,000            | 0.03                              | 0.05  | 600    | 8,600             |
|               | 35                | 11.7 | 0.05                                                                                                                                                                                                                                                                                                                                | 0.1   | 620    | 12,000            | 0.03                              | 0.07  | 500    | 10,000            | 0.02                              | 0.05  | 420    | 7,200             |
| 40            | 13.3              | 0.03 | 0.07                                                                                                                                                                                                                                                                                                                                | 450   | 10,000 | 0.02              | 0.05                              | 320   | 8,200  | 0.01              | 0.03                              | 260   | 6,400  |                   |
| 1.75          | 15                | 4.3  | 0.25                                                                                                                                                                                                                                                                                                                                | 1     | 3,000  | 20,000            | 0.15                              | 0.5   | 2,300  | 16,000            | 0.13                              | 0.4   | 1,500  | 14,000            |
|               | 20                | 5.7  | 0.18                                                                                                                                                                                                                                                                                                                                | 0.6   | 2,500  | 18,000            | 0.1                               | 0.3   | 1,800  | 15,000            | 0.1                               | 0.2   | 1,200  | 12,000            |
|               | 25                | 7.1  | 0.12                                                                                                                                                                                                                                                                                                                                | 0.35  | 1,800  | 16,000            | 0.1                               | 0.2   | 1,600  | 14,000            | 0.06                              | 0.12  | 1,000  | 10,000            |
|               | 30                | 8.6  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.25  | 1,500  | 14,000            | 0.07                              | 0.15  | 950    | 11,000            | 0.05                              | 0.08  | 800    | 9,000             |
|               | 35                | 10.0 | 0.08                                                                                                                                                                                                                                                                                                                                | 0.2   | 1,200  | 13,000            | 0.07                              | 0.12  | 800    | 10,000            | 0.03                              | 0.06  | 650    | 7,500             |
|               | 40                | 11.4 | 0.07                                                                                                                                                                                                                                                                                                                                | 0.1   | 800    | 11,000            | 0.04                              | 0.07  | 720    | 9,000             | 0.02                              | 0.05  | 450    | 7,000             |
|               | 45                | 12.9 | 0.06                                                                                                                                                                                                                                                                                                                                | 0.07  | 700    | 10,000            | 0.035                             | 0.05  | 600    | 7,500             | 0.015                             | 0.03  | 320    | 6,000             |
| 2             | 8                 | 2.0  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 20,000            | 0.2                               | 0.8   | 2,500  | 16,000            | 0.2                               | 0.6   | 2,000  | 12,000            |
|               | 10                | 2.5  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 20,000            | 0.2                               | 0.8   | 2,500  | 16,000            | 0.2                               | 0.6   | 2,000  | 12,000            |
|               | 12                | 3.0  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 20,000            | 0.2                               | 0.8   | 2,500  | 16,000            | 0.2                               | 0.6   | 2,000  | 12,000            |
|               | 14                | 3.5  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 20,000            | 0.2                               | 0.8   | 2,000  | 16,000            | 0.2                               | 0.6   | 1,600  | 12,000            |
|               | 15                | 3.8  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 20,000            | 0.2                               | 0.8   | 2,000  | 16,000            | 0.2                               | 0.6   | 1,600  | 12,000            |
|               | 20                | 5.0  | 0.2                                                                                                                                                                                                                                                                                                                                 | 1     | 2,400  | 16,000            | 0.1                               | 0.6   | 1,800  | 14,000            | 0.1                               | 0.4   | 1,400  | 10,000            |
|               | 25                | 6.3  | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.8   | 1,600  | 16,000            | 0.1                               | 0.4   | 1,200  | 14,000            | 0.1                               | 0.2   | 1,000  | 10,000            |
|               | 30                | 7.5  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.3   | 1,600  | 14,000            | 0.07                              | 0.2   | 1,200  | 10,000            | 0.05                              | 0.15  | 1,000  | 8,200             |
|               | 35                | 8.8  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.2   | 1,200  | 14,000            | 0.07                              | 0.15  | 1,000  | 10,000            | 0.05                              | 0.1   | 820    | 8,200             |
|               | 40                | 10.0 | 0.07                                                                                                                                                                                                                                                                                                                                | 0.15  | 1,200  | 12,000            | 0.05                              | 0.1   | 1,000  | 8,600             | 0.03                              | 0.07  | 820    | 6,800             |
|               | 45                | 11.3 | 0.07                                                                                                                                                                                                                                                                                                                                | 0.1   | 750    | 12,000            | 0.05                              | 0.07  | 620    | 8,600             | 0.03                              | 0.05  | 500    | 6,800             |
|               | 50                | 12.5 | 0.05                                                                                                                                                                                                                                                                                                                                | 0.08  | 550    | 10,000            | 0.03                              | 0.05  | 500    | 7,500             | 0.02                              | 0.03  | 420    | 5,500             |
| 2.5           | 10                | 2.0  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 18,000            | 0.2                               | 1.2   | 2,500  | 12,000            | 0.2                               | 0.7   | 2,000  | 9,200             |
|               | 15                | 3.0  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 18,000            | 0.2                               | 1.2   | 2,500  | 12,000            | 0.2                               | 0.7   | 2,000  | 9,200             |
|               | 20                | 4.0  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.2   | 3,000  | 15,000            | 0.2                               | 1     | 2,000  | 10,000            | 0.15                              | 0.5   | 1,600  | 8,000             |
|               | 25                | 5.0  | 0.2                                                                                                                                                                                                                                                                                                                                 | 1     | 2,500  | 15,000            | 0.15                              | 0.8   | 1,800  | 8,600             | 0.1                               | 0.3   | 1,200  | 7,200             |
|               | 30                | 6.0  | 0.2                                                                                                                                                                                                                                                                                                                                 | 0.8   | 2,000  | 12,000            | 0.15                              | 0.5   | 1,500  | 7,600             | 0.1                               | 0.2   | 860    | 6,400             |
|               | 40                | 8.0  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.2   | 1,200  | 10,000            | 0.07                              | 0.15  | 1,000  | 6,800             | 0.05                              | 0.1   | 650    | 5,500             |
| 3             | 10                | 1.7  | 0.3                                                                                                                                                                                                                                                                                                                                 | 2     | 3,000  | 16,000            | 0.3                               | 1.2   | 2,500  | 8,000             | 0.2                               | 1     | 2,000  | 7,000             |
|               | 15                | 2.5  | 0.3                                                                                                                                                                                                                                                                                                                                 | 2     | 3,000  | 16,000            | 0.3                               | 1.2   | 2,500  | 8,000             | 0.2                               | 1     | 2,000  | 7,000             |
|               | 20                | 3.3  | 0.3                                                                                                                                                                                                                                                                                                                                 | 2     | 3,000  | 16,000            | 0.3                               | 1.2   | 2,500  | 8,000             | 0.2                               | 1     | 2,000  | 7,000             |
|               | 25                | 4.2  | 0.3                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 16,000            | 0.2                               | 1     | 2,000  | 8,000             | 0.15                              | 0.7   | 1,500  | 7,000             |
|               | 30                | 5.0  | 0.2                                                                                                                                                                                                                                                                                                                                 | 1.5   | 3,000  | 14,000            | 0.2                               | 1     | 2,000  | 7,200             | 0.15                              | 0.7   | 1,500  | 6,500             |
|               | 35                | 5.8  | 0.2                                                                                                                                                                                                                                                                                                                                 | 1.2   | 2,400  | 13,000            | 0.17                              | 0.8   | 1,600  | 6,800             | 0.12                              | 0.5   | 1,200  | 5,800             |
|               | 40                | 6.7  | 0.2                                                                                                                                                                                                                                                                                                                                 | 1     | 1,800  | 12,000            | 0.15                              | 0.6   | 1,200  | 6,400             | 0.1                               | 0.4   | 1,000  | 5,200             |
|               | 50                | 8.3  | 0.1                                                                                                                                                                                                                                                                                                                                 | 0.6   | 1,200  | 8,200             | 0.1                               | 0.3   | 860    | 4,800             | 0.05                              | 0.2   | 620    | 4,000             |
|               | 60                | 10.0 | 0.07                                                                                                                                                                                                                                                                                                                                | 0.3   | 600    | 6,000             | 0.05                              | 0.15  | 450    | 3,200             | 0.03                              | 0.07  | 300    | 2,500             |
| Notes         |                   |      | ※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 We recommend using oil mist coolant.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of depth of cut and rigidity of machine.<br>※5 Length of tool overhang must be as short as possible. |       |        |                   |                                   |       |        |                   |                                   |       |        |                   |

MUGEN COATING PREMIUM 2-Flute Ball End Mill with Short Shank for Hardened Steel

Recommended Milling Conditions

Sharp cutting edge reduces cutting load for tough materials.  
Suitable for shrink fit holder



- It fits for Shrink Chuck System.
- It is designed for high speed cutting of hardened steels.

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Shank Dia. (d) | Shank Length (ℓ2) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------|-------------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                        |                   |          |                |                |                   |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00554-01011 | R0.1       | 0.5                    | 0.2               | 0.2      | 0.175          | 4              | 28.2              | 35                 | 0.57                                                             | 0.60  | 0.62  | 0.64  | 0.71  |
| 08-00554-02011 | R0.2       | 1                      | 0.4               | 0.4      | 0.365          | 4              | 27.9              | 35                 | 1.12                                                             | 1.16  | 1.20  | 1.25  | 1.37  |
| 08-00554-03011 | R0.3       | 1.5                    | 0.6               | 0.6      | 0.56           | 4              | 27.6              | 35                 | 1.65                                                             | 1.71  | 1.77  | 1.85  | 2.02  |
| 08-00554-04011 | R0.4       | 2                      | 0.8               | 0.8      | 0.76           | 4              | 27.3              | 35                 | 2.16                                                             | 2.24  | 2.33  | 2.42  | 2.65  |
| 08-00554-05011 | R0.5       | 2.5                    | 1                 | 1        | 0.95           | 4              | 32.1              | 40                 | 3.51                                                             | 3.78  | 4.02  | 4.26  | 4.70  |
| 08-00554-06011 | R0.6       | 3                      | 1.2               | 1.2      | 1.15           | 4              | 31.8              | 40                 | 4.04                                                             | 4.34  | 4.60  | 4.85  | 5.32  |
| 08-00554-07511 | R0.75      | 3.8                    | 1.5               | 1.5      | 1.45           | 4              | 31.3              | 40                 | 4.90                                                             | 5.23  | 5.52  | 5.79  | 6.29  |
| 08-00554-10011 | R1         | 5                      | 2                 | 2        | 1.94           | 4              | 30.5              | 40                 | 6.22                                                             | 6.59  | 6.91  | 7.21  | 7.74  |
| 08-00554-15011 | R1.5       | 8                      | 3                 | 3        | 2.85           | 4              | 28.7              | 40                 | 9.70                                                             | 10.11 | 10.47 | 10.80 | Free  |
| 08-00554-20012 | R2         | 10                     | 4                 | 4        | 3.8            | 6              | 24.8              | 40                 | 10.83                                                            | 11.23 | 11.66 | 12.14 | 13.26 |
| 08-00554-25012 | R2.5       | 12                     | 5                 | 5        | 4.8            | 6              | 30.1              | 45                 | 12.89                                                            | 13.36 | 13.87 | 14.43 | Free  |
| 08-00554-30012 | R3         | 15                     | 6                 | 6        | 5.7            | 6              | 29                | 45                 | Free                                                             | Free  | Free  | Free  | Free  |

How to Order

When you order, indicate MACH225SF (R). ※(γ) is reference value.

| Work Material | Carbon Steels・Prehardened Steels<br>S50C・HPM・NAK<br>(~43HRC)                                                                                                                                                                                                                                                                             |        |                   |        |              | Hardened Steels<br>SKD61・STAVAX・HPM38<br>(~55HRC) |        |                   |        |              | Hardened Steels<br>SKD11<br>(~62HRC) |        |                   |        |              |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|--------------|---------------------------------------------------|--------|-------------------|--------|--------------|--------------------------------------|--------|-------------------|--------|--------------|
|               | Normal Speed                                                                                                                                                                                                                                                                                                                             |        | High Speed        |        | Depth of Cut | Normal Speed                                      |        | High Speed        |        | Depth of Cut | Normal Speed                         |        | High Speed        |        | Depth of Cut |
| Radius        | Spindle Speed                                                                                                                                                                                                                                                                                                                            | Feed   | Spindle Speed     | Feed   | ap×ae        | Spindle Speed                                     | Feed   | Spindle Speed     | Feed   | ap×ae        | Spindle Speed                        | Feed   | Spindle Speed     | Feed   | ap×ae        |
|               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                        | mm/min | min <sup>-1</sup> | mm/min | mm           | min <sup>-1</sup>                                 | mm/min | min <sup>-1</sup> | mm/min | mm           | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup> | mm/min | mm           |
| 0.1           | 20,000                                                                                                                                                                                                                                                                                                                                   | 400    | 50,000            | 800    | 0.01×0.02    | 20,000                                            | 250    | 50,000            | 500    | 0.01×0.02    | 20,000                               | 250    | 50,000            | 500    | 0.01×0.02    |
| 0.2           | 20,000                                                                                                                                                                                                                                                                                                                                   | 600    | 50,000            | 1,000  | 0.02×0.05    | 20,000                                            | 320    | 50,000            | 680    | 0.02×0.05    | 20,000                               | 320    | 50,000            | 680    | 0.02×0.05    |
| 0.3           | 20,000                                                                                                                                                                                                                                                                                                                                   | 1,200  | 50,000            | 2,000  | 0.05×0.1     | 20,000                                            | 460    | 50,000            | 1,000  | 0.03×0.05    | 20,000                               | 460    | 50,000            | 1,000  | 0.03×0.05    |
| 0.4           | 20,000                                                                                                                                                                                                                                                                                                                                   | 1,600  | 50,000            | 2,500  | 0.1×0.2      | 20,000                                            | 580    | 50,000            | 1,200  | 0.05×0.1     | 20,000                               | 580    | 50,000            | 1,200  | 0.05×0.1     |
| 0.5           | 20,000                                                                                                                                                                                                                                                                                                                                   | 2,000  | 50,000            | 5,000  | 0.2×0.3      | 20,000                                            | 1,200  | 50,000            | 3,000  | 0.1×0.2      | 20,000                               | 800    | 50,000            | 2,000  | 0.1×0.2      |
| 0.75          | 20,000                                                                                                                                                                                                                                                                                                                                   | 2,000  | 50,000            | 5,000  | 0.2×0.3      | 20,000                                            | 1,600  | 42,000            | 3,000  | 0.1×0.2      | 20,000                               | 1,200  | 32,000            | 2,000  | 0.1×0.2      |
| 1             | 20,000                                                                                                                                                                                                                                                                                                                                   | 3,200  | 50,000            | 8,000  | 0.3×0.5      | 20,000                                            | 2,500  | 32,000            | 3,500  | 0.2×0.5      | 20,000                               | 2,000  | 24,000            | 2,400  | 0.2×0.5      |
| 1.5           | 16,000                                                                                                                                                                                                                                                                                                                                   | 2,800  | 32,000            | 6,000  | 0.3×0.5      | 16,000                                            | 2,500  | 21,000            | 3,500  | 0.2×0.5      | 13,000                               | 2,000  | 16,000            | 2,400  | 0.2×0.5      |
| 2             | 12,000                                                                                                                                                                                                                                                                                                                                   | 2,400  | 24,000            | 5,000  | 0.5×1        | 12,000                                            | 2,000  | 16,000            | 3,000  | 0.2×0.7      | 9,600                                | 1,600  | 12,000            | 2,000  | 0.2×0.7      |
| 2.5           | 9,600                                                                                                                                                                                                                                                                                                                                    | 2,000  | 20,000            | 5,000  | 0.5×1        | 9,600                                             | 2,000  | 13,000            | 3,000  | 0.2×0.7      | 7,600                                | 1,300  | 9,600             | 1,600  | 0.2×0.7      |
| 3             | 8,000                                                                                                                                                                                                                                                                                                                                    | 2,000  | 16,000            | 4,000  | 0.5×1.5      | 8,000                                             | 1,600  | 10,000            | 2,500  | 0.2×1        | 6,400                                | 1,000  | 8,000             | 1,300  | 0.2×1        |
| Notes         | ※1 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br>※2 We recommend using oil mist coolant.<br>※3 Adjust milling conditions according to the volume of depth of cut and rigidity of machine.<br>※4 Adjust both spindle speed and feed at the same rate.<br>※5 Length of tool overhang must be as short as possible. |        |                   |        |              |                                                   |        |                   |        |              |                                      |        |                   |        |              |

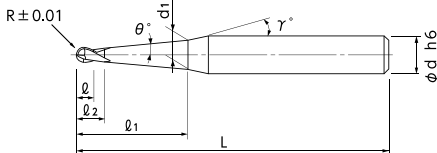




MUGEN COATING PREMIUM 2-Flute Long Taper Neck Ball End Mill

MUGEN COATING PREMIUM 2-Flute Long Taper Neck Ball End Mill

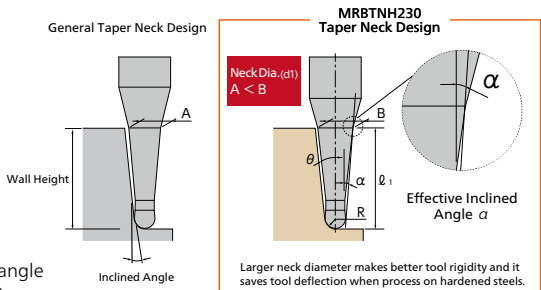
Taper neck to improve tool rigidity.  
Option of same taper angle as inclined working angle



- Taper neck type ball end mill improves accuracy for deep milling.
- Optimized taper neck design and MUGEN COATING PREMIUM realized to show its higher ability for hardened steels.
- Lineup of total 209 size with high versatility 2-flute end mills.
- **I** : Semi-standard item, please inquire for price and delivery.

※Please select the tool with the same neck angle as the inclined angle of the milling surface.

[Neck Shape]  
(γ) is reference value. Tool measurement required in order to avoid interference to the work material.



※Please select the tool with the same neck angle as the inclined angle of the milling surface.

| Code No.       | Radius (R) | Neck ※ Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|------------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|
| 08-00588-02051 | R0.2       | 2°                     | 3                      | 0.58           | 0.3               | 0.6                      | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-02053 |            |                        | 4                      | 0.65           | 0.3               | 0.6                      | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-02055 |            |                        | 6                      | 0.79           | 0.3               | 0.6                      | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-02073 |            | 3°                     | 5                      | 0.88           | 0.3               | 0.6                      | 12°                    | 2°59′                        | 4              | 50                 |
| 08-00588-02075 |            |                        | 7                      | 1.09           | 0.3               | 0.6                      | 12°                    | 2°59′                        | 4              | 50                 |
| 08-00588-02093 |            |                        | 5                      | 1.22           | 0.3               | 0.6                      | 12°                    | 4°59′                        | 4              | 50                 |
| 08-00588-02095 | R0.25      | 5°                     | 7                      | 1.57           | 0.3               | 0.6                      | 12°                    | 4°59′                        | 4              | 50                 |
| 08-00588-02521 |            |                        | 4                      | 0.54           | 0.35              | 0.75                     | 12°                    | 0°29′                        | 4              | 50                 |
| 08-00588-02523 |            |                        | 5                      | 0.56           | 0.35              | 0.75                     | 12°                    | 0°29′                        | 4              | 50                 |
| 08-00588-02531 |            | 1°                     | 4                      | 0.61           | 0.35              | 0.75                     | 12°                    | 0°59′                        | 4              | 50                 |
| 08-00588-02533 |            |                        | 5                      | 0.64           | 0.35              | 0.75                     | 12°                    | 0°59′                        | 4              | 50                 |
| 08-00588-02541 |            |                        | 4                      | 0.67           | 0.35              | 0.75                     | 12°                    | 1°29′                        | 4              | 50                 |
| 08-00588-02543 |            | 1°30′                  | 5                      | 0.73           | 0.35              | 0.75                     | 12°                    | 1°29′                        | 4              | 50                 |
| 08-00588-02551 |            |                        | 4                      | 0.74           | 0.35              | 0.75                     | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-02553 |            |                        | 5                      | 0.81           | 0.35              | 0.75                     | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-03021 |            | 2°                     | 4                      | 0.64           | 0.45              | 0.9                      | 12°                    | 0°29′                        | 4              | 50                 |
| 08-00588-03023 |            |                        | 5                      | 0.66           | 0.45              | 0.9                      | 12°                    | 0°29′                        | 4              | 50                 |
| 08-00588-03025 |            |                        | 6                      | 0.67           | 0.45              | 0.9                      | 12°                    | 0°29′                        | 4              | 50                 |
| 08-00588-03027 | R0.3       | 30′                    | 8                      | 0.71           | 0.45              | 0.9                      | 12°                    | 0°29′                        | 4              | 50                 |
| 08-00588-03031 |            |                        | 4                      | 0.7            | 0.45              | 0.9                      | 12°                    | 0°59′                        | 4              | 50                 |
| 08-00588-03033 |            |                        | 5                      | 0.74           | 0.45              | 0.9                      | 12°                    | 0°59′                        | 4              | 50                 |
| 08-00588-03035 |            | 1°                     | 6                      | 0.77           | 0.45              | 0.9                      | 12°                    | 0°59′                        | 4              | 50                 |
| 08-00588-03037 |            |                        | 8                      | 0.84           | 0.45              | 0.9                      | 12°                    | 0°59′                        | 4              | 50                 |
| 08-00588-03041 |            |                        | 4                      | 0.77           | 0.45              | 0.9                      | 12°                    | 1°29′                        | 4              | 50                 |
| 08-00588-03043 |            | 1°30′                  | 5                      | 0.82           | 0.45              | 0.9                      | 12°                    | 1°29′                        | 4              | 50                 |
| 08-00588-03045 |            |                        | 6                      | 0.87           | 0.45              | 0.9                      | 12°                    | 1°29′                        | 4              | 50                 |
| 08-00588-03047 |            |                        | 8                      | 0.98           | 0.45              | 0.9                      | 12°                    | 1°29′                        | 4              | 50                 |
| 08-00588-03053 |            | 2°                     | 5                      | 0.9            | 0.45              | 0.9                      | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-03055 |            |                        | 6                      | 0.97           | 0.45              | 0.9                      | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-03057 |            |                        | 8                      | 1.11           | 0.45              | 0.9                      | 12°                    | 1°59′                        | 4              | 50                 |
| 08-00588-03072 |            | 3°                     | 4                      | 0.96           | 0.45              | 0.9                      | 12°                    | 2°59′                        | 4              | 50                 |
| 08-00588-03073 |            |                        | 5                      | 1.07           | 0.45              | 0.9                      | 12°                    | 2°59′                        | 4              | 50                 |
| 08-00588-03075 |            |                        | 7                      | 1.28           | 0.45              | 0.9                      | 12°                    | 2°59′                        | 4              | 50                 |
| 08-00588-03092 |            | 5°                     | 5                      | 1.4            | 0.45              | 0.9                      | 12°                    | 4°59′                        | 4              | 50                 |
| 08-00588-03094 |            |                        | 7                      | 1.75           | 0.45              | 0.9                      | 12°                    | 4°59′                        | 4              | 50                 |
| 08-00588-04021 | R0.4       | 30′                    | 8                      | 0.89           | 0.6               | 1.2                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-04023 |            |                        | 12                     | 0.96           | 0.6               | 1.2                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-04031 |            |                        | 8                      | 1.03           | 0.6               | 1.2                      | 12°                    | 0°59′                        | 4              | 60                 |
| 08-00588-04033 |            | 1°                     | 12                     | 1.17           | 0.6               | 1.2                      | 12°                    | 0°59′                        | 4              | 60                 |
| 08-00588-04041 |            |                        | 8                      | 1.16           | 0.6               | 1.2                      | 12°                    | 1°29′                        | 4              | 60                 |
| 08-00588-04043 |            |                        | 12                     | 1.37           | 0.6               | 1.2                      | 12°                    | 1°29′                        | 4              | 60                 |
| 08-00588-04051 |            | 1°30′                  | 8                      | 1.29           | 0.6               | 1.2                      | 12°                    | 1°59′                        | 4              | 60                 |
| 08-00588-04053 |            |                        | 12                     | 1.57           | 0.6               | 1.2                      | 12°                    | 1°59′                        | 4              | 60                 |
| 08-00588-04521 |            |                        | 8                      | 0.99           | 0.65              | 1.35                     | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-04523 |            | 30′                    | 12                     | 1.06           | 0.65              | 1.35                     | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-04525 |            |                        | 16                     | 1.13           | 0.65              | 1.35                     | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-04531 |            |                        | 8                      | 1.12           | 0.65              | 1.35                     | 12°                    | 0°59′                        | 4              | 60                 |
| 08-00588-04533 | R0.45      | 1°                     | 12                     | 1.26           | 0.65              | 1.35                     | 12°                    | 0°59′                        | 4              | 60                 |
| 08-00588-04535 |            |                        | 16                     | 1.4            | 0.65              | 1.35                     | 12°                    | 0°59′                        | 4              | 60                 |
| 08-00588-04541 |            |                        | 8                      | 1.25           | 0.65              | 1.35                     | 12°                    | 1°29′                        | 4              | 60                 |
| 08-00588-04543 |            | 1°30′                  | 12                     | 1.46           | 0.65              | 1.35                     | 12°                    | 1°29′                        | 4              | 60                 |
| 08-00588-04545 |            |                        | 16                     | 1.67           | 0.65              | 1.35                     | 12°                    | 1°29′                        | 4              | 60                 |
| 08-00588-05021 |            |                        | 6                      | 1.05           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-05022 | R0.5       | 30′                    | 8                      | 1.08           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-05023 |            |                        | 10                     | 1.12           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-05024 |            |                        | 12                     | 1.15           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-05025 |            |                        | 16                     | 1.22           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 60                 |
| 08-00588-05026 |            |                        | 20                     | 1.29           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 70                 |
| 08-00588-05027 |            |                        | 6                      | 1.05           | 0.75              | 1.5                      | 12°                    | 0°29′                        | 4              | 60                 |

How to Order

When you order, indicate MRBTNH230 (R)×(θ)×(ℓ1).

※(γ) is reference value.

Machining case

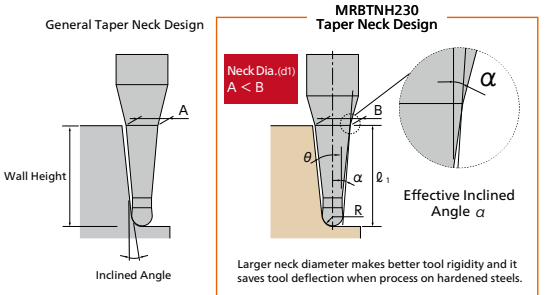
W-014



MRBTNH230

MUGEN COATING PREMIUM 2-Flute Long Taper Neck Ball End Mill

[Neck Shape]  
( $\gamma$ ) is reference value. Tool measurement required in order to avoid interference to the work material.



MUGEN COATING PREMIUM 2-Flute Long Taper Neck Ball End Mill

MRBTNH230

◆ New Size

Unit : mm

| Code No.       | Radius (R) | Neck Taper Angle ( $\theta$ ) | Under Neck Length ( $\ell_1$ ) | Neck Dia. (d1) | Length of Cut ( $\ell$ ) | Under Neck Length 2 ( $\ell_2$ ) | Neck Taper Angle 2 ( $\gamma$ ) | Effective Inclined Angle ( $\alpha$ ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------------------|--------------------------------|----------------|--------------------------|----------------------------------|---------------------------------|---------------------------------------|----------------|--------------------|
| 08-00588-05027 | R0.5       | 30'                           | 25                             | 1.38           | 0.75                     | 1.5                              | 12°                             | 0°29'                                 | 4              | 70                 |
| 08-00588-05028 |            |                               | 30                             | 1.47           | 0.75                     | 1.5                              | 12°                             | 0°29'                                 | 4              | 70                 |
| 08-00588-05031 |            |                               | 6                              | 1.15           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-05032 |            |                               | 8                              | 1.22           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-05033 |            |                               | 10                             | 1.29           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-05034 |            |                               | 12                             | 1.36           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-05035 |            | 1°                            | 16                             | 1.5            | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-05036 |            |                               | 20                             | 1.63           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-05037 |            |                               | 25                             | 1.81           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-05038 |            |                               | 30                             | 1.98           | 0.75                     | 1.5                              | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-05041 |            |                               | 6                              | 1.24           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-05042 |            |                               | 8                              | 1.35           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-05043 |            | 1°30'                         | 10                             | 1.45           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-05044 |            |                               | 12                             | 1.56           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-05045 |            |                               | 16                             | 1.77           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-05046 |            |                               | 20                             | 1.98           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 70                 |
| 08-00588-05047 |            |                               | 25                             | 2.24           | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 70                 |
| 08-00588-05048 |            |                               | 30                             | 2.5            | 0.75                     | 1.5                              | 12°                             | 1°29'                                 | 4              | 70                 |
| 08-00588-05052 |            | 2°                            | 8                              | 1.48           | 0.75                     | 1.5                              | 12°                             | 1°59'                                 | 4              | 60                 |
| 08-00588-05053 |            |                               | 10                             | 1.62           | 0.75                     | 1.5                              | 12°                             | 1°59'                                 | 4              | 60                 |
| 08-00588-05056 |            |                               | 20                             | 2.32           | 0.75                     | 1.5                              | 12°                             | 1°59'                                 | 4              | 70                 |
| 08-00588-05058 |            | 3°                            | 30                             | 3.01           | 0.75                     | 1.5                              | 12°                             | 1°59'                                 | 4              | 70                 |
| 08-00588-05073 |            |                               | 10                             | 1.95           | 0.75                     | 1.5                              | 12°                             | 2°59'                                 | 4              | 60                 |
| 08-00588-05076 |            |                               | 20                             | 3              | 0.75                     | 1.5                              | 12°                             | 2°59'                                 | 4              | 70                 |
| 08-00588-05078 |            | 1°                            | 30                             | 4.05           | 0.75                     | 1.5                              | 12°                             | 2°59'                                 | 6              | 70                 |
| 08-00588-06031 |            |                               | 6                              | 1.34           | 0.9                      | 1.8                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-06032 |            |                               | 8                              | 1.41           | 0.9                      | 1.8                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-06033 | R0.6       | 1°                            | 10                             | 1.48           | 0.9                      | 1.8                              | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-06036 |            |                               | 20                             | 1.83           | 0.9                      | 1.8                              | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-06038 |            |                               | 30                             | 2.18           | 0.9                      | 1.8                              | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-06041 |            |                               | 6                              | 1.43           | 0.9                      | 1.8                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-06042 |            |                               | 8                              | 1.54           | 0.9                      | 1.8                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-06043 |            | 1°30'                         | 10                             | 1.64           | 0.9                      | 1.8                              | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-06046 |            |                               | 20                             | 2.17           | 0.9                      | 1.8                              | 12°                             | 1°29'                                 | 4              | 70                 |
| 08-00588-06048 |            |                               | 30                             | 2.69           | 0.9                      | 1.8                              | 12°                             | 1°29'                                 | 4              | 70                 |
| 08-00588-06073 |            |                               | 10                             | 2.14           | 0.9                      | 1.8                              | 12°                             | 2°59'                                 | 4              | 60                 |
| 08-00588-06076 |            | 3°                            | 20                             | 3.19           | 0.9                      | 1.8                              | 12°                             | 2°59'                                 | 4              | 70                 |
| 08-00588-06078 |            |                               | 35                             | 4.76           | 0.9                      | 1.8                              | 12°                             | 2°59'                                 | 6              | 80                 |
| 08-00588-07521 | R0.75      | 30'                           | 10                             | 1.61           | 1.1                      | 2.25                             | 12°                             | 0°29'                                 | 4              | 60                 |
| 08-00588-07523 |            |                               | 15                             | 1.69           | 1.1                      | 2.25                             | 12°                             | 0°29'                                 | 4              | 60                 |
| 08-00588-07525 |            |                               | 20                             | 1.78           | 1.1                      | 2.25                             | 12°                             | 0°29'                                 | 4              | 70                 |
| 08-00588-07527 |            |                               | 25                             | 1.87           | 1.1                      | 2.25                             | 12°                             | 0°29'                                 | 4              | 70                 |
| 08-00588-07529 |            |                               | 30                             | 1.96           | 1.1                      | 2.25                             | 12°                             | 0°29'                                 | 4              | 70                 |
| 08-00588-07531 |            | 1°                            | 10                             | 1.77           | 1.1                      | 2.25                             | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-07533 |            |                               | 15                             | 1.94           | 1.1                      | 2.25                             | 12°                             | 0°59'                                 | 4              | 60                 |
| 08-00588-07535 |            |                               | 20                             | 2.12           | 1.1                      | 2.25                             | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-07537 |            |                               | 25                             | 2.29           | 1.1                      | 2.25                             | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-07539 |            |                               | 30                             | 2.47           | 1.1                      | 2.25                             | 12°                             | 0°59'                                 | 4              | 70                 |
| 08-00588-07541 |            |                               | 10                             | 1.93           | 1.1                      | 2.25                             | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-07543 |            | 1°30'                         | 15                             | 2.19           | 1.1                      | 2.25                             | 12°                             | 1°29'                                 | 4              | 60                 |
| 08-00588-07545 |            |                               | 20                             | 2.45           | 1.1                      | 2.25                             | 12°                             | 1°29'                                 | 4              | 70                 |
| 08-00588-07551 |            | 2°                            | 10                             | 2.09           | 1.1                      | 2.25                             | 12°                             | 1°59'                                 | 4              | 60                 |
| 08-00588-07553 |            |                               | 15                             | 2.44           | 1.1                      | 2.25                             | 12°                             | 1°59'                                 | 4              | 60                 |
| 08-00588-07555 |            |                               | 20                             | 2.79           | 1.1                      | 2.25                             | 12°                             | 1°59'                                 | 4              | 70                 |
| 08-00588-10021 | R1         | 30'                           | 12                             | 2.14           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 60                 |
| 08-00588-10022 |            |                               | 16                             | 2.21           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 60                 |

How to Order

When you order, indicate MRBTNH230 (R)×(θ)×(ℓ1).

※(γ) is reference value.

※Please select the tool with the same neck angle as the inclined angle of the milling surface.

Unit : mm

| Code No.       | Radius (R) | Neck Taper Angle ( $\theta$ ) | Under Neck Length ( $\ell_1$ ) | Neck Dia. (d1) | Length of Cut ( $\ell$ ) | Under Neck Length 2 ( $\ell_2$ ) | Neck Taper Angle 2 ( $\gamma$ ) | Effective Inclined Angle ( $\alpha$ ) | Shank Dia. (d) | Overall Length (L) |    |
|----------------|------------|-------------------------------|--------------------------------|----------------|--------------------------|----------------------------------|---------------------------------|---------------------------------------|----------------|--------------------|----|
| 08-00588-10023 | R1         | 30'                           | 20                             | 2.28           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 70                 |    |
| 08-00588-10024 |            |                               | 25                             | 2.37           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 70                 |    |
| 08-00588-10025 |            |                               | 30                             | 2.46           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 70                 |    |
| 08-00588-10026 |            |                               | 35                             | 2.54           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 80                 |    |
| 08-00588-10027 |            |                               | 40                             | 2.63           | 1.5                      | 3                                | 12°                             | 0°29'                                 | 4              | 80                 |    |
| 08-00588-10028 |            |                               | 50                             | 2.81           | 1.5                      | 3                                | 12°                             | 0°30'                                 | 4              | 90                 |    |
| 08-00588-10031 |            | 1°                            | 12                             | 2.33           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 4              | 60                 |    |
| 08-00588-10032 |            |                               | 16                             | 2.47           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 4              | 60                 |    |
| 08-00588-10033 |            |                               | 20                             | 2.61           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 4              | 70                 |    |
| 08-00588-10034 |            |                               | 25                             | 2.79           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 4              | 70                 |    |
| 08-00588-10035 |            |                               | 30                             | 2.96           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 4              | 70                 |    |
| 08-00588-10036 |            |                               | 35                             | 3.14           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 6              | 80                 |    |
| 08-00588-10037 |            | 1°30'                         | 40                             | 3.31           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 6              | 80                 |    |
| 08-00588-10038 |            |                               | 50                             | 3.66           | 1.5                      | 3                                | 12°                             | 0°59'                                 | 6              | 90                 |    |
| 08-00588-10041 |            |                               | 12                             | 2.53           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 4              | 60                 |    |
| 08-00588-10042 |            |                               | 16                             | 2.74           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 4              | 60                 |    |
| 08-00588-10043 |            |                               | 20                             | 2.95           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 4              | 70                 |    |
| 08-00588-10044 |            |                               | 25                             | 3.21           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 4              | 70                 |    |
| 08-00588-10045 |            | 2°                            | 30                             | 3.47           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 6              | 70                 |    |
| 08-00588-10046 |            |                               | 35                             | 3.73           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 6              | 80                 |    |
| 08-00588-10047 |            |                               | 40                             | 3.99           | 1.5                      | 3                                | 12°                             | 1°29'                                 | 6              | 80                 |    |
| 08-00588-10048 |            |                               | 50                             | 4.52           | 1.5                      | 3                                | 12°                             | 1°30'                                 | 6              | 90                 |    |
| 08-00588-10051 |            |                               | 12                             | 2.72           | 1.5                      | 3                                | 12°                             | 1°59'                                 | 4              | 60                 |    |
| 08-00588-10052 |            |                               | 16                             | 3              | 1.5                      | 3                                | 12°                             | 1°59'                                 | 4              | 60                 |    |
| 08-00588-10053 |            | 30'                           | 20                             | 3.28           | 1.5                      | 3                                | 12°                             | 1°59'                                 | 4              | 70                 |    |
| 08-00588-10054 |            |                               | 25                             | 3.63           | 1.5                      | 3                                | 12°                             | 1°59'                                 | 6              | 70                 |    |
| 08-00588-10055 |            |                               | 30                             | 3.98           | 1.5                      | 3                                | 12°                             | 1°59'                                 | 6              | 70                 |    |
| 08-00588-10057 |            |                               | 40                             | 4.67           | 1.5                      | 3                                | 12°                             | 1°59'                                 | 6              | 80                 |    |
| 08-00588-10058 |            |                               | 50                             | 5.37           | 1.5                      | 3                                | 12°                             | 2°00'                                 | 6              | 90                 |    |
| 08-00588-15021 |            |                               | R1.5                           | 15             | 3.13                     | 2.5                              | 4.5                             | 12°                                   | 0°29'          | 6                  | 70 |
| 08-00588-15022 |            | 20                            |                                | 3.22           | 2.5                      | 4.5                              | 12°                             | 0°29'                                 | 6              | 70                 |    |
| 08-00588-15023 |            | 25                            |                                | 3.31           | 2.5                      | 4.5                              | 12°                             | 0°29'                                 | 6              | 70                 |    |
| 08-00588-15024 |            | 30                            |                                | 3.4            | 2.5                      | 4.5                              | 12°                             | 0°29'                                 | 6              | 70                 |    |
| 08-00588-15025 |            | 40                            |                                | 3.57           | 2.5                      | 4.5                              | 12°                             | 0°29'                                 | 6              | 80                 |    |
| 08-00588-15026 |            | 50                            |                                | 3.74           | 2.5                      | 4.5                              | 12°                             | 0°29'                                 | 6              | 90                 |    |
| 08-00588-15031 |            | 1°                            |                                | 15             | 3.37                     | 2.5                              | 4.5                             | 12°                                   | 0°59'          | 6                  | 70 |
| 08-00588-15032 |            |                               |                                | 20             | 3.54                     | 2.5                              | 4.5                             | 12°                                   | 0°59'          | 6                  | 70 |
| 08-00588-15033 |            |                               |                                | 25             | 3.72                     | 2.5                              | 4.5                             | 12°                                   | 0°59'          | 6                  | 70 |
| 08-00588-15034 |            |                               |                                | 30             | 3.89                     | 2.5                              | 4.5                             | 12°                                   | 0°59'          | 6                  | 70 |
| 08-00588-15035 |            |                               |                                | 40             | 4.24                     | 2.5                              | 4.5                             | 12°                                   | 0°59'          | 6                  | 80 |
| 08-00588-15036 |            |                               |                                | 50             | 4.59                     | 2.5                              | 4.5                             | 12°                                   | 0°59'          | 6                  | 90 |
| 08-00588-15041 |            | 1°30'                         |                                | 15             | 3.61                     | 2.5                              | 4.5                             | 12°                                   | 1°29'          | 6                  | 70 |
| 08-00588-15042 |            |                               |                                | 20             | 3.87                     | 2.5                              | 4.5                             | 12°                                   | 1°29'          | 6                  | 70 |
| 08-00588-15043 |            |                               |                                | 25             | 4.13                     | 2.5                              | 4.5                             | 12°                                   | 1°29'          | 6                  | 70 |
| 08-00588-15044 |            |                               |                                | 30             | 4.39                     | 2.5                              | 4.5                             | 12°                                   | 1°29'          | 6                  | 70 |
| 08-00588-15045 |            |                               |                                | 40             | 4.91                     | 2.5                              | 4.5                             | 12°                                   | 1°29'          | 6                  | 80 |
| 08-00588-15046 |            |                               |                                | 50             | 5.44                     | 2.5                              | 4.5                             | 12°                                   | 1°29'          | 6                  | 90 |
| 08-00588-15051 |            | 2°                            |                                | 15             | 3.84                     | 2.5                              | 4.5                             | 12°                                   | 1°59'          | 6                  | 70 |
| 08-00588-15052 | 20         |                               |                                | 4.19           | 2.5                      | 4.5                              | 12°                             | 1°59'                                 | 6              | 70                 |    |
| 08-00588-15054 | 30         |                               |                                | 4.89           | 2.5                      | 4.5                              | 12°                             | 1°59'                                 | 6              | 70                 |    |
| 08-00588-20031 | R2         | 1°                            |                                | 20             | 4.57                     | 3                                | 6                               | 12°                                   | 0°59'          | 6                  | 80 |
| 08-00588-20033 |            |                               |                                | 30             | 4.92                     | 3                                | 6                               | 12°                                   | 0°59'          | 6                  | 80 |
| 08-00588-20035 |            |                               |                                | 40             | 5.26                     | 3                                | 6                               | 12°                                   | 0°59'          | 6                  | 80 |
| 08-00588-20036 |            |                               | 50                             | 5.62           | 3                        | 6                                | 12°                             | 0°59'                                 | 6              | 90                 |    |
| 08-00588-20037 |            |                               | 61.1                           | 6              | 3                        | 6                                | —                               | 0°59'                                 | 6              | 110                |    |

| Work Material |                        |                         | Prehardened Steels<br>HPM・NAK<br>(~41HRC) |       |        |                   | Hardened Steels<br>STAVAX・SKD61<br>(~52HRC) |       |     |              | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |                   |        | High Speed Steels<br>SKH・HAP<br>(~65HRC) |       |        |                   |
|---------------|------------------------|-------------------------|-------------------------------------------|-------|--------|-------------------|---------------------------------------------|-------|-----|--------------|--------------------------------------------|--------|-------------------|--------|------------------------------------------|-------|--------|-------------------|
| Radius        | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | Depth of Cut                              |       | Feed   |                   | Spindle<br>Speed                            |       |     | Depth of Cut |                                            | Feed   |                   |        | Depth of Cut                             |       | Feed   |                   |
|               |                        |                         | ap mm                                     | ae mm | mm/min | min <sup>-1</sup> | ap mm                                       | ae mm |     | ap mm        | ae mm                                      | mm/min | min <sup>-1</sup> |        | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.05          | 3°                     | 0.5                     | 0.005                                     | 0.005 | 120    | 40,000            | 0.003                                       | 0.005 | 100 | 40,000       | 0.002                                      | 0.005  | 70                | 40,000 | 0.002                                    | 0.003 | 50     | 40,000            |
|               |                        | 0.75                    | 0.003                                     | 0.005 | 100    | 40,000            | 0.002                                       | 0.003 | 70  | 40,000       | 0.001                                      | 0.003  | 50                | 40,000 | 0.001                                    | 0.002 | 30     | 40,000            |
| 0.075         | 3°                     | 1                       | 0.005                                     | 0.005 | 180    | 40,000            | 0.003                                       | 0.005 | 150 | 40,000       | 0.002                                      | 0.005  | 120               | 40,000 | 0.002                                    | 0.003 | 70     | 40,000            |
|               |                        | 1.5                     | 0.003                                     | 0.005 | 100    | 40,000            | 0.002                                       | 0.003 | 70  | 40,000       | 0.001                                      | 0.003  | 50                | 40,000 | 0.001                                    | 0.002 | 30     | 40,000            |
| 0.1           | 30°                    | 1.5                     | 0.003                                     | 0.01  | 200    | 40,000            | 0.003                                       | 0.005 | 180 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 100    | 40,000            |
|               |                        | 2                       | 0.003                                     | 0.005 | 150    | 40,000            | 0.002                                       | 0.003 | 120 | 40,000       | 0.001                                      | 0.002  | 100               | 40,000 | 0.001                                    | 0.002 | 60     | 40,000            |
|               | 1°                     | 1.5                     | 0.003                                     | 0.007 | 200    | 40,000            | 0.003                                       | 0.005 | 180 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 100    | 40,000            |
|               |                        | 2                       | 0.003                                     | 0.007 | 160    | 40,000            | 0.003                                       | 0.005 | 140 | 40,000       | 0.002                                      | 0.003  | 120               | 40,000 | 0.001                                    | 0.002 | 80     | 40,000            |
|               | 1°30'                  | 1.5                     | 0.005                                     | 0.01  | 230    | 40,000            | 0.003                                       | 0.005 | 200 | 40,000       | 0.002                                      | 0.003  | 160               | 40,000 | 0.001                                    | 0.002 | 120    | 40,000            |
|               |                        | 2                       | 0.003                                     | 0.01  | 200    | 40,000            | 0.003                                       | 0.005 | 160 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 100    | 40,000            |
|               | 2°                     | 1.5                     | 0.007                                     | 0.01  | 250    | 40,000            | 0.005                                       | 0.01  | 230 | 40,000       | 0.003                                      | 0.005  | 180               | 40,000 | 0.002                                    | 0.003 | 140    | 40,000            |
|               |                        | 2                       | 0.003                                     | 0.01  | 230    | 40,000            | 0.003                                       | 0.005 | 180 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 100    | 40,000            |
|               | 3°                     | 3                       | 0.005                                     | 0.01  | 230    | 40,000            | 0.003                                       | 0.005 | 180 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 100    | 40,000            |
|               |                        | 5                       | 0.003                                     | 0.005 | 200    | 40,000            | 0.002                                       | 0.003 | 160 | 40,000       | 0.001                                      | 0.002  | 120               | 40,000 | 0.001                                    | 0.002 | 80     | 40,000            |
|               | 5°                     | 3                       | 0.007                                     | 0.01  | 250    | 40,000            | 0.005                                       | 0.01  | 200 | 40,000       | 0.003                                      | 0.005  | 160               | 40,000 | 0.002                                    | 0.003 | 120    | 40,000            |
|               |                        | 5                       | 0.005                                     | 0.01  | 230    | 40,000            | 0.003                                       | 0.005 | 180 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 100    | 40,000            |
| 0.15          | 30°                    | 2                       | 0.003                                     | 0.007 | 230    | 40,000            | 0.003                                       | 0.005 | 200 | 40,000       | 0.002                                      | 0.003  | 160               | 40,000 | 0.002                                    | 0.002 | 120    | 40,000            |
|               |                        | 3                       | 0.003                                     | 0.005 | 180    | 40,000            | 0.002                                       | 0.003 | 140 | 40,000       | 0.001                                      | 0.002  | 120               | 40,000 | 0.001                                    | 0.002 | 70     | 40,000            |
|               | 1°                     | 2                       | 0.003                                     | 0.01  | 230    | 40,000            | 0.003                                       | 0.005 | 200 | 40,000       | 0.002                                      | 0.003  | 160               | 40,000 | 0.002                                    | 0.002 | 120    | 40,000            |
|               |                        | 3                       | 0.003                                     | 0.007 | 200    | 40,000            | 0.003                                       | 0.005 | 160 | 40,000       | 0.002                                      | 0.003  | 140               | 40,000 | 0.001                                    | 0.002 | 90     | 40,000            |
|               | 1°30'                  | 2                       | 0.005                                     | 0.01  | 250    | 40,000            | 0.003                                       | 0.005 | 230 | 40,000       | 0.002                                      | 0.003  | 180               | 40,000 | 0.002                                    | 0.002 | 140    | 40,000            |
|               |                        | 3                       | 0.003                                     | 0.01  | 220    | 40,000            | 0.003                                       | 0.005 | 180 | 40,000       | 0.002                                      | 0.003  | 150               | 40,000 | 0.001                                    | 0.002 | 110    | 40,000            |
|               | 2°                     | 2                       | 0.007                                     | 0.01  | 280    | 40,000            | 0.005                                       | 0.01  | 250 | 40,000       | 0.003                                      | 0.005  | 200               | 40,000 | 0.002                                    | 0.003 | 160    | 40,000            |
|               |                        | 3                       | 0.003                                     | 0.01  | 250    | 40,000            | 0.003                                       | 0.005 | 200 | 40,000       | 0.002                                      | 0.003  | 160               | 40,000 | 0.002                                    | 0.002 | 120    | 40,000            |
|               | 3°                     | 2                       | 0.01                                      | 0.015 | 300    | 40,000            | 0.007                                       | 0.01  | 280 | 40,000       | 0.005                                      | 0.007  | 230               | 40,000 | 0.003                                    | 0.005 | 200    | 40,000            |
|               |                        | 3                       | 0.007                                     | 0.015 | 280    | 40,000            | 0.005                                       | 0.01  | 250 | 40,000       | 0.003                                      | 0.007  | 200               | 40,000 | 0.002                                    | 0.005 | 180    | 40,000            |
|               | 5°                     | 5                       | 0.007                                     | 0.01  | 250    | 40,000            | 0.005                                       | 0.007 | 230 | 40,000       | 0.003                                      | 0.005  | 180               | 40,000 | 0.002                                    | 0.003 | 160    | 40,000            |
|               |                        | 7                       | 0.005                                     | 0.007 | 230    | 40,000            | 0.003                                       | 0.005 | 200 | 40,000       | 0.002                                      | 0.003  | 160               | 40,000 | 0.001                                    | 0.002 | 140    | 40,000            |
| 0.2           | 30°                    | 3                       | 0.01                                      | 0.015 | 300    | 40,000            | 0.007                                       | 0.01  | 280 | 40,000       | 0.005                                      | 0.007  | 230               | 40,000 | 0.003                                    | 0.005 | 200    | 40,000            |
|               |                        | 5                       | 0.007                                     | 0.015 | 280    | 40,000            | 0.005                                       | 0.01  | 250 | 40,000       | 0.003                                      | 0.007  | 200               | 40,000 | 0.002                                    | 0.005 | 180    | 40,000            |
|               | 1°                     | 7                       | 0.007                                     | 0.01  | 250    | 40,000            | 0.005                                       | 0.007 | 230 | 40,000       | 0.003                                      | 0.005  | 180               | 40,000 | 0.002                                    | 0.003 | 160    | 40,000            |
|               |                        | 3                       | 0.01                                      | 0.02  | 360    | 40,000            | 0.007                                       | 0.01  | 300 | 40,000       | 0.005                                      | 0.007  | 240               | 40,000 | 0.003                                    | 0.005 | 160    | 40,000            |
|               | 1°30'                  | 4                       | 0.007                                     | 0.01  | 240    | 40,000            | 0.005                                       | 0.005 | 160 | 40,000       | 0.003                                      | 0.003  | 120               | 40,000 | 0.002                                    | 0.003 | 100    | 40,000            |
|               |                        | 6                       | 0.005                                     | 0.01  | 160    | 40,000            | 0.003                                       | 0.005 | 120 | 40,000       | 0.002                                      | 0.003  | 100               | 40,000 | 0.001                                    | 0.003 | 70     | 40,000            |
|               | 2°                     | 3                       | 0.01                                      | 0.02  | 400    | 40,000            | 0.007                                       | 0.01  | 320 | 40,000       | 0.005                                      | 0.007  | 260               | 40,000 | 0.003                                    | 0.005 | 200    | 40,000            |
|               |                        | 4                       | 0.01                                      | 0.015 | 320    | 40,000            | 0.005                                       | 0.007 | 240 | 40,000       | 0.003                                      | 0.005  | 160               | 40,000 | 0.002                                    | 0.003 | 120    | 40,000            |
|               | 3°                     | 6                       | 0.005                                     | 0.007 | 200    | 40,000            | 0.005                                       | 0.005 | 160 | 40,000       | 0.003                                      | 0.003  | 120               | 40,000 | 0.002                                    | 0.002 | 90     | 40,000            |
|               |                        | 3                       | 0.015                                     | 0.02  | 450    | 40,000            | 0.007                                       | 0.01  | 360 | 40,000       | 0.005                                      | 0.007  | 280               | 40,000 | 0.003                                    | 0.005 | 240    | 40,000            |
|               | 5°                     | 4                       | 0.01                                      | 0.02  | 400    | 40,000            | 0.007                                       | 0.01  | 300 | 40,000       | 0.005                                      | 0.007  | 240               | 40,000 | 0.003                                    | 0.005 | 160    | 40,000            |
|               |                        | 6                       | 0.007                                     | 0.01  | 300    | 40,000            | 0.005                                       | 0.007 | 240 | 40,000       | 0.003                                      | 0.005  | 160               | 40,000 | 0.002                                    | 0.003 | 120    | 40,000            |
| 0.25          | 30°                    | 3                       | 0.015                                     | 0.02  | 480    | 40,000            | 0.007                                       | 0.01  | 400 | 40,000       | 0.005                                      | 0.007  | 320               | 40,000 | 0.003                                    | 0.005 | 280    | 40,000            |
|               |                        | 4                       | 0.01                                      | 0.02  | 400    | 40,000            | 0.007                                       | 0.01  | 320 | 40,000       | 0.005                                      | 0.007  | 260               | 40,000 | 0.003                                    | 0.005 | 220    | 40,000            |
|               | 1°                     | 6                       | 0.01                                      | 0.015 | 320    | 40,000            | 0.005                                       | 0.007 | 240 | 40,000       | 0.003                                      | 0.005  | 180               | 40,000 | 0.002                                    | 0.003 | 140    | 40,000            |
|               |                        | 5                       | 0.01                                      | 0.02  | 400    | 40,000            | 0.005                                       | 0.007 | 320 | 40,000       | 0.003                                      | 0.005  | 240               | 40,000 | 0.002                                    | 0.003 | 140    | 40,000            |
|               | 1°30'                  | 5                       | 0.015                                     | 0.02  | 420    | 40,000            | 0.01                                        | 0.015 | 360 | 40,000       | 0.007                                      | 0.01   | 300               | 40,000 | 0.005                                    | 0.007 | 260    | 40,000            |
|               |                        | 7                       | 0.015                                     | 0.015 | 400    | 40,000            | 0.007                                       | 0.01  | 320 | 40,000       | 0.005                                      | 0.007  | 240               | 40,000 | 0.003                                    | 0.005 | 220    | 40,000            |
|               | 2°                     | 4                       | 0.012                                     | 0.02  | 500    | 40,000            | 0.007                                       | 0.01  | 450 | 40,000       | 0.005                                      | 0.007  | 360               | 40,000 | 0.003                                    | 0.005 | 280    | 40,000            |
|               |                        | 5                       | 0.008                                     | 0.01  | 460    | 40,000            | 0.005                                       | 0.005 | 400 | 40,000       | 0.003                                      | 0.003  | 300               | 40,000 | 0.002                                    | 0.003 | 240    | 40,000            |
|               | 3°                     | 4                       | 0.015                                     | 0.03  | 580    | 40,000            | 0.007                                       | 0.01  | 520 | 40,000       | 0.005                                      | 0.007  | 400               | 40,000 | 0.003                                    | 0.005 | 320    | 40,000            |
|               |                        | 5                       | 0.012                                     | 0.02  | 500    | 40,000            | 0.007                                       | 0.01  | 440 | 40,000       | 0.005                                      | 0.007  | 360               | 40,000 | 0.003                                    | 0.005 | 260    | 40,000            |
|               | 5°                     | 4                       | 0.015                                     | 0.035 | 640    | 40,000            | 0.01                                        | 0.02  | 560 | 40,000       | 0.007                                      | 0.01   | 480               | 40,000 | 0.005                                    | 0.007 | 360    | 40,000            |
|               |                        | 5                       | 0.012                                     | 0.02  | 500    | 40,000            | 0.007                                       | 0.01  | 460 | 40,000       | 0.005                                      | 0.007  | 380               | 40,000 | 0.003                                    | 0.005 | 280    | 40,000            |
| 0.3           | 30°                    | 4                       | 0.015                                     | 0.035 | 700    | 40,000            | 0.01                                        | 0.02  | 640 | 40,000       | 0.007                                      | 0.01   | 540               | 40,000 | 0.005                                    | 0.007 | 400    | 40,000            |
|               |                        | 5                       | 0.015                                     | 0.03  | 600    | 40,000            | 0.007                                       | 0.015 | 520 | 40,000       | 0.005                                      | 0.01   | 420               | 40,000 | 0.003                                    | 0.007 | 300    | 40,000            |
|               | 1°                     | 4                       | 0.025                                     | 0.07  | 900    | 40,000            | 0.02                                        | 0.03  | 800 | 40,000       | 0.02                                       | 0.03   | 700               | 40,000 | 0.02                                     | 0.03  | 600    | 40,000            |
|               |                        | 5                       | 0.025                                     | 0.05  | 750    | 40,000            | 0.02                                        | 0.03  | 700 | 40,000       | 0.02                                       | 0.03   | 600               | 40,000 | 0.02                                     | 0.03  | 500    | 40,000            |
|               | 1°30'                  | 6                       | 0.02                                      | 0.04  | 540    | 35,000            | 0.01                                        | 0.02  | 500 | 30,000       | 0.01                                       | 0.02   | 450               | 30,000 | 0.01                                     | 0.02  | 400    | 30,000            |
|               |                        | 8                       | 0.01                                      | 0.02  | 460    | 35,000            | 0.007                                       | 0.01  | 400 | 30,000       | 0.007                                      | 0.01   | 350               | 30,000 | 0.007                                    | 0.01  | 300    | 30,000            |

| Work Material |                        |                         | Prehardened Steels<br>HPM・NAK<br>(~41HRC) |       |        |                  | Hardened Steels<br>STAVAX・SKD61<br>(~52HRC) |                   |        |                  | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |       |        |                  | High Speed Steels<br>SKH・HAP<br>(~65HRC) |                   |        |                  |
|---------------|------------------------|-------------------------|-------------------------------------------|-------|--------|------------------|---------------------------------------------|-------------------|--------|------------------|--------------------------------------------|-------|--------|------------------|------------------------------------------|-------------------|--------|------------------|
| Radius        | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | Depth of Cut                              |       | Feed   | Spindle<br>Speed | Depth of Cut                                |                   | Feed   | Spindle<br>Speed | Depth of Cut                               |       | Feed   | Spindle<br>Speed | Depth of Cut                             |                   | Feed   | Spindle<br>Speed |
|               |                        |                         | ap mm                                     | ae mm |        |                  | mm/min                                      | min <sup>-1</sup> |        |                  | ap mm                                      | ae mm |        |                  | mm/min                                   | min <sup>-1</sup> |        |                  |
| 0.3           | 30°                    | 8                       | 0.008                                     | 0.015 | 400    | 30,000           | 0.005                                       | 0.007             | 360    | 25,000           | 0.003                                      | 0.005 | 300    | 25,000           | 0.003                                    | 0.003             | 260    | 20,000           |
|               |                        | 4                       | 0.025                                     | 0.07  | 900    | 40,000           | 0.02                                        | 0.03              | 800    | 40,000           | 0.01                                       | 0.03  | 580    | 40,000           | 0.01                                     | 0.02              | 450    | 30,000           |
|               |                        | 5                       | 0.025                                     | 0.05  | 750    | 40,000           | 0.02                                        | 0.03              | 700    | 35,000           | 0.01                                       | 0.02  | 500    | 35,000           | 0.008                                    | 0.015             | 420    | 30,000           |
|               |                        | 6                       | 0.02                                      | 0.04  | 540    | 35,000           | 0.01                                        | 0.02              | 500    | 30,000           | 0.007                                      | 0.015 | 460    | 30,000           | 0.007                                    | 0.01              | 400    | 30,000           |
|               | 1°                     | 8                       | 0.01                                      | 0.02  | 460    | 35,000           | 0.007                                       | 0.01              | 400    | 30,000           | 0.005                                      | 0.007 | 360    | 30,000           | 0.003                                    | 0.005             | 320    | 30,000           |
|               |                        | 4                       | 0.025                                     | 0.07  | 1,000  | 40,000           | 0.02                                        | 0.03              | 900    | 40,000           | 0.01                                       | 0.03  | 620    | 40,000           | 0.01                                     | 0.02              | 480    | 30,000           |
|               |                        | 5                       | 0.025                                     | 0.05  | 800    | 40,000           | 0.02                                        | 0.03              | 750    | 40,000           | 0.01                                       | 0.03  | 560    | 40,000           | 0.01                                     | 0.02              | 440    | 30,000           |
|               |                        | 6                       | 0.025                                     | 0.04  | 750    | 40,000           | 0.02                                        | 0.025             | 700    | 35,000           | 0.01                                       | 0.02  | 500    | 35,000           | 0.008                                    | 0.015             | 420    | 30,000           |
|               | 1°30'                  | 8                       | 0.013                                     | 0.02  | 500    | 35,000           | 0.01                                        | 0.015             | 460    | 30,000           | 0.007                                      | 0.01  | 400    | 30,000           | 0.005                                    | 0.008             | 360    | 30,000           |
|               |                        | 5                       | 0.025                                     | 0.07  | 1,000  | 40,000           | 0.02                                        | 0.03              | 900    | 40,000           | 0.01                                       | 0.03  | 620    | 40,000           | 0.01                                     | 0.02              | 480    | 30,000           |
|               |                        | 6                       | 0.025                                     | 0.05  | 800    | 40,000           | 0.02                                        | 0.03              | 750    | 40,000           | 0.01                                       | 0.03  | 560    | 40,000           | 0.01                                     | 0.02              | 440    | 30,000           |
|               |                        | 8                       | 0.025                                     | 0.04  | 750    | 40,000           | 0.02                                        | 0.025             | 700    | 35,000           | 0.01                                       | 0.02  | 500    | 35,000           | 0.008                                    | 0.015             | 420    | 30,000           |
|               | 2°                     | 8                       | 0.013                                     | 0.02  | 500    | 35,000           | 0.01                                        | 0.015             | 460    | 30,000           | 0.007                                      | 0.01  | 400    | 30,000           | 0.005                                    | 0.008             | 360    | 30,000           |
|               |                        | 5                       | 0.025                                     | 0.07  | 1,000  | 40,000           | 0.02                                        | 0.03              | 900    | 40,000           | 0.01                                       | 0.03  | 620    | 40,000           | 0.01                                     | 0.02              | 480    | 30,000           |
|               |                        | 6                       | 0.025                                     | 0.05  | 800    | 40,000           | 0.02                                        | 0.03              | 750    | 35,000           | 0.01                                       | 0.02  | 560    | 35,000           | 0.008                                    | 0.015             | 440    | 30,000           |
|               |                        | 8                       | 0.02                                      | 0.03  | 540    | 35,000           | 0.01                                        | 0.02              | 500    | 30,000           | 0.007                                      | 0.015 | 460    | 30,000           | 0.007                                    | 0.01              | 400    | 30,000           |
|               | 3°                     | 4                       | 0.03                                      | 0.1   | 1,200  | 40,000           | 0.03                                        | 0.05              | 1,200  | 40,000           | 0.025                                      | 0.03  | 800    | 40,000           | 0.02                                     | 0.025             | 600    | 30,000           |
|               |                        | 5                       | 0.03                                      | 0.07  | 1,000  | 40,000           | 0.03                                        | 0.05              | 1,000  | 40,000           | 0.025                                      | 0.03  | 600    | 40,000           | 0.02                                     | 0.025             | 500    | 30,000           |
|               |                        | 7                       | 0.025                                     | 0.05  | 800    | 40,000           | 0.02                                        | 0.03              | 900    | 35,000           | 0.015                                      | 0.025 | 500    | 35,000           | 0.01                                     | 0.02              | 400    | 30,000           |
|               |                        | 5                       | 0.03                                      | 0.1   | 1,200  | 40,000           | 0.03                                        | 0.05              | 1,200  | 40,000           | 0.025                                      | 0.03  | 800    | 40,000           | 0.02                                     | 0.025             | 600    | 30,000           |
| 5°            | 7                      | 0.03                    | 0.07                                      | 1,000 | 40,000 | 0.03             | 0.05                                        | 1,000             | 35,000 | 0.025            | 0.03                                       | 600   | 35,000 | 0.02             | 0.025                                    | 500               | 30,000 |                  |
|               | 8                      | 0.015                   | 0.03                                      | 720   | 35,000 | 0.012            | 0.02                                        | 600               | 30,000 | 0.007            | 0.015                                      | 540   | 30,000 | 0.005            | 0.01                                     | 480               | 25,000 |                  |
|               | 12                     | 0.005                   | 0.01                                      | 460   | 30,000 | 0.005            | 0.005                                       | 400               | 25,000 | 0.003            | 0.003                                      | 360   | 25,000 | 0.002            | 0.003                                    | 320               | 25,000 |                  |
|               | 8                      | 0.03                    | 0.05                                      | 800   | 35,000 | 0.02             | 0.03                                        | 700               | 30,000 | 0.01             | 0.02                                       | 680   | 30,000 | 0.007            | 0.01                                     | 520               | 25,000 |                  |
| 1°30'         | 12                     | 0.005                   | 0.01                                      | 480   | 30,000 | 0.005            | 0.005                                       | 420               | 25,000 | 0.003            | 0.003                                      | 380   | 25,000 | 0.002            | 0.003                                    | 340               | 25,000 |                  |
|               | 8                      | 0.05                    | 0.07                                      | 900   | 35,000 | 0.03             | 0.05                                        | 800               | 30,000 | 0.02             | 0.03                                       | 760   | 30,000 | 0.01             | 0.02                                     | 560               | 25,000 |                  |
|               | 12                     | 0.015                   | 0.03                                      | 640   | 35,000 | 0.01             | 0.02                                        | 500               | 30,000 | 0.007            | 0.01                                       | 500   | 30,000 | 0.005            | 0.01                                     | 480               | 25,000 |                  |
|               | 8                      | 0.05                    | 0.08                                      | 1,000 | 35,000 | 0.03             | 0.05                                        | 900               | 30,000 | 0.02             | 0.03                                       | 760   | 30,000 | 0.01             | 0.02                                     | 560               | 25,000 |                  |
| 2°            | 12                     | 0.03                    | 0.05                                      | 800   | 35,000 | 0.02             | 0.03                                        | 700               | 30,000 | 0.01             | 0.02                                       | 600   | 30,000 | 0.007            | 0.01                                     | 520               | 25,000 |                  |
|               | 8                      | 0.05                    | 0.07                                      | 1,400 | 35,000 | 0.03             | 0.05                                        | 1,100             | 30,000 | 0.02             | 0.03                                       | 1,000 | 30,000 | 0.015            | 0.025                                    | 800               | 25,000 |                  |
|               | 12                     | 0.03                    | 0.05                                      | 1,000 | 30,000 | 0.02             | 0.03                                        | 800               | 25,000 | 0.015            | 0.025                                      | 600   | 25,000 | 0.01             | 0.015                                    | 400               | 25,000 |                  |
|               | 16                     | 0.01                    | 0.02                                      | 500   | 25,000 | 0.007            | 0.015                                       | 400               | 20,000 | 0.005            | 0.01                                       | 300   | 20,000 | 0.003            | 0.005                                    | 250               | 20,000 |                  |
| 1°            | 8                      | 0.05                    | 0.07                                      | 1,500 | 35,000 | 0.03             | 0.05                                        | 1,200             | 30,000 | 0.02             | 0.03                                       | 1,000 | 30,000 | 0.015            | 0.025                                    | 800               | 25,000 |                  |
|               | 12                     | 0.03                    | 0.05                                      | 1,200 | 30,000 | 0.02             | 0.03                                        | 1,000             | 25,000 | 0.015            | 0.025                                      | 700   | 25,000 | 0.01             | 0.015                                    | 500               | 25,000 |                  |
|               | 16                     | 0.012                   | 0.025                                     | 600   | 25,000 | 0.01             | 0.02                                        | 500               | 20,000 | 0.007            | 0.015                                      | 400   | 20,000 | 0.005            | 0.01                                     | 350               | 20,000 |                  |
|               | 8                      | 0.07                    | 0.1                                       | 1,600 | 35,000 | 0.05             | 0.05                                        | 1,200             | 30,000 | 0.03             | 0.03                                       | 1,000 | 30,000 | 0.02             | 0.025                                    | 800               | 25,000 |                  |
| 1°30'         | 12                     | 0.03                    | 0.05                                      | 1,400 | 35,000 | 0.03             | 0.05                                        | 1,000             | 30,000 | 0.025            | 0.03                                       | 700   | 25,000 | 0.01             | 0.02                                     | 550               | 25,000 |                  |
|               | 16                     | 0.015                   | 0.025                                     | 800   | 30,000 | 0.012            | 0.025                                       | 600               | 25,000 | 0.01             | 0.02                                       | 500   | 20,000 | 0.007            | 0.015                                    | 400               | 20,000 |                  |
|               | 6                      | 0.1                     | 0.2                                       | 1,600 | 35,000 | 0.05             | 0.1                                         | 1,400             | 30,000 | 0.04             | 0.05                                       | 1,200 | 25,000 | 0.02             | 0.05                                     | 740               | 20,000 |                  |
|               | 8                      | 0.08                    | 0.2                                       | 1,300 | 35,000 | 0.04             | 0.06                                        | 1,200             | 30,000 | 0.03             | 0.04                                       | 950   | 25,000 | 0.02             | 0.03                                     | 680               | 20,000 |                  |
| 0.5           | 30°                    | 10                      | 0.03                                      | 0.06  | 1,000  | 30,000           | 0.03                                        | 0.05              | 820    | 25,000           | 0.015                                      | 0.03  | 750    | 20,000           | 0.01                                     | 0.02              | 500    | 18,000           |
|               |                        | 12                      | 0.03                                      | 0.06  | 820    | 30,000           | 0.03                                        | 0.05              | 720    | 25,000           | 0.015                                      | 0.03  | 620    | 20,000           | 0.01                                     | 0.02              | 450    | 18,000           |
|               |                        | 16                      | 0.012                                     | 0.025 | 540    | 25,000           | 0.008                                       | 0.02              | 500    | 20,000           | 0.005                                      | 0.01  | 420    | 18,000           | 0.003                                    | 0.006             | 350    | 16,000           |
|               |                        | 20                      | 0.005                                     | 0.01  | 300    | 20,000           | 0.005                                       | 0.005             | 250    | 18,000           | 0.003                                      | 0.005 | 200    | 16,000           | 0.002                                    | 0.003             | 150    | 14,000           |
|               |                        | 25                      | 0.005                                     | 0.005 | 180    | 20,000           | 0.003                                       | 0.005             | 150    | 18,000           | 0.002                                      | 0.005 | 120    | 16,000           | 0.002                                    | 0.002             | 85     | 14,000           |
|               |                        | 30                      | 0.003                                     | 0.005 | 120    | 16,000           | 0.003                                       | 0.003             | 100    | 16,000           | 0.002                                      | 0.003 | 75     | 14,000           | 0.001                                    | 0.002             | 60     | 12,000           |
|               |                        | 6                       | 0.1                                       | 0.25  | 2,000  | 35,000           | 0.05                                        | 0.15              | 1,800  | 30,000           | 0.04                                       | 0.1   | 1,600  | 25,000           | 0.03                                     | 0.05              | 920    | 20,000           |
|               |                        | 8                       | 0.1                                       | 0.2   | 1,600  | 35,000           | 0.05                                        | 0.1               | 1,400  | 30,000           | 0.04                                       | 0.05  | 1,200  | 25,000           | 0.02                                     | 0.05              | 740    | 20,000           |
|               | 1°                     | 10                      | 0.05                                      | 0.1   | 1,200  | 35,000           | 0.04                                        | 0.06              | 1,000  | 30,000           | 0.03                                       | 0.04  | 800    | 25,000           | 0.02                                     | 0.03              | 560    | 20,000           |
|               |                        | 12                      | 0.04                                      | 0.06  | 1,000  | 30,000           | 0.03                                        | 0.05              | 820    | 25,000           | 0.02                                       | 0.03  | 700    | 20,000           | 0.01                                     | 0.02              | 500    | 18,000           |
|               |                        | 16                      | 0.015                                     | 0.025 | 600    | 25,000           | 0.01                                        | 0.025             | 500    | 20,000           | 0.007                                      | 0.02  | 450    | 18,000           | 0.005                                    | 0.01              | 400    | 16,000           |
|               |                        | 20                      | 0.012                                     | 0.025 | 500    | 25,000           | 0.008                                       | 0.02              | 400    | 20,000           | 0.005                                      | 0.01  | 360    | 18,000           | 0.003                                    | 0.006             | 320    | 16,000           |
|               |                        | 25                      | 0.005                                     | 0.01  | 300    | 20,000           | 0.005                                       | 0.005             | 250    | 18,000           | 0.003                                      | 0.005 | 200    | 16,000           | 0.002                                    | 0.003             | 150    | 14,000           |
|               |                        | 30                      | 0.005                                     | 0.005 | 200    | 20,000           | 0.003                                       | 0.005             | 150    | 18,000           | 0.002                                      | 0.005 | 120    | 16,000           | 0.002                                    | 0.002             | 85     | 14,000           |
|               |                        | 6                       | 0.15                                      | 0.25  | 2,000  | 40,000           | 0.1                                         | 0.2               | 2,000  | 40,000           | 0.05                                       | 0.15  | 1,600  | 30,000           | 0.05                                     | 0.1               | 1,200  | 25,000           |
|               |                        | 8                       | 0.1                                       | 0.2   | 1,800  | 35,000           | 0.05                                        | 0.1               | 1,600  | 30,000           | 0.04                                       | 0.05  | 1,200  | 25,000           | 0.02                                     | 0.05              | 800    | 20,000           |
| 1°30'         | 10                     | 0.08                    | 0.2                                       | 1,400 | 35,000 | 0.04             | 0.06                                        | 1,200             | 30,000 | 0.03             | 0.04                                       | 900   | 25,000 | 0.02             | 0.03                                     | 700               | 20,000 |                  |
|               | 12                     | 0.05                    | 0.1                                       | 1,200 | 35,000 | 0.04             | 0.06                                        | 1,000             | 30,000 | 0.03             | 0.04                                       | 800   | 25,000 | 0.02             | 0.03                                     | 550               | 20,000 |                  |
|               | 16                     | 0.03                    | 0.05                                      | 800   | 30,000 | 0.02             | 0.05                                        | 700               | 25,000 | 0.02             | 0.03                                       | 600   | 20,000 | 0.01             | 0.02                                     | 500               | 18,000 |                  |
|               | 20                     | 0.015                   | 0.025                                     | 600   | 25,000 | 0.01             | 0.025                                       | 500               | 20,000 | 0.007            | 0.02                                       | 450   | 18,000 | 0.005            | 0.01                                     | 400               | 16,000 |                  |
|               | 25                     | 0.012                   | 0.025                                     | 500   | 25,000 | 0.008            | 0.02                                        | 400               | 20,000 | 0.005            | 0.01                                       | 350   | 18,000 | 0.003            | 0.006                                    | 300               | 16,000 |                  |
|               | 30                     | 0.01                    | 0.02                                      | 400   | 20,000 | 0.005            | 0.01                                        | 300               | 20,000 | 0.003            | 0.007                                      | 250   | 18,000 | 0.002            | 0.005                                    | 200               | 16,000 |                  |

| Work Material |                        |                         | Prehardened Steels<br>HPM・NAK<br>(~41HRC) |       |        |                   | Hardened Steels<br>STAVAX・SKD61<br>(~52HRC) |       |        |                   | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |       |        |                   | High Speed Steels<br>SKH・HAP<br>(~65HRC) |       |        |                   |
|---------------|------------------------|-------------------------|-------------------------------------------|-------|--------|-------------------|---------------------------------------------|-------|--------|-------------------|--------------------------------------------|-------|--------|-------------------|------------------------------------------|-------|--------|-------------------|
| Radius        | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | Depth of Cut                              |       | Feed   |                   | Spindle<br>Speed                            |       | mm/min | min <sup>-1</sup> | Depth of Cut                               |       | Feed   |                   | Spindle<br>Speed                         |       | mm/min | min <sup>-1</sup> |
|               |                        |                         | ap mm                                     | ae mm | mm/min | min <sup>-1</sup> | ap mm                                       | ae mm |        |                   | ap mm                                      | ae mm | mm/min | min <sup>-1</sup> | ap mm                                    | ae mm | mm/min | min <sup>-1</sup> |
| 0.5           | 2°                     | 8                       | 0.1                                       | 0.2   | 2,000  | 35,000            | 0.05                                        | 0.1   | 1,600  | 30,000            | 0.04                                       | 0.05  | 1,200  | 25,000            | 0.02                                     | 0.05  | 900    | 20,000            |
|               |                        | 10                      | 0.05                                      | 0.2   | 1,600  | 35,000            | 0.04                                        | 0.1   | 1,200  | 30,000            | 0.03                                       | 0.05  | 1,000  | 25,000            | 0.02                                     | 0.05  | 700    | 20,000            |
|               |                        | 20                      | 0.03                                      | 0.05  | 800    | 30,000            | 0.02                                        | 0.05  | 700    | 25,000            | 0.02                                       | 0.03  | 600    | 20,000            | 0.01                                     | 0.02  | 450    | 18,000            |
|               | 3°                     | 30                      | 0.015                                     | 0.03  | 600    | 20,000            | 0.01                                        | 0.03  | 500    | 20,000            | 0.007                                      | 0.02  | 400    | 18,000            | 0.005                                    | 0.01  | 350    | 16,000            |
|               |                        | 10                      | 0.1                                       | 0.2   | 2,000  | 35,000            | 0.05                                        | 0.1   | 1,600  | 30,000            | 0.03                                       | 0.07  | 1,200  | 25,000            | 0.025                                    | 0.05  | 800    | 20,000            |
|               |                        | 20                      | 0.04                                      | 0.1   | 1,200  | 30,000            | 0.03                                        | 0.05  | 1,000  | 25,000            | 0.02                                       | 0.03  | 800    | 20,000            | 0.015                                    | 0.025 | 500    | 18,000            |
| 0.6           | 1°                     | 30                      | 0.02                                      | 0.05  | 700    | 20,000            | 0.015                                       | 0.03  | 700    | 20,000            | 0.01                                       | 0.025 | 600    | 18,000            | 0.01                                     | 0.02  | 400    | 16,000            |
|               |                        | 6                       | 0.15                                      | 0.3   | 2,500  | 35,000            | 0.07                                        | 0.15  | 2,000  | 30,000            | 0.05                                       | 0.1   | 1,500  | 25,000            | 0.03                                     | 0.07  | 1,000  | 20,000            |
|               |                        | 8                       | 0.1                                       | 0.25  | 2,000  | 35,000            | 0.07                                        | 0.1   | 1,600  | 30,000            | 0.05                                       | 0.07  | 1,200  | 25,000            | 0.03                                     | 0.05  | 800    | 20,000            |
|               |                        | 10                      | 0.1                                       | 0.2   | 1,200  | 35,000            | 0.05                                        | 0.1   | 1,000  | 30,000            | 0.03                                       | 0.07  | 800    | 25,000            | 0.025                                    | 0.05  | 600    | 20,000            |
|               |                        | 20                      | 0.02                                      | 0.03  | 600    | 25,000            | 0.015                                       | 0.03  | 500    | 20,000            | 0.01                                       | 0.025 | 450    | 18,000            | 0.007                                    | 0.02  | 400    | 16,000            |
|               | 1°30′                  | 30                      | 0.01                                      | 0.02  | 400    | 20,000            | 0.005                                       | 0.01  | 250    | 18,000            | 0.005                                      | 0.007 | 200    | 16,000            | 0.003                                    | 0.005 | 150    | 14,000            |
|               |                        | 6                       | 0.2                                       | 0.3   | 3,000  | 40,000            | 0.1                                         | 0.2   | 2,400  | 35,000            | 0.07                                       | 0.15  | 2,000  | 30,000            | 0.05                                     | 0.1   | 1,600  | 25,000            |
|               |                        | 8                       | 0.15                                      | 0.25  | 2,400  | 35,000            | 0.07                                        | 0.15  | 1,600  | 30,000            | 0.05                                       | 0.1   | 1,400  | 25,000            | 0.03                                     | 0.07  | 1,000  | 20,000            |
|               |                        | 10                      | 0.15                                      | 0.2   | 2,000  | 35,000            | 0.07                                        | 0.1   | 1,200  | 30,000            | 0.05                                       | 0.07  | 1,000  | 25,000            | 0.03                                     | 0.05  | 800    | 20,000            |
|               |                        | 20                      | 0.05                                      | 0.1   | 1,200  | 25,000            | 0.03                                        | 0.05  | 600    | 20,000            | 0.025                                      | 0.03  | 500    | 18,000            | 0.02                                     | 0.025 | 450    | 16,000            |
|               | 3°                     | 30                      | 0.02                                      | 0.04  | 400    | 20,000            | 0.01                                        | 0.02  | 350    | 20,000            | 0.007                                      | 0.015 | 300    | 18,000            | 0.005                                    | 0.01  | 250    | 16,000            |
|               |                        | 10                      | 0.15                                      | 0.25  | 3,000  | 35,000            | 0.1                                         | 0.2   | 2,000  | 30,000            | 0.07                                       | 0.15  | 1,600  | 25,000            | 0.05                                     | 0.1   | 1,200  | 20,000            |
|               |                        | 20                      | 0.1                                       | 0.15  | 2,000  | 30,000            | 0.07                                        | 0.1   | 1,400  | 25,000            | 0.05                                       | 0.07  | 1,000  | 20,000            | 0.03                                     | 0.05  | 800    | 18,000            |
|               |                        | 35                      | 0.03                                      | 0.05  | 1,000  | 20,000            | 0.02                                        | 0.03  | 700    | 20,000            | 0.015                                      | 0.025 | 600    | 18,000            | 0.01                                     | 0.02  | 500    | 16,000            |
|               |                        | 10                      | 0.15                                      | 0.2   | 2,000  | 30,000            | 0.1                                         | 0.15  | 1,600  | 25,000            | 0.05                                       | 0.15  | 1,400  | 25,000            | 0.05                                     | 0.07  | 1,000  | 20,000            |
|               | 30′                    | 15                      | 0.07                                      | 0.15  | 1,400  | 25,000            | 0.05                                        | 0.08  | 1,000  | 20,000            | 0.03                                       | 0.07  | 800    | 20,000            | 0.02                                     | 0.04  | 600    | 18,000            |
|               |                        | 20                      | 0.03                                      | 0.05  | 800    | 18,000            | 0.02                                        | 0.04  | 600    | 16,000            | 0.012                                      | 0.025 | 450    | 16,000            | 0.008                                    | 0.015 | 360    | 14,000            |
|               |                        | 25                      | 0.02                                      | 0.04  | 540    | 18,000            | 0.01                                        | 0.03  | 450    | 16,000            | 0.01                                       | 0.02  | 360    | 16,000            | 0.007                                    | 0.01  | 300    | 14,000            |
|               |                        | 30                      | 0.01                                      | 0.03  | 360    | 14,000            | 0.007                                       | 0.02  | 320    | 14,000            | 0.005                                      | 0.01  | 240    | 14,000            | 0.003                                    | 0.005 | 200    | 12,000            |
|               |                        | 10                      | 0.15                                      | 0.25  | 2,000  | 30,000            | 0.1                                         | 0.2   | 1,800  | 25,000            | 0.05                                       | 0.2   | 1,400  | 25,000            | 0.05                                     | 0.1   | 1,000  | 20,000            |
| 0.75          | 1°                     | 15                      | 0.08                                      | 0.15  | 1,600  | 25,000            | 0.05                                        | 0.1   | 1,200  | 20,000            | 0.03                                       | 0.1   | 920    | 20,000            | 0.02                                     | 0.05  | 780    | 18,000            |
|               |                        | 20                      | 0.05                                      | 0.1   | 1,000  | 20,000            | 0.03                                        | 0.07  | 800    | 18,000            | 0.02                                       | 0.05  | 600    | 18,000            | 0.015                                    | 0.03  | 550    | 16,000            |
|               |                        | 25                      | 0.03                                      | 0.05  | 700    | 18,000            | 0.02                                        | 0.04  | 550    | 16,000            | 0.012                                      | 0.025 | 400    | 16,000            | 0.008                                    | 0.015 | 350    | 14,000            |
|               |                        | 30                      | 0.02                                      | 0.04  | 450    | 16,000            | 0.01                                        | 0.03  | 360    | 16,000            | 0.01                                       | 0.02  | 300    | 16,000            | 0.007                                    | 0.01  | 250    | 14,000            |
|               |                        | 10                      | 0.15                                      | 0.25  | 2,000  | 30,000            | 0.1                                         | 0.2   | 2,000  | 25,000            | 0.05                                       | 0.2   | 1,600  | 25,000            | 0.05                                     | 0.1   | 1,200  | 20,000            |
|               | 1°30′                  | 15                      | 0.08                                      | 0.15  | 1,800  | 25,000            | 0.05                                        | 0.1   | 1,400  | 20,000            | 0.03                                       | 0.1   | 920    | 20,000            | 0.02                                     | 0.05  | 780    | 18,000            |
|               |                        | 20                      | 0.06                                      | 0.1   | 1,200  | 25,000            | 0.05                                        | 0.07  | 1,000  | 20,000            | 0.03                                       | 0.05  | 820    | 20,000            | 0.02                                     | 0.03  | 650    | 18,000            |
|               |                        | 10                      | 0.2                                       | 0.3   | 2,000  | 30,000            | 0.1                                         | 0.2   | 2,000  | 25,000            | 0.05                                       | 0.2   | 1,600  | 25,000            | 0.05                                     | 0.1   | 1,200  | 20,000            |
|               | 2°                     | 15                      | 0.1                                       | 0.2   | 2,000  | 30,000            | 0.1                                         | 0.1   | 1,600  | 25,000            | 0.05                                       | 0.1   | 1,200  | 25,000            | 0.05                                     | 0.05  | 900    | 20,000            |
|               |                        | 20                      | 0.07                                      | 0.12  | 1,400  | 25,000            | 0.05                                        | 0.1   | 1,200  | 20,000            | 0.03                                       | 0.1   | 900    | 20,000            | 0.02                                     | 0.05  | 750    | 18,000            |
| 1             | 30′                    | 12                      | 0.15                                      | 0.3   | 2,400  | 20,000            | 0.1                                         | 0.3   | 2,000  | 18,000            | 0.1                                        | 0.2   | 1,600  | 16,000            | 0.1                                      | 0.1   | 1,200  | 14,000            |
|               |                        | 16                      | 0.1                                       | 0.2   | 1,800  | 18,000            | 0.07                                        | 0.15  | 1,600  | 16,000            | 0.05                                       | 0.08  | 1,200  | 14,000            | 0.03                                     | 0.07  | 800    | 12,000            |
|               |                        | 20                      | 0.07                                      | 0.12  | 1,600  | 16,000            | 0.05                                        | 0.1   | 1,400  | 14,000            | 0.03                                       | 0.06  | 1,000  | 12,000            | 0.02                                     | 0.04  | 700    | 10,000            |
|               |                        | 25                      | 0.05                                      | 0.1   | 1,000  | 14,000            | 0.03                                        | 0.08  | 850    | 14,000            | 0.02                                       | 0.05  | 700    | 12,000            | 0.02                                     | 0.02  | 600    | 10,000            |
|               |                        | 30                      | 0.03                                      | 0.08  | 800    | 12,000            | 0.03                                        | 0.05  | 700    | 12,000            | 0.02                                       | 0.03  | 540    | 10,000            | 0.01                                     | 0.02  | 420    | 8,500             |
|               |                        | 35                      | 0.03                                      | 0.05  | 600    | 12,000            | 0.025                                       | 0.04  | 500    | 12,000            | 0.015                                      | 0.025 | 420    | 10,000            | 0.008                                    | 0.015 | 320    | 8,500             |
|               |                        | 40                      | 0.02                                      | 0.04  | 420    | 12,000            | 0.02                                        | 0.03  | 360    | 12,000            | 0.01                                       | 0.02  | 300    | 10,000            | 0.008                                    | 0.01  | 240    | 8,500             |
|               |                        | 50                      | 0.01                                      | 0.03  | 300    | 10,000            | 0.01                                        | 0.02  | 240    | 10,000            | 0.005                                      | 0.01  | 200    | 8,500             | 0.005                                    | 0.005 | 160    | 7,000             |
|               | 1°                     | 12                      | 0.15                                      | 0.3   | 2,400  | 20,000            | 0.15                                        | 0.3   | 2,000  | 18,000            | 0.1                                        | 0.2   | 1,600  | 16,000            | 0.1                                      | 0.1   | 1,200  | 14,000            |
|               |                        | 16                      | 0.12                                      | 0.2   | 1,800  | 18,000            | 0.1                                         | 0.15  | 1,600  | 16,000            | 0.1                                        | 0.1   | 1,400  | 14,000            | 0.05                                     | 0.1   | 900    | 12,000            |
|               |                        | 20                      | 0.1                                       | 0.15  | 1,600  | 18,000            | 0.07                                        | 0.1   | 1,400  | 16,000            | 0.05                                       | 0.08  | 1,200  | 14,000            | 0.03                                     | 0.05  | 800    | 12,000            |
|               |                        | 25                      | 0.07                                      | 0.12  | 1,400  | 14,000            | 0.05                                        | 0.1   | 1,200  | 14,000            | 0.03                                       | 0.05  | 1,000  | 12,000            | 0.02                                     | 0.03  | 700    | 10,000            |
|               |                        | 30                      | 0.05                                      | 0.1   | 1,000  | 14,000            | 0.035                                       | 0.08  | 850    | 14,000            | 0.025                                      | 0.05  | 700    | 12,000            | 0.02                                     | 0.02  | 600    | 10,000            |
|               |                        | 35                      | 0.05                                      | 0.1   | 800    | 12,000            | 0.035                                       | 0.06  | 700    | 12,000            | 0.02                                       | 0.05  | 600    | 10,000            | 0.015                                    | 0.02  | 500    | 8,500             |
|               |                        | 40                      | 0.03                                      | 0.05  | 700    | 12,000            | 0.03                                        | 0.05  | 600    | 12,000            | 0.02                                       | 0.04  | 540    | 10,000            | 0.01                                     | 0.02  | 400    | 8,500             |
|               |                        | 50                      | 0.025                                     | 0.04  | 420    | 12,000            | 0.02                                        | 0.03  | 360    | 12,000            | 0.01                                       | 0.02  | 300    | 10,000            | 0.008                                    | 0.01  | 240    | 8,500             |
|               | 1°30′                  | 12                      | 0.2                                       | 0.35  | 2,400  | 20,000            | 0.15                                        | 0.35  | 2,000  | 18,000            | 0.12                                       | 0.2   | 1,600  | 16,000            | 0.1                                      | 0.15  | 1,200  | 14,000            |
|               |                        | 16                      | 0.15                                      | 0.2   | 1,800  | 18,000            | 0.1                                         | 0.2   | 1,600  | 16,000            | 0.1                                        | 0.15  | 1,400  | 14,000            | 0.05                                     | 0.1   | 1,000  | 12,000            |
|               |                        | 20                      | 0.1                                       | 0.2   | 1,800  | 18,000            | 0.07                                        | 0.15  | 1,600  | 16,000            | 0.05                                       | 0.1   | 1,200  | 14,000            | 0.03                                     | 0.1   | 900    | 12,000            |
|               |                        | 25                      | 0.1                                       | 0.15  | 1,600  | 16,000            | 0.07                                        | 0.12  | 1,400  | 16,000            | 0.05                                       | 0.08  | 1,200  | 14,000            | 0.03                                     | 0.07  | 900    | 12,000            |
|               |                        | 30                      | 0.07                                      | 0.12  | 1,400  | 14,000            | 0.05                                        | 0.1   | 1,200  | 14,000            | 0.03                                       | 0.06  | 1,000  | 12,000            | 0.02                                     | 0.03  | 850    | 10,000            |
|               |                        | 35                      | 0.06                                      | 0.12  | 1,000  | 14,000            | 0.05                                        | 0.1   | 900    | 14,000            | 0.03                                       | 0.05  | 800    | 12,000            | 0.02                                     | 0.03  | 700    | 10,000            |
|               |                        | 50                      | 0.06                                      | 0.12  | 1,000  | 14,000            | 0.05                                        | 0.1   | 900    | 14,000            | 0.03                                       | 0.05  | 800    | 12,000            | 0.02                                     | 0.03  | 700    | 10,000            |

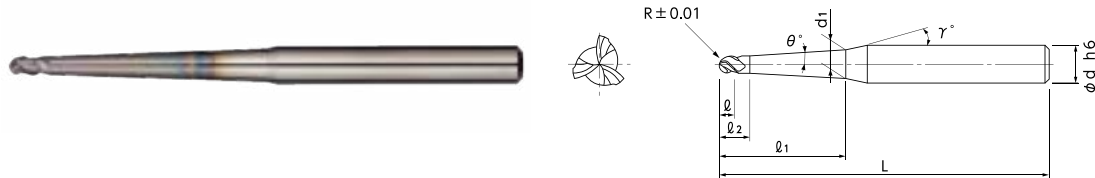
| Work Material |                        |                         | Prehardened Steels<br>HPM・NAK<br>(~41HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |        |                  | Hardened Steels<br>STAVAX・SKD61<br>(~52HRC) |                   |        |                  | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |       |        |                  | High Speed Steels<br>SKH・HAP<br>(~65HRC) |                   |        |                  |
|---------------|------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|------------------|---------------------------------------------|-------------------|--------|------------------|--------------------------------------------|-------|--------|------------------|------------------------------------------|-------------------|--------|------------------|
| Radius        | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       | Feed   | Spindle<br>Speed | Depth of Cut                                |                   | Feed   | Spindle<br>Speed | Depth of Cut                               |       | Feed   | Spindle<br>Speed | Depth of Cut                             |                   | Feed   | Spindle<br>Speed |
|               |                        |                         | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ae mm |        |                  | mm/min                                      | min <sup>-1</sup> |        |                  | ap mm                                      | ae mm |        |                  | mm/min                                   | min <sup>-1</sup> |        |                  |
| 1             | 1°30′                  | 40                      | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.1   | 900    | 14,000           | 0.03                                        | 0.08              | 800    | 14,000           | 0.02                                       | 0.05  | 700    | 12,000           | 0.02                                     | 0.02              | 600    | 10,000           |
|               |                        | 50                      | 0.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.07  | 800    | 12,000           | 0.03                                        | 0.05              | 700    | 12,000           | 0.02                                       | 0.04  | 600    | 10,000           | 0.01                                     | 0.02              | 420    | 8,500            |
|               | 2°                     | 12                      | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.4   | 2,400  | 20,000           | 0.2                                         | 0.3               | 2,000  | 20,000           | 0.15                                       | 0.25  | 1,600  | 18,000           | 0.1                                      | 0.2               | 1,200  | 16,000           |
|               |                        | 16                      | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3   | 2,400  | 20,000           | 0.1                                         | 0.3               | 2,000  | 18,000           | 0.1                                        | 0.2   | 1,600  | 16,000           | 0.1                                      | 0.1               | 1,200  | 14,000           |
|               |                        | 20                      | 0.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.2   | 2,000  | 18,000           | 0.1                                         | 0.2               | 1,800  | 16,000           | 0.1                                        | 0.1   | 1,400  | 14,000           | 0.05                                     | 0.1               | 1,100  | 12,000           |
|               |                        | 25                      | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.2   | 1,800  | 16,000           | 0.07                                        | 0.15              | 1,600  | 16,000           | 0.05                                       | 0.1   | 1,200  | 14,000           | 0.03                                     | 0.07              | 1,000  | 12,000           |
|               |                        | 30                      | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.15  | 1,600  | 16,000           | 0.07                                        | 0.15              | 1,400  | 16,000           | 0.05                                       | 0.08  | 1,100  | 14,000           | 0.03                                     | 0.07              | 900    | 12,000           |
|               |                        | 40                      | 0.07                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.12  | 1,400  | 14,000           | 0.05                                        | 0.1               | 1,200  | 14,000           | 0.03                                       | 0.05  | 1,000  | 12,000           | 0.02                                     | 0.03              | 800    | 10,000           |
|               |                        | 50                      | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.12  | 1,000  | 14,000           | 0.05                                        | 0.1               | 900    | 14,000           | 0.03                                       | 0.05  | 800    | 12,000           | 0.02                                     | 0.03              | 600    | 10,000           |
| 1.5           | 30′                    | 15                      | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.4   | 2,400  | 18,000           | 0.1                                         | 0.4               | 2,000  | 18,000           | 0.1                                        | 0.3   | 1,600  | 14,000           | 0.1                                      | 0.2               | 1,200  | 12,000           |
|               |                        | 20                      | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3   | 2,000  | 18,000           | 0.1                                         | 0.3               | 1,600  | 18,000           | 0.1                                        | 0.2   | 1,400  | 14,000           | 0.08                                     | 0.1               | 1,000  | 12,000           |
|               |                        | 25                      | 0.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3   | 1,800  | 16,000           | 0.1                                         | 0.25              | 1,400  | 16,000           | 0.07                                       | 0.15  | 1,200  | 12,000           | 0.05                                     | 0.07              | 900    | 10,000           |
|               |                        | 30                      | 0.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.25  | 1,200  | 16,000           | 0.08                                        | 0.2               | 1,200  | 14,000           | 0.05                                       | 0.1   | 1,000  | 12,000           | 0.035                                    | 0.06              | 700    | 10,000           |
|               |                        | 40                      | 0.07                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.15  | 800    | 14,000           | 0.04                                        | 0.1               | 720    | 12,000           | 0.025                                      | 0.06  | 600    | 10,000           | 0.02                                     | 0.04              | 480    | 8,000            |
|               |                        | 50                      | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.1   | 600    | 12,000           | 0.025                                       | 0.04              | 540    | 10,000           | 0.015                                      | 0.02  | 480    | 7,000            | 0.01                                     | 0.02              | 360    | 5,000            |
|               | 1°                     | 15                      | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.5   | 2,400  | 20,000           | 0.15                                        | 0.5               | 2,000  | 20,000           | 0.15                                       | 0.4   | 1,600  | 18,000           | 0.1                                      | 0.3               | 1,400  | 14,000           |
|               |                        | 20                      | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.4   | 2,000  | 18,000           | 0.1                                         | 0.4               | 1,800  | 18,000           | 0.1                                        | 0.2   | 1,400  | 16,000           | 0.08                                     | 0.2               | 1,200  | 12,000           |
|               |                        | 25                      | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3   | 1,800  | 18,000           | 0.1                                         | 0.3               | 1,600  | 16,000           | 0.1                                        | 0.15  | 1,200  | 12,000           | 0.06                                     | 0.1               | 1,000  | 10,000           |
| 30            |                        | 0.12                    | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,600 | 16,000 | 0.08             | 0.2                                         | 1,200             | 14,000 | 0.05             | 0.1                                        | 1,000 | 12,000 | 0.035            | 0.07                                     | 700               | 10,000 |                  |
| 40            |                        | 0.07                    | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000 | 16,000 | 0.04             | 0.1                                         | 800               | 12,000 | 0.03             | 0.06                                       | 600   | 10,000 | 0.02             | 0.04                                     | 500               | 8,000  |                  |
| 50            |                        | 0.05                    | 0.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 700   | 12,000 | 0.025            | 0.04                                        | 580               | 10,000 | 0.015            | 0.02                                       | 480   | 7,000  | 0.01             | 0.02                                     | 360               | 5,000  |                  |
| 2             |                        | 1°30′                   | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.25  | 0.5    | 3,000            | 20,000                                      | 0.2               | 0.5    | 2,400            | 20,000                                     | 0.2   | 0.4    | 2,000            | 18,000                                   | 0.15              | 0.3    | 1,400            |
|               | 20                     |                         | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.4   | 2,400  | 18,000           | 0.1                                         | 0.4               | 2,000  | 18,000           | 0.1                                        | 0.3   | 1,600  | 16,000           | 0.1                                      | 0.2               | 1,200  | 12,000           |
|               | 25                     |                         | 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3   | 2,000  | 18,000           | 0.1                                         | 0.3               | 1,600  | 18,000           | 0.1                                        | 0.2   | 1,400  | 16,000           | 0.1                                      | 0.1               | 1,000  | 12,000           |
|               | 30                     |                         | 0.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3   | 1,800  | 16,000           | 0.1                                         | 0.25              | 1,400  | 16,000           | 0.07                                       | 0.15  | 1,200  | 14,000           | 0.05                                     | 0.07              | 900    | 10,000           |
|               | 40                     |                         | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.25  | 1,200  | 16,000           | 0.06                                        | 0.2               | 1,000  | 14,000           | 0.04                                       | 0.1   | 800    | 12,000           | 0.03                                     | 0.05              | 520    | 10,000           |
|               | 50                     |                         | 0.07                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.15  | 800    | 12,000           | 0.035                                       | 0.1               | 600    | 10,000           | 0.02                                       | 0.07  | 500    | 8,000            | 0.02                                     | 0.05              | 400    | 6,000            |
|               | 2°                     | 15                      | 0.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.6   | 3,000  | 20,000           | 0.2                                         | 0.6               | 2,400  | 20,000           | 0.2                                        | 0.4   | 2,000  | 18,000           | 0.15                                     | 0.3               | 1,600  | 14,000           |
|               |                        | 20                      | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.5   | 2,400  | 18,000           | 0.15                                        | 0.4               | 2,000  | 18,000           | 0.12                                       | 0.3   | 1,600  | 16,000           | 0.1                                      | 0.2               | 1,200  | 12,000           |
|               |                        | 30                      | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.4   | 2,000  | 16,000           | 0.15                                        | 0.3               | 1,800  | 16,000           | 0.1                                        | 0.2   | 1,400  | 14,000           | 0.07                                     | 0.12              | 1,000  | 12,000           |
| 2             | 1°                     | 20                      | 0.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.5   | 3,000  | 18,000           | 0.4                                         | 1                 | 2,400  | 18,000           | 0.2                                        | 0.8   | 2,000  | 16,000           | 0.15                                     | 0.6               | 1,600  | 12,000           |
|               |                        | 30                      | 0.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1     | 2,400  | 16,000           | 0.2                                         | 0.7               | 1,600  | 14,000           | 0.1                                        | 0.3   | 1,200  | 12,000           | 0.06                                     | 0.15              | 1,000  | 10,000           |
|               |                        | 40                      | 0.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.3   | 2,000  | 12,000           | 0.1                                         | 0.15              | 1,200  | 9,000            | 0.06                                       | 0.1   | 1,000  | 6,000            | 0.035                                    | 0.07              | 800    | 5,000            |
|               |                        | 50                      | 0.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.2   | 1,600  | 10,000           | 0.07                                        | 0.1               | 900    | 7,000            | 0.04                                       | 0.07  | 750    | 5,000            | 0.02                                     | 0.05              | 550    | 4,000            |
|               |                        | 61.1                    | 0.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.1   | 1,200  | 8,000            | 0.025                                       | 0.04              | 600    | 5,000            | 0.015                                      | 0.025 | 480    | 3,500            | 0.01                                     | 0.02              | 360    | 3,000            |
| Notes         |                        |                         | ※1 Above conditions are for contour line roughing process.<br>※2 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※3 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※4 Coolant supply and chip disposal in the deep portion are very important.<br>※5 Recommended oil mist coolant.<br>※6 Adjust milling conditions according to the volume of Depth of Cut and rigidity of machine. |       |        |                  |                                             |                   |        |                  |                                            |       |        |                  |                                          |                   |        |                  |



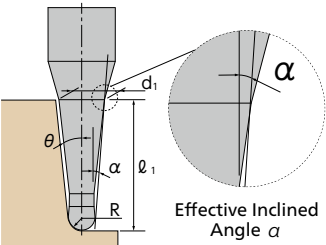
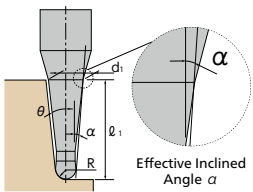
MUGEN COATING PREMIUM 3-Flute Long Taper Neck Ball End Mill

MUGEN COATING PREMIUM 3-Flute Long Taper Neck Ball End Mill

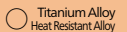
3-flute with high helix angle and taper neck design for deep area milling with high efficiency



- Higher rigidity brought by taper neck than existing long neck.
- MUGEN COATING PREMIUM because of high heat resistance, realized long tool life for hardened steels.
- High effective machining achieved by NS original 3-flute design.



Unit : mm

 S

  Hardened Steel  
H

 Coating

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|
| 08-00590-05020 | R0.5       | 30'                  | 12                     | 1.11           | 0.75              | 1.25                     | 12°                    | 0°15'                        | 6              | 60                 |
| 08-00590-05021 |            |                      | 16                     | 1.18           | 0.75              | 1.25                     | 12°                    | 0°19'                        | 6              | 60                 |
| 08-00590-05022 |            |                      | 20                     | 1.25           | 0.75              | 1.25                     | 12°                    | 0°21'                        | 6              | 70                 |
| 08-00590-05023 |            |                      | 25                     | 1.34           | 0.75              | 1.25                     | 12°                    | 0°23'                        | 6              | 70                 |
| 08-00590-05024 |            |                      | 30                     | 1.42           | 0.75              | 1.25                     | 12°                    | 0°24'                        | 6              | 70                 |
| 08-00590-05030 |            |                      | 12                     | 1.30           | 0.75              | 1.25                     | 12°                    | 0°42'                        | 6              | 60                 |
| 08-00590-05031 |            | 1°                   | 16                     | 1.44           | 0.75              | 1.25                     | 12°                    | 0°46'                        | 6              | 60                 |
| 08-00590-05032 |            |                      | 20                     | 1.58           | 0.75              | 1.25                     | 12°                    | 0°49'                        | 6              | 70                 |
| 08-00590-05033 |            |                      | 25                     | 1.75           | 0.75              | 1.25                     | 12°                    | 0°51'                        | 6              | 70                 |
| 08-00590-05034 |            |                      | 30                     | 1.93           | 0.75              | 1.25                     | 12°                    | 0°53'                        | 6              | 70                 |
| 08-00590-05040 |            | 1°30'                | 12                     | 1.48           | 0.75              | 1.25                     | 12°                    | 1°09'                        | 6              | 60                 |
| 08-00590-05041 |            |                      | 16                     | 1.69           | 0.75              | 1.25                     | 12°                    | 1°14'                        | 6              | 60                 |
| 08-00590-05042 |            |                      | 20                     | 1.90           | 0.75              | 1.25                     | 12°                    | 1°17'                        | 6              | 70                 |
| 08-00590-05043 |            |                      | 25                     | 2.17           | 0.75              | 1.25                     | 12°                    | 1°20'                        | 6              | 70                 |
| 08-00590-05044 |            |                      | 30                     | 2.43           | 0.75              | 1.25                     | 12°                    | 1°21'                        | 6              | 70                 |
| 08-00590-05050 |            | 2°                   | 20                     | 2.23           | 0.75              | 1.25                     | 12°                    | 1°45'                        | 6              | 70                 |
| 08-00590-05051 |            |                      | 30                     | 2.93           | 0.75              | 1.25                     | 12°                    | 1°50'                        | 6              | 70                 |
| 08-00590-07520 | R0.75      | 30'                  | 12                     | 1.58           | 1.1               | 1.85                     | 12°                    | 0°12'                        | 6              | 60                 |
| 08-00590-07521 |            |                      | 16                     | 1.65           | 1.1               | 1.85                     | 12°                    | 0°16'                        | 6              | 60                 |
| 08-00590-07523 |            |                      | 20                     | 1.72           | 1.1               | 1.85                     | 12°                    | 0°19'                        | 6              | 70                 |
| 08-00590-07524 |            |                      | 25                     | 1.81           | 1.1               | 1.85                     | 12°                    | 0°21'                        | 6              | 70                 |
| 08-00590-07525 |            |                      | 30                     | 1.90           | 1.1               | 1.85                     | 12°                    | 0°22'                        | 6              | 70                 |
| 08-00590-07530 |            | 1°                   | 12                     | 1.76           | 1.1               | 1.85                     | 12°                    | 0°37'                        | 6              | 60                 |
| 08-00590-07531 |            |                      | 16                     | 1.90           | 1.1               | 1.85                     | 12°                    | 0°43'                        | 6              | 60                 |
| 08-00590-07532 |            |                      | 20                     | 2.04           | 1.1               | 1.85                     | 12°                    | 0°46'                        | 6              | 70                 |
| 08-00590-07533 |            |                      | 25                     | 2.22           | 1.1               | 1.85                     | 12°                    | 0°49'                        | 6              | 70                 |
| 08-00590-07534 |            |                      | 30                     | 2.39           | 1.1               | 1.85                     | 12°                    | 0°51'                        | 6              | 70                 |
| 08-00590-07540 |            | 1°30'                | 20                     | 2.36           | 1.1               | 1.85                     | 12°                    | 1°13'                        | 6              | 70                 |
| 08-00590-07541 |            |                      | 30                     | 2.88           | 1.1               | 1.85                     | 12°                    | 1°19'                        | 6              | 70                 |
| 08-00590-07552 |            | 2°                   | 30                     | 3.37           | 1.1               | 1.85                     | 12°                    | 1°47'                        | 6              | 70                 |

How to Order

When you order, indicate MRBTNH345 (R)×(θ)×(ℓ1).

※(γ) is reference value.

Machining case

W-015  
W-016

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|
| 08-00590-10020 | R1         | 30'                  | 12                     | 2.06           | 1.5               | 2.5                      | 12°                    | 0°08'                        | 6              | 60                 |
| 08-00590-10021 |            |                      | 16                     | 2.13           | 1.5               | 2.5                      | 12°                    | 0°13'                        | 6              | 60                 |
| 08-00590-10022 |            |                      | 20                     | 2.20           | 1.5               | 2.5                      | 12°                    | 0°16'                        | 6              | 70                 |
| 08-00590-10023 |            |                      | 25                     | 2.28           | 1.5               | 2.5                      | 12°                    | 0°19'                        | 6              | 70                 |
| 08-00590-10024 |            |                      | 30                     | 2.37           | 1.5               | 2.5                      | 12°                    | 0°21'                        | 6              | 70                 |
| 08-00590-10025 |            |                      | 40                     | 2.54           | 1.5               | 2.5                      | 12°                    | 0°23'                        | 6              | 80                 |
| 08-00590-10030 |            | 1°                   | 12                     | 2.22           | 1.5               | 2.5                      | 12°                    | 0°31'                        | 6              | 60                 |
| 08-00590-10031 |            |                      | 16                     | 2.36           | 1.5               | 2.5                      | 12°                    | 0°38'                        | 6              | 60                 |
| 08-00590-10032 |            |                      | 20                     | 2.50           | 1.5               | 2.5                      | 12°                    | 0°43'                        | 6              | 70                 |
| 08-00590-10033 |            |                      | 25                     | 2.68           | 1.5               | 2.5                      | 12°                    | 0°46'                        | 6              | 70                 |
| 08-00590-10034 |            |                      | 30                     | 2.85           | 1.5               | 2.5                      | 12°                    | 0°48'                        | 6              | 70                 |
| 08-00590-10035 |            |                      | 40                     | 3.20           | 1.5               | 2.5                      | 12°                    | 0°51'                        | 6              | 80                 |
| 08-00590-10040 |            | 1°30'                | 20                     | 2.81           | 1.5               | 2.5                      | 12°                    | 1°09'                        | 6              | 70                 |
| 08-00590-10041 |            |                      | 25                     | 3.07           | 1.5               | 2.5                      | 12°                    | 1°13'                        | 6              | 70                 |
| 08-00590-10042 |            |                      | 30                     | 3.33           | 1.5               | 2.5                      | 12°                    | 1°16'                        | 6              | 70                 |
| 08-00590-10043 |            | 2°                   | 40                     | 3.85           | 1.5               | 2.5                      | 12°                    | 1°19'                        | 6              | 80                 |
| 08-00590-10050 |            |                      | 20                     | 3.11           | 1.5               | 2.5                      | 12°                    | 1°35'                        | 6              | 70                 |
| 08-00590-10051 |            |                      | 25                     | 3.46           | 1.5               | 2.5                      | 12°                    | 1°40'                        | 6              | 70                 |
| 08-00590-10052 |            |                      | 30                     | 3.81           | 1.5               | 2.5                      | 12°                    | 1°43'                        | 6              | 70                 |
| 08-00590-10053 |            |                      | 40                     | 4.51           | 1.5               | 2.5                      | 12°                    | 1°47'                        | 6              | 80                 |
| 08-00590-15020 | R1.5       | 30'                  | 15                     | 3.16           | 4.5               | 6                        | 12°                    | 0°18'                        | 6              | 70                 |
| 08-00590-15021 |            |                      | 20                     | 3.24           | 4.5               | 6                        | 12°                    | 0°21'                        | 6              | 70                 |
| 08-00590-15022 |            |                      | 25                     | 3.33           | 4.5               | 6                        | 12°                    | 0°22'                        | 6              | 70                 |
| 08-00590-15023 |            |                      | 30                     | 3.42           | 4.5               | 6                        | 12°                    | 0°24'                        | 6              | 70                 |
| 08-00590-15024 |            |                      | 40                     | 3.59           | 4.5               | 6                        | 12°                    | 0°25'                        | 6              | 80                 |
| 08-00590-15030 |            | 1°                   | 15                     | 3.31           | 4.5               | 6                        | 12°                    | 0°36'                        | 6              | 70                 |
| 08-00590-15031 |            |                      | 20                     | 3.49           | 4.5               | 6                        | 12°                    | 0°42'                        | 6              | 70                 |
| 08-00590-15032 |            |                      | 25                     | 3.66           | 4.5               | 6                        | 12°                    | 0°45'                        | 6              | 70                 |
| 08-00590-15033 |            |                      | 30                     | 3.84           | 4.5               | 6                        | 12°                    | 0°48'                        | 6              | 70                 |
| 08-00590-15034 |            |                      | 40                     | 4.19           | 4.5               | 6                        | 12°                    | 0°51'                        | 6              | 80                 |
| 08-00590-15040 |            | 1°30'                | 30                     | 4.26           | 4.5               | 6                        | 12°                    | 1°12'                        | 6              | 70                 |
| 08-00590-15041 |            |                      | 40                     | 4.78           | 4.5               | 6                        | 12°                    | 1°16'                        | 6              | 80                 |
| 08-00590-15042 |            |                      | 50                     | 5.30           | 4.5               | 6                        | 12°                    | 1°19'                        | 6              | 100                |
| 08-00590-15050 |            | 2°                   | 30                     | 4.68           | 4.5               | 6                        | 12°                    | 1°36'                        | 6              | 70                 |
| 08-00590-15051 |            |                      | 40                     | 5.37           | 4.5               | 6                        | 12°                    | 1°42'                        | 6              | 80                 |
| 08-00590-20031 | R2         | 1°                   | 30                     | 4.77           | 6                 | 8                        | 12°                    | 0°44'                        | 6              | 80                 |
| 08-00590-20032 |            |                      | 40                     | 5.12           | 6                 | 8                        | 12°                    | 0°48'                        | 6              | 80                 |
| 08-00590-20033 |            |                      | 50                     | 5.47           | 6                 | 8                        | 12°                    | 0°50'                        | 6              | 100                |
| 08-00590-20034 |            |                      | 65.2                   | —              | 6                 | 8                        | —                      | 0°53'                        | 6              | 110                |

P Prehardened Steel

M Stainless Steel

S Titanium Alloy Heat Resistant Alloy

  Hardened Steel  
H

 Coating

Prehardened Steel P

Stainless Steel M

Titanium Alloy Heat Resistant Alloy S

Hardened Steel H  
~ 55 HRC  
~ 65 HRC

Coating  
Long Neck Tapered Ball

| Work Material |                        |                         | Hardened Steels<br>SKD61・STAVAX<br>(~52HRC) |       |        |                   | Hardened Steels<br>SKD11<br>(~62HRC) |       |        |                   |
|---------------|------------------------|-------------------------|---------------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|
| Radius        | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | Depth of Cut                                |       | Feed   | Spindle<br>Speed  | Depth of Cut                         |       | Feed   | Spindle<br>Speed  |
|               |                        |                         | ap mm                                       | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> |
| 0.5           | 30′                    | 12                      | 0.02                                        | 0.1   | 1,000  | 16,000            | 0.01                                 | 0.07  | 800    | 14,000            |
|               |                        | 16                      | 0.01                                        | 0.1   | 600    | 12,000            | 0.005                                | 0.07  | 500    | 10,000            |
|               |                        | 20                      | 0.01                                        | 0.07  | 400    | 10,000            | 0.005                                | 0.05  | 300    | 8,000             |
|               |                        | 25                      | 0.005                                       | 0.05  | 300    | 8,000             | 0.003                                | 0.03  | 250    | 6,000             |
|               |                        | 30                      | 0.005                                       | 0.02  | 200    | 6,000             | 0.003                                | 0.01  | 150    | 4,000             |
|               | 1°                     | 12                      | 0.03                                        | 0.15  | 1,200  | 16,000            | 0.02                                 | 0.1   | 1,000  | 14,000            |
|               |                        | 16                      | 0.02                                        | 0.15  | 700    | 12,000            | 0.01                                 | 0.1   | 600    | 10,000            |
|               |                        | 20                      | 0.02                                        | 0.1   | 500    | 10,000            | 0.01                                 | 0.08  | 400    | 8,000             |
|               |                        | 25                      | 0.01                                        | 0.08  | 400    | 8,000             | 0.008                                | 0.06  | 300    | 6,000             |
|               |                        | 30                      | 0.01                                        | 0.06  | 300    | 6,000             | 0.005                                | 0.04  | 200    | 4,000             |
|               | 1°30′                  | 12                      | 0.03                                        | 0.15  | 1,200  | 16,000            | 0.02                                 | 0.1   | 1,000  | 14,000            |
|               |                        | 16                      | 0.02                                        | 0.15  | 700    | 12,000            | 0.01                                 | 0.1   | 600    | 10,000            |
|               |                        | 20                      | 0.02                                        | 0.1   | 500    | 10,000            | 0.01                                 | 0.08  | 400    | 8,000             |
|               |                        | 25                      | 0.01                                        | 0.08  | 400    | 8,000             | 0.008                                | 0.06  | 300    | 6,000             |
|               |                        | 30                      | 0.01                                        | 0.06  | 300    | 6,000             | 0.005                                | 0.04  | 200    | 4,000             |
|               | 2°                     | 20                      | 0.03                                        | 0.2   | 700    | 12,000            | 0.02                                 | 0.15  | 600    | 10,000            |
|               |                        | 30                      | 0.02                                        | 0.1   | 500    | 8,000             | 0.01                                 | 0.08  | 400    | 6,000             |
| 0.75          | 30′                    | 12                      | 0.06                                        | 0.2   | 1,500  | 18,000            | 0.04                                 | 0.15  | 1,200  | 16,000            |
|               |                        | 16                      | 0.04                                        | 0.2   | 1,200  | 16,000            | 0.02                                 | 0.15  | 950    | 14,000            |
|               |                        | 20                      | 0.02                                        | 0.1   | 700    | 12,000            | 0.015                                | 0.07  | 600    | 10,000            |
|               |                        | 25                      | 0.01                                        | 0.1   | 500    | 9,000             | 0.01                                 | 0.07  | 350    | 7,000             |
|               |                        | 30                      | 0.01                                        | 0.05  | 300    | 7,000             | 0.01                                 | 0.04  | 200    | 5,000             |
|               | 1°                     | 12                      | 0.06                                        | 0.2   | 1,500  | 18,000            | 0.05                                 | 0.15  | 1,300  | 16,000            |
|               |                        | 16                      | 0.04                                        | 0.2   | 1,200  | 16,000            | 0.04                                 | 0.15  | 1,000  | 14,000            |
|               |                        | 20                      | 0.04                                        | 0.15  | 700    | 12,000            | 0.04                                 | 0.1   | 700    | 10,000            |
|               |                        | 25                      | 0.03                                        | 0.15  | 600    | 9,000             | 0.01                                 | 0.1   | 400    | 7,000             |
|               |                        | 30                      | 0.02                                        | 0.1   | 400    | 7,000             | 0.015                                | 0.08  | 270    | 5,000             |
|               | 1°30′                  | 20                      | 0.05                                        | 0.2   | 800    | 12,000            | 0.04                                 | 0.15  | 800    | 10,000            |
|               |                        | 30                      | 0.03                                        | 0.1   | 400    | 7,000             | 0.02                                 | 0.1   | 350    | 5,000             |
|               | 2°                     | 30                      | 0.04                                        | 0.2   | 500    | 7,000             | 0.03                                 | 0.15  | 400    | 6,000             |
| 1             | 30′                    | 12                      | 0.1                                         | 0.3   | 1,500  | 16,000            | 0.08                                 | 0.2   | 1,400  | 14,000            |
|               |                        | 16                      | 0.1                                         | 0.3   | 1,200  | 12,000            | 0.08                                 | 0.2   | 1,000  | 10,000            |
|               |                        | 20                      | 0.07                                        | 0.25  | 800    | 10,000            | 0.05                                 | 0.2   | 600    | 8,000             |
|               |                        | 25                      | 0.07                                        | 0.2   | 600    | 8,500             | 0.05                                 | 0.15  | 500    | 6,500             |
|               |                        | 30                      | 0.04                                        | 0.1   | 400    | 7,000             | 0.02                                 | 0.07  | 300    | 5,000             |
|               | 1°                     | 40                      | 0.02                                        | 0.07  | 300    | 5,000             | 0.01                                 | 0.05  | 200    | 4,000             |
|               |                        | 12                      | 0.1                                         | 0.3   | 1,500  | 16,000            | 0.08                                 | 0.25  | 1,400  | 14,000            |
|               |                        | 16                      | 0.1                                         | 0.3   | 1,200  | 12,000            | 0.08                                 | 0.25  | 1,000  | 10,000            |
|               |                        | 20                      | 0.08                                        | 0.25  | 1,000  | 10,000            | 0.06                                 | 0.2   | 800    | 8,000             |
|               |                        | 25                      | 0.08                                        | 0.2   | 800    | 8,500             | 0.06                                 | 0.15  | 600    | 6,500             |
|               |                        | 30                      | 0.07                                        | 0.15  | 600    | 7,000             | 0.04                                 | 0.1   | 400    | 5,000             |
|               | 1°30′                  | 40                      | 0.04                                        | 0.08  | 400    | 5,000             | 0.02                                 | 0.06  | 300    | 4,000             |
|               |                        | 20                      | 0.08                                        | 0.3   | 1,000  | 10,000            | 0.06                                 | 0.25  | 800    | 8,000             |
|               |                        | 25                      | 0.08                                        | 0.2   | 800    | 8,500             | 0.06                                 | 0.15  | 600    | 6,500             |
|               |                        | 30                      | 0.07                                        | 0.15  | 600    | 7,000             | 0.04                                 | 0.1   | 400    | 5,000             |
|               |                        | 40                      | 0.04                                        | 0.08  | 400    | 5,000             | 0.02                                 | 0.06  | 300    | 4,000             |
|               |                        | 40                      | 0.04                                        | 0.08  | 400    | 5,000             | 0.02                                 | 0.06  | 300    | 4,000             |

| Work Material |                        |                         | Hardened Steels<br>SKD61・STAVAX<br>(~52HRC)                                                                                                                                                                                                                                                                                                      |       |        |                   | Hardened Steels<br>SKD11<br>(~62HRC) |       |        |                   |
|---------------|------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------------|-------|--------|-------------------|
| Radius        | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | Depth of Cut                                                                                                                                                                                                                                                                                                                                     |       | Feed   | Spindle<br>Speed  | Depth of Cut                         |       | Feed   | Spindle<br>Speed  |
|               |                        |                         | ap mm                                                                                                                                                                                                                                                                                                                                            | ae mm | mm/min | min <sup>-1</sup> | ap mm                                | ae mm | mm/min | min <sup>-1</sup> |
| 1             | 2°                     | 20                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.35  | 1,200  | 10,000            | 0.08                                 | 0.25  | 1,000  | 8,000             |
|               |                        | 25                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 1,000  | 8,000             | 0.08                                 | 0.2   | 800    | 6,500             |
|               |                        | 30                      | 0.08                                                                                                                                                                                                                                                                                                                                             | 0.25  | 800    | 6,000             | 0.06                                 | 0.15  | 600    | 5,000             |
|               |                        | 40                      | 0.05                                                                                                                                                                                                                                                                                                                                             | 0.1   | 500    | 4,000             | 0.03                                 | 0.08  | 400    | 4,000             |
| 1.5           | 30′                    | 15                      | 0.2                                                                                                                                                                                                                                                                                                                                              | 0.4   | 2,000  | 18,000            | 0.1                                  | 0.3   | 1,600  | 15,000            |
|               |                        | 20                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 1,500  | 14,000            | 0.07                                 | 0.2   | 1,200  | 12,000            |
|               |                        | 25                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 1,200  | 12,000            | 0.07                                 | 0.2   | 1,000  | 10,000            |
|               |                        | 30                      | 0.07                                                                                                                                                                                                                                                                                                                                             | 0.2   | 1,000  | 8,500             | 0.05                                 | 0.1   | 700    | 7,000             |
|               |                        | 40                      | 0.05                                                                                                                                                                                                                                                                                                                                             | 0.2   | 600    | 6,000             | 0.02                                 | 0.1   | 400    | 4,200             |
|               | 1°                     | 15                      | 0.2                                                                                                                                                                                                                                                                                                                                              | 0.4   | 2,000  | 18,000            | 0.1                                  | 0.3   | 1,600  | 15,000            |
|               |                        | 20                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 1,500  | 16,000            | 0.08                                 | 0.2   | 1,200  | 12,000            |
|               |                        | 25                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 1,200  | 14,000            | 0.08                                 | 0.2   | 1,000  | 10,000            |
|               |                        | 30                      | 0.08                                                                                                                                                                                                                                                                                                                                             | 0.2   | 1,000  | 10,000            | 0.06                                 | 0.15  | 800    | 7,000             |
|               |                        | 40                      | 0.07                                                                                                                                                                                                                                                                                                                                             | 0.1   | 700    | 7,000             | 0.04                                 | 0.08  | 500    | 4,200             |
|               | 1°30′                  | 30                      | 0.08                                                                                                                                                                                                                                                                                                                                             | 0.2   | 1,000  | 12,000            | 0.06                                 | 0.15  | 800    | 7,000             |
|               |                        | 40                      | 0.07                                                                                                                                                                                                                                                                                                                                             | 0.1   | 700    | 8,000             | 0.04                                 | 0.08  | 500    | 4,200             |
|               |                        | 50                      | 0.05                                                                                                                                                                                                                                                                                                                                             | 0.1   | 400    | 6,000             | 0.03                                 | 0.08  | 300    | 3,500             |
|               | 2°                     | 30                      | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 1,500  | 12,000            | 0.08                                 | 0.3   | 1,200  | 10,000            |
|               |                        | 40                      | 0.08                                                                                                                                                                                                                                                                                                                                             | 0.2   | 800    | 8,000             | 0.06                                 | 0.2   | 600    | 7,000             |
|               | 2                      | 1°                      | 30                                                                                                                                                                                                                                                                                                                                               | 0.3   | 0.5    | 1,500             | 8,500                                | 0.2   | 0.4    | 1,200             |
| 40            |                        |                         | 0.2                                                                                                                                                                                                                                                                                                                                              | 0.5   | 1,200  | 6,000             | 0.1                                  | 0.4   | 1,000  | 5,000             |
| 50            |                        |                         | 0.1                                                                                                                                                                                                                                                                                                                                              | 0.3   | 700    | 5,000             | 0.05                                 | 0.2   | 600    | 4,000             |
| 65.2          |                        |                         | 0.07                                                                                                                                                                                                                                                                                                                                             | 0.2   | 400    | 4,000             | 0.03                                 | 0.1   | 300    | 3,000             |
| Notes         |                        |                         | ※1 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※2 Coolant supply and chip disposal are important for machining deep-rib.<br>※3 We recommend using oil mist coolant.<br>※4 Adjust milling conditions according to the volume of depth of cut and rigidity of machine. |       |        |                   |                                      |       |        |                   |

Prehardened Steel P

Stainless Steel M

Titanium Alloy Heat Resistant Alloy S

Hardened Steel H  
~ 55 HRC  
~ 65 HRC

Coating  
Long Neck Tapered Ball



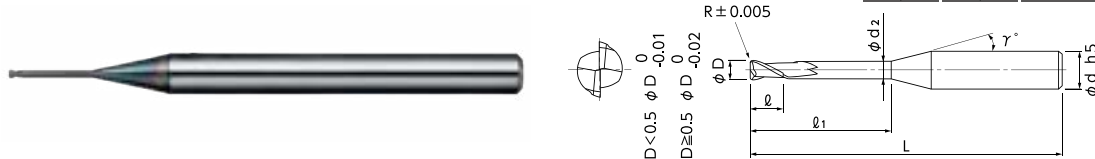
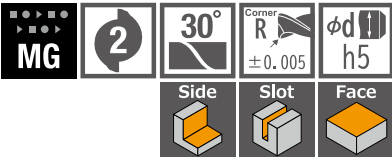
# MHRH230R

Size  $\phi 0.2 \times R0.02 \sim \phi 0.9 \times R0.1$



MUGEN COATING PREMIUM 2-Flute Long Neck Radius End Mill for Hardened Steel

Long neck corner radius end mill  
for prehardened steels and hardened steels(  $\leq 65\text{HRC}$ ).  
Maximum L/D=16



- MUGEN COATING PREMIUM for hardened steels and unique new design excel in chipping prevention and resolve chatterring to realize excellent finished surface.
- Total 97 sizes.

[Neck Shape]  
( $\gamma$ ) is reference value.Tool measurement required in order to avoid interference to the work material.

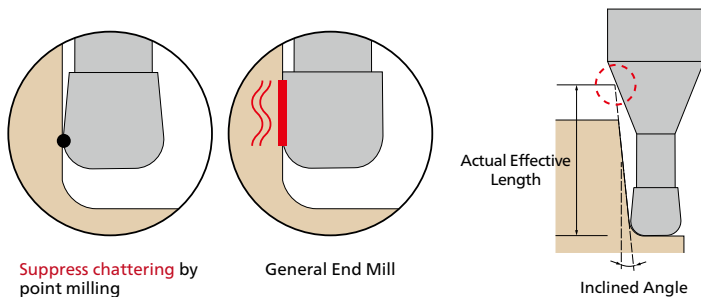
Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>( $\ell_1$ ) | Length<br>of Cut<br>( $\ell$ ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |      |
|----------------|-------------|-------------------------|--------------------------------------|--------------------------------|----------------------|-------------------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|------|
|                |             |                         |                                      |                                |                      |                                     |                      |                          | 30°                                                                 | 1°   | 1°30' | 2°   | 3°   |
| 08-00227-02021 | 0.2         | R0.02                   | 0.5                                  | 0.15                           | 0.18                 | 12°                                 | 4                    | 45                       | 0.56                                                                | 0.59 | 0.62  | 0.65 | 0.71 |
| 08-00227-02023 |             |                         | 1                                    |                                |                      |                                     |                      | 45                       | 1.09                                                                | 1.13 | 1.19  | 1.24 | 1.38 |
| 08-00227-02025 |             |                         | 1.5                                  |                                |                      |                                     |                      | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| 08-00227-02027 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.13                                                                | 2.22 | 2.33  | 2.44 | 2.71 |
| 08-00227-02051 |             |                         | 0.5                                  |                                |                      |                                     |                      | 45                       | 0.56                                                                | 0.59 | 0.61  | 0.64 | 0.70 |
| 08-00227-02053 |             | R0.05                   | 1                                    |                                |                      |                                     |                      | 45                       | 1.08                                                                | 1.13 | 1.18  | 1.24 | 1.37 |
| 08-00227-02055 |             |                         | 1.5                                  |                                |                      |                                     |                      | 45                       | 1.61                                                                | 1.68 | 1.75  | 1.84 | 2.03 |
| 08-00227-02057 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.13                                                                | 2.22 | 2.32  | 2.43 | 2.70 |
| 08-00227-03021 |             | R0.02                   | 1                                    |                                | 0.25                 | 12°                                 | 4                    | 45                       | 1.09                                                                | 1.13 | 1.19  | 1.24 | 1.38 |
| 08-00227-03022 |             |                         | 1.5                                  |                                |                      |                                     |                      | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| 08-00227-03023 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.13                                                                | 2.22 | 2.33  | 2.44 | 2.71 |
| 08-00227-03024 |             |                         | 2.5                                  |                                |                      |                                     |                      | 45                       | 2.65                                                                | 2.77 | 2.90  | 3.04 | 3.37 |
| 08-00227-03025 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.17                                                                | 3.31 | 3.47  | 3.64 | 4.03 |
| 08-00227-03051 |             | R0.05                   | 1                                    |                                |                      |                                     |                      | 45                       | 1.08                                                                | 1.13 | 1.18  | 1.24 | 1.37 |
| 08-00227-03052 |             |                         | 1.5                                  |                                |                      |                                     |                      | 45                       | 1.61                                                                | 1.68 | 1.75  | 1.84 | 2.03 |
| 08-00227-03053 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.13                                                                | 2.22 | 2.32  | 2.43 | 2.70 |
| 08-00227-03054 |             |                         | 2.5                                  |                                |                      |                                     |                      | 45                       | 2.65                                                                | 2.77 | 2.89  | 3.03 | 3.36 |
| 08-00227-03055 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.17                                                                | 3.31 | 3.46  | 3.63 | 4.02 |
| 08-00227-04021 | 0.4         | R0.02                   | 1                                    | 0.3                            | 0.37                 | 12°                                 | 4                    | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.27 | 1.41 |
| 08-00227-04022 |             |                         | 1.5                                  |                                |                      |                                     |                      | 45                       | 1.63                                                                | 1.70 | 1.78  | 1.87 | 2.07 |
| 08-00227-04023 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.15                                                                | 2.25 | 2.35  | 2.47 | 2.74 |
| 08-00227-04024 |             |                         | 2.5                                  |                                |                      |                                     |                      | 45                       | 2.67                                                                | 2.79 | 2.92  | 3.07 | 3.40 |
| 08-00227-04025 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.20                                                                | 3.34 | 3.49  | 3.67 | 4.06 |
| 08-00227-04027 |             |                         | 4                                    |                                |                      |                                     |                      | 45                       | 4.24                                                                | 4.43 | 4.63  | 4.86 | 5.39 |
| 08-00227-04051 |             | R0.05                   | 1                                    |                                |                      |                                     |                      | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.27 | 1.40 |
| 08-00227-04052 |             |                         | 1.5                                  |                                |                      |                                     |                      | 45                       | 1.63                                                                | 1.70 | 1.78  | 1.86 | 2.06 |
| 08-00227-04053 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.15                                                                | 2.25 | 2.35  | 2.46 | 2.73 |
| 08-00227-04054 |             |                         | 2.5                                  |                                |                      |                                     |                      | 45                       | 2.67                                                                | 2.79 | 2.92  | 3.06 | 3.39 |
| 08-00227-04055 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.19                                                                | 3.34 | 3.49  | 3.66 | 4.05 |
| 08-00227-04057 |             |                         | 4                                    |                                |                      |                                     |                      | 45                       | 4.24                                                                | 4.43 | 4.63  | 4.86 | 5.38 |
| 08-00227-04101 |             | R0.1                    | 1                                    |                                |                      |                                     |                      | 45                       | 1.11                                                                | 1.15 | 1.20  | 1.26 | 1.38 |
| 08-00227-04103 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.15                                                                | 2.24 | 2.34  | 2.45 | 2.71 |
| 08-00227-04105 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.19                                                                | 3.33 | 3.48  | 3.65 | 4.04 |
| 08-00227-04107 |             |                         | 4                                    |                                |                      |                                     |                      | 45                       | 4.24                                                                | 4.42 | 4.62  | 4.85 | 5.36 |
| 08-00227-05021 | 0.5         | R0.02                   | 1                                    |                                | 0.4                  | 12°                                 | 4                    | 45                       | 1.14                                                                | 1.19 | 1.24  | 1.30 | 1.44 |
| 08-00227-05022 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.18                                                                | 2.27 | 2.38  | 2.50 | 2.77 |
| 08-00227-05023 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.22                                                                | 3.36 | 3.52  | 3.69 | 4.10 |
| 08-00227-05024 |             |                         | 4                                    |                                |                      |                                     |                      | 45                       | 4.26                                                                | 4.45 | 4.66  | 4.89 | 5.42 |
| 08-00227-05025 |             |                         | 5                                    |                                |                      |                                     |                      | 45                       | 5.31                                                                | 5.54 | 5.80  | 6.09 | 6.75 |
| 08-00227-05026 |             |                         | 6                                    |                                |                      |                                     |                      | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.08 |
| 08-00227-05051 |             | R0.05                   | 1                                    |                                |                      |                                     |                      | 45                       | 1.13                                                                | 1.18 | 1.24  | 1.29 | 1.43 |
| 08-00227-05052 |             |                         | 2                                    |                                |                      |                                     |                      | 45                       | 2.18                                                                | 2.27 | 2.38  | 2.49 | 2.76 |
| 08-00227-05053 |             |                         | 3                                    |                                |                      |                                     |                      | 45                       | 3.22                                                                | 3.36 | 3.52  | 3.69 | 4.09 |
| 08-00227-05054 |             |                         | 4                                    |                                |                      |                                     |                      | 45                       | 4.26                                                                | 4.45 | 4.66  | 4.88 | 5.41 |
| 08-00227-05055 |             |                         | 5                                    |                                |                      |                                     |                      | 45                       | 5.31                                                                | 5.54 | 5.80  | 6.08 | 6.74 |
| 08-00227-05056 |             |                         | 6                                    |                                |                      |                                     |                      | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.07 |

## How to Order

When you order, indicate MHRH230R (D)×(R)×( $\ell_1$ ). ※( $\gamma$ ) is reference value.

MUGEN COATING PREMIUM 2-Flute Long Neck Radius End Mill for Hardened Steel



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 08-00227-05101 | 0.5         | R0.1                    | 1                                         | 0.4                     | 0.46                              | 12°                        | 4                    | 45                       | 1.13                                                                | 1.18  | 1.23  | 1.28  | 1.41  |
| 08-00227-05102 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.27  | 2.37  | 2.48  | 2.74  |
| 08-00227-05103 |             |                         | 3                                         |                         |                                   |                            |                      | 45                       | 3.22                                                                | 3.36  | 3.51  | 3.68  | 4.07  |
| 08-00227-05104 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.65  | 4.87  | 5.40  |
| 08-00227-05105 |             |                         | 5                                         |                         |                                   |                            |                      | 45                       | 5.30                                                                | 5.54  | 5.79  | 6.07  | 6.72  |
| 08-00227-05106 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.93  | 7.27  | 8.05  |
| 08-00227-06021 | 0.6         | R0.02                   | 2                                         | 0.5                     | 0.56                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.50  | 2.77  |
| 08-00227-06023 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.89  | 5.42  |
| 08-00227-06025 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.08  |
| 08-00227-06027 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.81  | 9.22  | 9.68  | 10.73 |
| 08-00227-06029 |             |                         | 10                                        |                         |                                   |                            |                      | 50                       | 10.52                                                               | 10.99 | 11.50 | 12.07 | 13.39 |
| 08-00227-06051 |             | R0.05                   | 2                                         |                         |                                   |                            |                      | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.49  | 2.76  |
| 08-00227-06053 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.88  | 5.41  |
| 08-00227-06055 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.07  |
| 08-00227-06057 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.81  | 9.22  | 9.67  | 10.72 |
| 08-00227-06059 |             |                         | 10                                        |                         |                                   |                            |                      | 50                       | 10.52                                                               | 10.99 | 11.50 | 12.06 | 13.38 |
| 08-00227-06101 |             | R0.1                    | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.27  | 2.37  | 2.48  | 2.74  |
| 08-00227-06103 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.65  | 4.87  | 5.40  |
| 08-00227-06105 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.93  | 7.27  | 8.05  |
| 08-00227-06107 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.80  | 9.21  | 9.66  | 10.71 |
| 08-00227-06109 |             |                         | 10                                        |                         |                                   |                            |                      | 50                       | 10.52                                                               | 10.98 | 11.49 | 12.05 | 13.36 |
| 08-00227-07020 | 0.7         | R0.02                   | 2                                         | 0.55                    | 0.66                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.50  | 2.77  |
| 08-00227-07021 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.89  | 5.42  |
| 08-00227-07023 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.08  |
| 08-00227-07050 |             | R0.05                   | 2                                         |                         |                                   |                            |                      | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.49  | 2.76  |
| 08-00227-07051 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.88  | 5.41  |
| 08-00227-07053 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.07  |
| 08-00227-07100 |             | R0.1                    | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.27  | 2.37  | 2.48  | 2.74  |
| 08-00227-07101 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.65  | 4.87  | 5.40  |
| 08-00227-07103 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.93  | 7.27  | 8.05  |
| 08-00227-08020 | 0.8         | R0.02                   | 2                                         | 0.65                    | 0.76                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.50  | 2.77  |
| 08-00227-08021 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.89  | 5.42  |
| 08-00227-08023 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.08  |
| 08-00227-08025 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.81  | 9.22  | 9.68  | 10.73 |
| 08-00227-08050 |             | R0.05                   | 2                                         |                         |                                   |                            |                      | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.49  | 2.76  |
| 08-00227-08051 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.88  | 5.41  |
| 08-00227-08053 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.07  |
| 08-00227-08055 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.81  | 9.22  | 9.67  | 10.72 |
| 08-00227-08059 |             | R0.1                    | 12                                        |                         |                                   |                            |                      | 50                       | 12.60                                                               | 13.17 | 13.78 | 14.46 | 16.03 |
| 08-00227-08100 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.27  | 2.37  | 2.48  | 2.74  |
| 08-00227-08101 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.65  | 4.87  | 5.40  |
| 08-00227-08103 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.93  | 7.27  | 8.05  |
| 08-00227-08105 |             | R0.2                    | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.80  | 9.21  | 9.66  | 10.71 |
| 08-00227-08109 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.60                                                               | 13.16 | 13.77 | 14.45 | 16.01 |
| 08-00227-08200 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.26  | 2.36  | 2.46  | 2.71  |
| 08-00227-08201 | 4           |                         | 45                                        | 4.26                    | 4.44                              | 4.64                       | 4.85                 | 5.36                     |                                                                     |       |       |       |       |
| 08-00227-08203 | R0.2        | 6                       | 45                                        | 6.34                    | 6.62                              | 6.92                       | 7.25                 | 8.02                     |                                                                     |       |       |       |       |
| 08-00227-08205 |             | 8                       | 50                                        | 8.43                    | 8.80                              | 9.20                       | 9.64                 | 10.67                    |                                                                     |       |       |       |       |
| 08-00227-08209 |             | 12                      | 50                                        | 12.60                   | 13.15                             | 13.76                      | 14.43                | 15.98                    |                                                                     |       |       |       |       |
| 08-00227-09101 |             | 0.9                     | R0.1                                      | 4                       | 0.7                               | 0.85                       | 12°                  | 4                        | 45                                                                  | 4.28  | 4.47  | 4.68  | 4.90  |
| 08-00227-09105 | 8           |                         |                                           | 50                      |                                   |                            |                      |                          | 8.46                                                                | 8.83  | 9.24  | 9.69  | 10.74 |

MHRH230R

Recommended Milling Conditions

MHRH230R

Recommended Milling Conditions

| Work Material |               |                   | Prehardened Steels<br>HPM・NAK<br>(~42HRC) |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |              |       | High Speed Steels<br>SKH<br>(~65HRC) |        |              |       |  |
|---------------|---------------|-------------------|-------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|--|
| Dia.          | Corner Radius | Under Neck Length | Spindle Speed                             | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |  |
|               |               |                   | min <sup>-1</sup>                         | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |  |
| 0.2           | 0.02          | 0.5               | 30,000                                    | 240    | 0.005        | 0.05  | 30,000                                            | 200    | 0.003        | 0.04  | 30,000                                     | 160    | 0.003        | 0.02  | 30,000                               | 120    | 0.003        | 0.01  |  |
|               |               | 1                 | 30,000                                    | 180    | 0.005        | 0.05  | 30,000                                            | 150    | 0.003        | 0.04  | 30,000                                     | 120    | 0.002        | 0.02  | 30,000                               | 80     | 0.002        | 0.01  |  |
|               |               | 1.5               | 30,000                                    | 120    | 0.004        | 0.05  | 30,000                                            | 100    | 0.002        | 0.04  | 30,000                                     | 80     | 0.002        | 0.02  | 30,000                               | 60     | 0.001        | 0.01  |  |
|               |               | 2                 | 30,000                                    | 70     | 0.003        | 0.05  | 30,000                                            | 50     | 0.002        | 0.04  | 30,000                                     | 40     | 0.001        | 0.02  | 30,000                               | 30     | 0.001        | 0.01  |  |
|               | 0.05          | 0.5               | 30,000                                    | 240    | 0.01         | 0.05  | 30,000                                            | 200    | 0.003        | 0.04  | 30,000                                     | 160    | 0.003        | 0.02  | 30,000                               | 120    | 0.003        | 0.01  |  |
|               |               | 1                 | 30,000                                    | 180    | 0.007        | 0.05  | 30,000                                            | 150    | 0.003        | 0.04  | 30,000                                     | 120    | 0.003        | 0.02  | 30,000                               | 80     | 0.003        | 0.01  |  |
|               |               | 1.5               | 30,000                                    | 120    | 0.005        | 0.05  | 30,000                                            | 100    | 0.002        | 0.04  | 30,000                                     | 80     | 0.002        | 0.02  | 30,000                               | 60     | 0.002        | 0.01  |  |
|               |               | 2                 | 30,000                                    | 70     | 0.003        | 0.05  | 30,000                                            | 50     | 0.002        | 0.04  | 30,000                                     | 40     | 0.002        | 0.02  | 30,000                               | 30     | 0.002        | 0.01  |  |
| 0.3           | 0.02          | 1                 | 30,000                                    | 350    | 0.015        | 0.1   | 30,000                                            | 300    | 0.003        | 0.08  | 30,000                                     | 250    | 0.003        | 0.04  | 30,000                               | 200    | 0.003        | 0.03  |  |
|               |               | 1.5               | 30,000                                    | 240    | 0.01         | 0.1   | 30,000                                            | 200    | 0.003        | 0.08  | 30,000                                     | 160    | 0.003        | 0.04  | 30,000                               | 120    | 0.003        | 0.03  |  |
|               |               | 2                 | 30,000                                    | 180    | 0.007        | 0.1   | 30,000                                            | 150    | 0.003        | 0.08  | 30,000                                     | 120    | 0.003        | 0.04  | 25,000                               | 100    | 0.003        | 0.03  |  |
|               |               | 2.5               | 30,000                                    | 150    | 0.005        | 0.1   | 25,000                                            | 100    | 0.002        | 0.08  | 25,000                                     | 80     | 0.002        | 0.04  | 20,000                               | 60     | 0.002        | 0.03  |  |
|               |               | 3                 | 30,000                                    | 70     | 0.004        | 0.1   | 25,000                                            | 50     | 0.002        | 0.08  | 25,000                                     | 40     | 0.002        | 0.04  | 20,000                               | 30     | 0.002        | 0.03  |  |
|               | 0.05          | 1                 | 30,000                                    | 350    | 0.02         | 0.1   | 30,000                                            | 300    | 0.003        | 0.08  | 30,000                                     | 250    | 0.003        | 0.04  | 30,000                               | 200    | 0.003        | 0.03  |  |
|               |               | 1.5               | 30,000                                    | 240    | 0.015        | 0.1   | 30,000                                            | 200    | 0.003        | 0.08  | 30,000                                     | 160    | 0.003        | 0.04  | 30,000                               | 120    | 0.003        | 0.03  |  |
|               |               | 2                 | 30,000                                    | 180    | 0.01         | 0.1   | 30,000                                            | 150    | 0.003        | 0.08  | 30,000                                     | 120    | 0.003        | 0.04  | 25,000                               | 100    | 0.003        | 0.03  |  |
|               |               | 2.5               | 30,000                                    | 150    | 0.007        | 0.1   | 25,000                                            | 100    | 0.002        | 0.08  | 25,000                                     | 80     | 0.002        | 0.04  | 20,000                               | 60     | 0.002        | 0.03  |  |
| 3             | 30,000        | 70                | 0.005                                     | 0.1    | 25,000       | 50    | 0.002                                             | 0.08   | 25,000       | 40    | 0.002                                      | 0.04   | 20,000       | 30    | 0.002                                | 0.03   |              |       |  |
| 0.4           | 0.02          | 1                 | 30,000                                    | 450    | 0.015        | 0.12  | 30,000                                            | 400    | 0.005        | 0.1   | 28,000                                     | 350    | 0.005        | 0.05  | 25,000                               | 300    | 0.004        | 0.04  |  |
|               |               | 1.5               | 30,000                                    | 400    | 0.012        | 0.12  | 30,000                                            | 350    | 0.005        | 0.1   | 28,000                                     | 300    | 0.005        | 0.05  | 25,000                               | 260    | 0.004        | 0.04  |  |
|               |               | 2                 | 30,000                                    | 360    | 0.01         | 0.12  | 30,000                                            | 300    | 0.005        | 0.1   | 25,000                                     | 250    | 0.005        | 0.05  | 25,000                               | 220    | 0.003        | 0.04  |  |
|               |               | 2.5               | 30,000                                    | 340    | 0.008        | 0.12  | 28,000                                            | 280    | 0.004        | 0.1   | 25,000                                     | 240    | 0.004        | 0.05  | 20,000                               | 180    | 0.003        | 0.04  |  |
|               |               | 3                 | 30,000                                    | 320    | 0.008        | 0.12  | 25,000                                            | 250    | 0.004        | 0.1   | 23,000                                     | 220    | 0.003        | 0.05  | 18,000                               | 160    | 0.002        | 0.04  |  |
|               |               | 4                 | 30,000                                    | 250    | 0.006        | 0.12  | 25,000                                            | 200    | 0.003        | 0.1   | 20,000                                     | 160    | 0.002        | 0.05  | 18,000                               | 120    | 0.002        | 0.04  |  |
|               | 0.05          | 1                 | 30,000                                    | 450    | 0.025        | 0.12  | 30,000                                            | 400    | 0.005        | 0.1   | 28,000                                     | 350    | 0.005        | 0.05  | 25,000                               | 300    | 0.005        | 0.04  |  |
|               |               | 1.5               | 30,000                                    | 400    | 0.022        | 0.12  | 30,000                                            | 350    | 0.005        | 0.1   | 28,000                                     | 300    | 0.005        | 0.05  | 25,000                               | 260    | 0.005        | 0.04  |  |
|               |               | 2                 | 30,000                                    | 360    | 0.02         | 0.12  | 30,000                                            | 300    | 0.005        | 0.1   | 25,000                                     | 250    | 0.005        | 0.05  | 25,000                               | 220    | 0.005        | 0.04  |  |
|               |               | 2.5               | 30,000                                    | 340    | 0.015        | 0.12  | 28,000                                            | 280    | 0.004        | 0.1   | 25,000                                     | 240    | 0.004        | 0.05  | 20,000                               | 180    | 0.004        | 0.04  |  |
|               |               | 3                 | 30,000                                    | 320    | 0.015        | 0.12  | 25,000                                            | 250    | 0.004        | 0.1   | 23,000                                     | 220    | 0.003        | 0.05  | 18,000                               | 160    | 0.003        | 0.04  |  |
|               |               | 4                 | 30,000                                    | 250    | 0.01         | 0.12  | 25,000                                            | 200    | 0.003        | 0.1   | 20,000                                     | 160    | 0.002        | 0.05  | 18,000                               | 120    | 0.002        | 0.04  |  |
|               | 0.1           | 1                 | 30,000                                    | 450    | 0.025        | 0.12  | 30,000                                            | 400    | 0.005        | 0.1   | 28,000                                     | 350    | 0.005        | 0.05  | 25,000                               | 300    | 0.005        | 0.04  |  |
|               |               | 2                 | 30,000                                    | 360    | 0.02         | 0.12  | 30,000                                            | 300    | 0.005        | 0.1   | 25,000                                     | 250    | 0.005        | 0.05  | 25,000                               | 220    | 0.005        | 0.04  |  |
|               |               | 3                 | 30,000                                    | 320    | 0.015        | 0.12  | 25,000                                            | 250    | 0.004        | 0.1   | 23,000                                     | 220    | 0.003        | 0.05  | 18,000                               | 160    | 0.003        | 0.04  |  |
|               |               | 4                 | 30,000                                    | 250    | 0.01         | 0.12  | 25,000                                            | 200    | 0.003        | 0.1   | 20,000                                     | 160    | 0.002        | 0.05  | 18,000                               | 120    | 0.002        | 0.04  |  |
| 0.5           | 0.02          | 1                 | 30,000                                    | 600    | 0.016        | 0.14  | 25,000                                            | 500    | 0.008        | 0.15  | 23,000                                     | 450    | 0.006        | 0.1   | 20,000                               | 400    | 0.004        | 0.08  |  |
|               |               | 2                 | 30,000                                    | 500    | 0.014        | 0.14  | 25,000                                            | 420    | 0.007        | 0.15  | 23,000                                     | 360    | 0.005        | 0.1   | 20,000                               | 300    | 0.003        | 0.08  |  |
|               |               | 3                 | 30,000                                    | 420    | 0.012        | 0.14  | 25,000                                            | 350    | 0.006        | 0.15  | 23,000                                     | 320    | 0.004        | 0.1   | 20,000                               | 280    | 0.003        | 0.08  |  |
|               |               | 4                 | 25,000                                    | 380    | 0.01         | 0.14  | 25,000                                            | 300    | 0.004        | 0.15  | 23,000                                     | 240    | 0.002        | 0.1   | 20,000                               | 180    | 0.002        | 0.08  |  |
|               |               | 5                 | 25,000                                    | 300    | 0.008        | 0.14  | 20,000                                            | 200    | 0.003        | 0.15  | 18,000                                     | 150    | 0.002        | 0.1   | 16,000                               | 100    | 0.002        | 0.08  |  |
|               |               | 6                 | 25,000                                    | 250    | 0.004        | 0.14  | 20,000                                            | 160    | 0.002        | 0.15  | 18,000                                     | 100    | 0.001        | 0.1   | 16,000                               | 70     | 0.001        | 0.08  |  |
|               | 0.05          | 1                 | 30,000                                    | 600    | 0.03         | 0.14  | 25,000                                            | 500    | 0.01         | 0.15  | 23,000                                     | 450    | 0.007        | 0.1   | 20,000                               | 400    | 0.005        | 0.08  |  |
|               |               | 2                 | 30,000                                    | 500    | 0.025        | 0.14  | 25,000                                            | 420    | 0.01         | 0.15  | 23,000                                     | 360    | 0.007        | 0.1   | 20,000                               | 300    | 0.005        | 0.08  |  |
|               |               | 3                 | 30,000                                    | 420    | 0.02         | 0.14  | 25,000                                            | 350    | 0.008        | 0.15  | 23,000                                     | 320    | 0.005        | 0.1   | 20,000                               | 280    | 0.003        | 0.08  |  |
|               |               | 4                 | 25,000                                    | 380    | 0.015        | 0.14  | 25,000                                            | 300    | 0.005        | 0.15  | 23,000                                     | 240    | 0.003        | 0.1   | 20,000                               | 180    | 0.002        | 0.08  |  |
|               |               | 5                 | 25,000                                    | 300    | 0.01         | 0.14  | 20,000                                            | 200    | 0.004        | 0.15  | 18,000                                     | 150    | 0.003        | 0.1   | 16,000                               | 100    | 0.002        | 0.08  |  |
|               |               | 6                 | 25,000                                    | 250    | 0.008        | 0.14  | 20,000                                            | 160    | 0.003        | 0.15  | 18,000                                     | 100    | 0.002        | 0.1   | 16,000                               | 70     | 0.001        | 0.08  |  |
|               |               | 0.1               |                                           |        |              |       |                                                   |        |              |       |                                            |        |              |       |                                      |        |              |       |  |
|               |               |                   |                                           |        |              |       |                                                   |        |              |       |                                            |        |              |       |                                      |        |              |       |  |

| Work Material |                    |                   | Prehardened Steels<br>HPM・NAK<br>(～42HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(～55HRC) |        |              |       | Hardened Steels<br>SKD11・PD613<br>(～62HRC) |        |              |       | High Speed Steels<br>SKH<br>(～65HRC) |        |              |       |
|---------------|--------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Corner Radius      | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                    |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 0.6           | 0.02               | 2                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 600    | 0.016        | 0.2   | 25,000                                            | 500    | 0.012        | 0.2   | 23,000                                     | 400    | 0.006        | 0.15  | 20,000                               | 320    | 0.004        | 0.1   |
|               |                    | 4                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 450    | 0.012        | 0.2   | 23,000                                            | 400    | 0.007        | 0.2   | 20,000                                     | 300    | 0.004        | 0.15  | 18,000                               | 200    | 0.003        | 0.1   |
|               |                    | 6                 | 23,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.008        | 0.2   | 20,000                                            | 200    | 0.005        | 0.2   | 18,000                                     | 150    | 0.003        | 0.15  | 12,000                               | 100    | 0.002        | 0.1   |
|               |                    | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 200    | 0.006        | 0.2   | 16,000                                            | 150    | 0.003        | 0.2   | 14,000                                     | 100    | 0.001        | 0.15  | 10,000                               | 80     | 0.001        | 0.1   |
|               | 0.05<br>0.1        | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 120    | 0.003        | 0.2   | 14,000                                            | 100    | 0.001        | 0.2   | 12,000                                     | 80     | 0.001        | 0.15  | 8,000                                | 50     | 0.001        | 0.1   |
|               |                    | 2                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 600    | 0.035        | 0.2   | 25,000                                            | 500    | 0.02         | 0.2   | 23,000                                     | 400    | 0.01         | 0.15  | 20,000                               | 320    | 0.007        | 0.1   |
|               |                    | 4                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 450    | 0.025        | 0.2   | 23,000                                            | 400    | 0.015        | 0.2   | 20,000                                     | 300    | 0.007        | 0.15  | 18,000                               | 200    | 0.005        | 0.1   |
|               |                    | 6                 | 23,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.015        | 0.2   | 20,000                                            | 200    | 0.008        | 0.2   | 18,000                                     | 150    | 0.005        | 0.15  | 12,000                               | 100    | 0.003        | 0.1   |
|               |                    | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 200    | 0.01         | 0.2   | 16,000                                            | 150    | 0.005        | 0.2   | 14,000                                     | 100    | 0.002        | 0.15  | 10,000                               | 80     | 0.001        | 0.1   |
|               |                    | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 120    | 0.005        | 0.2   | 14,000                                            | 100    | 0.002        | 0.2   | 12,000                                     | 80     | 0.001        | 0.15  | 8,000                                | 50     | 0.001        | 0.1   |
| 0.7           | 0.02               | 2                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 900    | 0.016        | 0.25  | 25,000                                            | 700    | 0.012        | 0.25  | 23,000                                     | 600    | 0.006        | 0.15  | 20,000                               | 450    | 0.003        | 0.12  |
|               |                    | 4                 | 28,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 700    | 0.012        | 0.25  | 25,000                                            | 600    | 0.008        | 0.25  | 23,000                                     | 500    | 0.005        | 0.15  | 20,000                               | 350    | 0.002        | 0.12  |
|               |                    | 6                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 500    | 0.008        | 0.25  | 20,000                                            | 350    | 0.005        | 0.25  | 18,000                                     | 250    | 0.003        | 0.15  | 16,000                               | 200    | 0.002        | 0.12  |
|               | 0.05<br>0.1        | 2                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 900    | 0.04         | 0.25  | 25,000                                            | 700    | 0.03         | 0.25  | 23,000                                     | 600    | 0.015        | 0.15  | 20,000                               | 450    | 0.01         | 0.12  |
|               |                    | 4                 | 28,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 700    | 0.03         | 0.25  | 25,000                                            | 600    | 0.02         | 0.25  | 23,000                                     | 500    | 0.01         | 0.15  | 20,000                               | 350    | 0.007        | 0.12  |
|               |                    | 6                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 500    | 0.02         | 0.25  | 20,000                                            | 350    | 0.01         | 0.25  | 18,000                                     | 250    | 0.007        | 0.15  | 16,000                               | 200    | 0.005        | 0.12  |
| 0.8           | 0.02               | 2                 | 28,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1,000  | 0.016        | 0.3   | 25,000                                            | 800    | 0.014        | 0.25  | 23,000                                     | 700    | 0.006        | 0.16  | 20,000                               | 500    | 0.005        | 0.14  |
|               |                    | 4                 | 28,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 900    | 0.012        | 0.3   | 25,000                                            | 700    | 0.008        | 0.25  | 23,000                                     | 600    | 0.005        | 0.16  | 20,000                               | 400    | 0.003        | 0.14  |
|               |                    | 6                 | 23,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 700    | 0.009        | 0.3   | 20,000                                            | 550    | 0.006        | 0.25  | 18,000                                     | 450    | 0.004        | 0.16  | 16,000                               | 320    | 0.002        | 0.14  |
|               |                    | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 500    | 0.006        | 0.3   | 16,000                                            | 400    | 0.003        | 0.25  | 14,000                                     | 300    | 0.002        | 0.16  | 12,000                               | 200    | 0.002        | 0.14  |
|               | 0.05<br>0.1<br>0.2 | 2                 | 28,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1,000  | 0.05         | 0.3   | 25,000                                            | 800    | 0.03         | 0.25  | 23,000                                     | 700    | 0.02         | 0.16  | 20,000                               | 500    | 0.015        | 0.14  |
|               |                    | 4                 | 28,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 900    | 0.045        | 0.3   | 25,000                                            | 700    | 0.025        | 0.25  | 23,000                                     | 600    | 0.015        | 0.16  | 20,000                               | 400    | 0.01         | 0.14  |
|               |                    | 6                 | 23,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 700    | 0.03         | 0.3   | 20,000                                            | 550    | 0.02         | 0.25  | 18,000                                     | 450    | 0.01         | 0.16  | 16,000                               | 320    | 0.007        | 0.14  |
|               |                    | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 500    | 0.02         | 0.3   | 16,000                                            | 400    | 0.01         | 0.25  | 14,000                                     | 300    | 0.005        | 0.16  | 12,000                               | 200    | 0.005        | 0.14  |
| 0.9           | 0.1                | 12                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.007        | 0.3   | 14,000                                            | 200    | 0.005        | 0.25  | 12,000                                     | 120    | 0.003        | 0.16  | 10,000                               | 80     | 0.001        | 0.14  |
|               |                    | 4                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1,100  | 0.05         | 0.3   | 25,000                                            | 850    | 0.03         | 0.3   | 20,000                                     | 700    | 0.02         | 0.2   | 18,000                               | 600    | 0.01         | 0.15  |
|               |                    | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 500    | 0.03         | 0.3   | 16,000                                            | 400    | 0.01         | 0.3   | 14,000                                     | 350    | 0.008        | 0.2   | 10,000                               | 250    | 0.005        | 0.15  |
| Notes         |                    |                   | ※1 Adjust milling conditions according to milling shape and machine type.<br>※2 ap : Axial Depth of Cut, ae : Radial Depth of Cut.<br>※3 Recommend to use oil mist coolant for machining hardened steels.<br>※4 Recommend to apply helical or ramping for approaching into axial direction.<br>※5 Adjust feed rate 50% lower and cutting depth (ae) 30% lower for milling deep wall area when L/D exceeds 8 for stable milling.<br>※6 For slotting, recommend reciprocating milling by adjusting feed & ap in below 50% of recommended milling condition.<br>※7 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine. |        |              |       |                                                   |        |              |       |                                            |        |              |       |                                      |        |              |       |

# MHRH430R

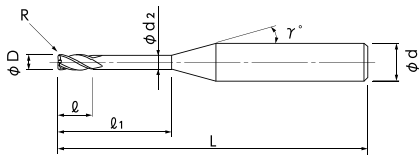
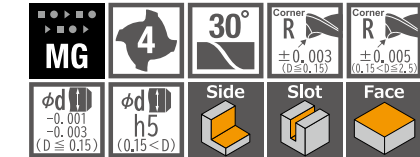
Lineup Expansion

Size  $\phi 0.1 \times R0.01 \sim \phi 6 \times R1$



MUGEN COATING PREMIUM 4-Flute Long Neck Radius End Mill for Hardened Steel

4-flute long neck corner radius end mill  
for prehardened steels and hardened steels(  $\sim 65\text{HRC}$  ).  
Maximum L/D=16



- MUGEN COATING PREMIUM for hardened steels and unique new design excel in chipping prevention and resolve chattering to realize excellent finished surface.
- 4 flutes end mill for higher efficiency.
- Total 336 sizes.

Beware of stocks because there is no blade to the shaft center of end teeth of  $\phi 0.1$  to  $\phi 0.3$ .

[Neck Shape]  
( $\gamma$ ) is reference value.Tool measurement required in order to avoid interference to the work material.

| Size                  | Diameter Tolerance | Corner R Tolerance | Shank Dia. Tolerance |
|-----------------------|--------------------|--------------------|----------------------|
| $D \leq 0.15$         | 0<br>-0.007        | $\pm 0.003$        | -0.001*<br>-0.003    |
| $0.15 < D \leq 0.5$   | 0<br>-0.01         | $\pm 0.005$        | h5                   |
| $0.5 \leq D \leq 2.5$ | 0<br>-0.02         | $\pm 0.01$         |                      |
| $D > 2.5$             |                    |                    |                      |

※Shank tolerance is h4(JIS), NS TOOL produces within 0.002mm from -0.001mm  $\sim$  -0.003mm.

◆ New Size

Unit : mm

| Code No.         | Dia.<br>(D) | Corner Radius<br>(R) | Under Neck Length<br>(L1) | Length of Cut<br>(L) | Neck Dia.<br>(d2) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|------------------|-------------|----------------------|---------------------------|----------------------|-------------------|----------------------------------|-------------------|-----------------------|------------------------------------------------------------------|------|-------|------|------|
|                  |             |                      |                           |                      |                   |                                  |                   |                       | 30°                                                              | 1°   | 1°30' | 2°   | 3°   |
| ◆ 08-00237-01013 | 0.1         | R0.01                | 0.3                       | 0.08                 | 0.085             | 12°                              | 4                 | 45                    | 0.34                                                             | 0.36 | 0.38  | 0.39 | 0.44 |
| ◆ 08-00237-01015 |             |                      | 0.5                       |                      |                   |                                  |                   | 45                    | 0.55                                                             | 0.58 | 0.60  | 0.63 | 0.70 |
| ◆ 08-00237-01512 | 0.15        | R0.01                | 0.3                       | 0.12                 | 0.135             | 12°                              | 4                 | 45                    | 0.34                                                             | 0.36 | 0.38  | 0.39 | 0.44 |
| ◆ 08-00237-01513 |             |                      | 0.5                       |                      |                   |                                  |                   | 45                    | 0.55                                                             | 0.58 | 0.60  | 0.63 | 0.70 |
| ◆ 08-00237-01515 |             |                      | 0.75                      |                      |                   |                                  |                   | 45                    | 0.81                                                             | 0.85 | 0.89  | 0.93 | 1.03 |
| ◆ 08-00237-01517 |             | R0.02                | 1                         |                      |                   |                                  |                   | 45                    | 1.07                                                             | 1.12 | 1.17  | 1.23 | 1.37 |
| ◆ 08-00237-01522 |             |                      | 0.3                       |                      |                   |                                  |                   | 45                    | 0.34                                                             | 0.36 | 0.37  | 0.39 | 0.43 |
| ◆ 08-00237-01523 |             |                      | 0.5                       |                      |                   |                                  |                   | 45                    | 0.55                                                             | 0.58 | 0.60  | 0.63 | 0.70 |
| ◆ 08-00237-01525 | 0.2         | R0.02                | 0.75                      |                      |                   |                                  |                   | 45                    | 0.81                                                             | 0.85 | 0.89  | 0.93 | 1.03 |
| ◆ 08-00237-01527 |             |                      | 1                         |                      |                   |                                  |                   | 45                    | 1.07                                                             | 1.12 | 1.17  | 1.23 | 1.36 |
| 08-00237-02021   |             | R0.02                | 0.5                       |                      | 0.15              | 12°                              | 4                 | 45                    | 0.56                                                             | 0.59 | 0.62  | 0.65 | 0.71 |
| 08-00237-02023   |             |                      | 1                         |                      |                   |                                  |                   | 45                    | 1.09                                                             | 1.13 | 1.19  | 1.24 | 1.38 |
| 08-00237-02025   |             |                      | 1.5                       |                      |                   |                                  |                   | 45                    | 1.61                                                             | 1.68 | 1.76  | 1.84 | 2.04 |
| 08-00237-02027   |             | R0.05                | 2                         |                      |                   |                                  |                   | 45                    | 2.13                                                             | 2.22 | 2.33  | 2.44 | 2.71 |
| 08-00237-02051   |             |                      | 0.5                       |                      |                   |                                  |                   | 45                    | 0.56                                                             | 0.59 | 0.61  | 0.64 | 0.70 |
| 08-00237-02053   |             |                      | 1                         |                      |                   |                                  |                   | 45                    | 1.08                                                             | 1.13 | 1.18  | 1.24 | 1.37 |
| 08-00237-02055   | 0.3         | R0.02                | 1.5                       |                      |                   |                                  |                   | 45                    | 1.61                                                             | 1.68 | 1.75  | 1.84 | 2.03 |
| 08-00237-02057   |             |                      | 2                         |                      |                   |                                  |                   | 45                    | 2.13                                                             | 2.22 | 2.32  | 2.43 | 2.70 |
| 08-00237-03021   |             | R0.02                | 1                         |                      | 0.25              | 12°                              | 4                 | 45                    | 1.09                                                             | 1.13 | 1.19  | 1.24 | 1.38 |
| 08-00237-03022   |             |                      | 1.5                       |                      |                   |                                  |                   | 45                    | 1.61                                                             | 1.68 | 1.76  | 1.84 | 2.04 |
| 08-00237-03023   |             |                      | 2                         |                      |                   |                                  |                   | 45                    | 2.13                                                             | 2.22 | 2.33  | 2.44 | 2.71 |
| 08-00237-03024   |             | R0.05                | 2.5                       |                      |                   |                                  |                   | 45                    | 2.65                                                             | 2.77 | 2.90  | 3.04 | 3.37 |
| 08-00237-03025   |             |                      | 3                         |                      |                   |                                  |                   | 45                    | 3.17                                                             | 3.31 | 3.47  | 3.64 | 4.03 |
| 08-00237-03051   |             |                      | 1                         |                      |                   |                                  |                   | 45                    | 1.08                                                             | 1.13 | 1.18  | 1.24 | 1.37 |
| 08-00237-03052   | 0.4         | R0.02                | 1.5                       |                      |                   |                                  |                   | 45                    | 1.61                                                             | 1.68 | 1.75  | 1.84 | 2.03 |
| 08-00237-03053   |             |                      | 2                         |                      |                   |                                  |                   | 45                    | 2.13                                                             | 2.22 | 2.32  | 2.43 | 2.70 |
| 08-00237-03054   |             |                      | 2.5                       |                      |                   |                                  |                   | 45                    | 2.65                                                             | 2.77 | 2.89  | 3.03 | 3.36 |
| 08-00237-03055   |             | R0.05                | 3                         |                      |                   |                                  |                   | 45                    | 3.17                                                             | 3.31 | 3.46  | 3.63 | 4.02 |
| 08-00237-04021   |             |                      | 1                         |                      | 0.3               | 12°                              | 4                 | 45                    | 1.11                                                             | 1.16 | 1.21  | 1.27 | 1.41 |
| 08-00237-04022   |             |                      | 1.5                       |                      |                   |                                  |                   | 45                    | 1.63                                                             | 1.70 | 1.78  | 1.87 | 2.07 |
| 08-00237-04023   |             |                      | 2                         |                      |                   |                                  |                   | 45                    | 2.15                                                             | 2.25 | 2.35  | 2.47 | 2.74 |
| 08-00237-04024   |             | R0.02                | 2.5                       |                      |                   |                                  |                   | 45                    | 2.67                                                             | 2.79 | 2.92  | 3.07 | 3.40 |
| 08-00237-04025   |             |                      | 3                         |                      |                   |                                  |                   | 45                    | 3.20                                                             | 3.34 | 3.49  | 3.67 | 4.06 |
| 08-00237-04027   |             |                      | 4                         |                      |                   |                                  |                   | 45                    | 4.24                                                             | 4.43 | 4.63  | 4.86 | 5.39 |

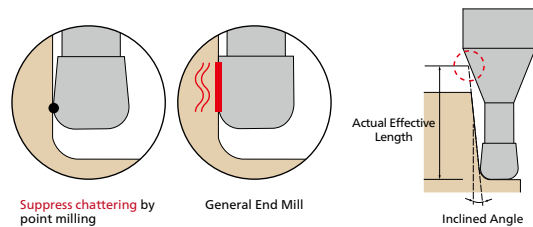
How to Order

When you order, indicate MHRH430R (D)×(R)×(L1). ※( $\gamma$ ) is reference value.

Machining case

W-017

MUGEN COATING PREMIUM 4-Flute Long Neck Radius End Mill for Hardened Steel



Unit : mm

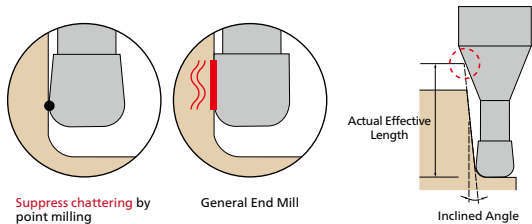
| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |       |       |       |       |       |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|-------|-------|-------|-------|-------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°   | 1°30' | 2°   | 3°    |       |       |       |       |       |
| 08-00237-04051 | 0.4         | R0.05                   | 1                                         | 0.3                     | 0.37                              | 12°                        | 4                    | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.27 | 1.40  |       |       |       |       |       |
| 08-00237-04052 |             |                         | 1.5                                       |                         |                                   |                            |                      | 45                       | 1.63                                                                | 1.70 | 1.78  | 1.86 | 2.06  |       |       |       |       |       |
| 08-00237-04053 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.15                                                                | 2.25 | 2.35  | 2.46 | 2.73  |       |       |       |       |       |
| 08-00237-04054 |             |                         | 2.5                                       |                         |                                   |                            |                      | 45                       | 2.67                                                                | 2.79 | 2.92  | 3.06 | 3.39  |       |       |       |       |       |
| 08-00237-04055 |             |                         | 3                                         |                         |                                   |                            |                      | 45                       | 3.19                                                                | 3.34 | 3.49  | 3.66 | 4.05  |       |       |       |       |       |
| 08-00237-04057 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.24                                                                | 4.43 | 4.63  | 4.86 | 5.38  |       |       |       |       |       |
| 08-00237-04101 |             | R0.1                    | 1                                         |                         |                                   |                            |                      | 45                       | 1.11                                                                | 1.15 | 1.20  | 1.26 | 1.38  |       |       |       |       |       |
| 08-00237-04103 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.15                                                                | 2.24 | 2.34  | 2.45 | 2.71  |       |       |       |       |       |
| 08-00237-04105 |             |                         | 3                                         |                         |                                   |                            |                      | 45                       | 3.19                                                                | 3.33 | 3.48  | 3.65 | 4.04  |       |       |       |       |       |
| 08-00237-04107 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.24                                                                | 4.42 | 4.62  | 4.85 | 5.36  |       |       |       |       |       |
| 08-00237-05021 | 0.5         | R0.02                   | 1                                         | 0.4                     | 0.46                              | 12°                        | 4                    | 45                       | 1.14                                                                | 1.19 | 1.24  | 1.30 | 1.44  |       |       |       |       |       |
| 08-00237-05022 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.18                                                                | 2.27 | 2.38  | 2.50 | 2.77  |       |       |       |       |       |
| 08-00237-05023 |             |                         | 3                                         |                         |                                   |                            |                      | 45                       | 3.22                                                                | 3.36 | 3.52  | 3.69 | 4.10  |       |       |       |       |       |
| 08-00237-05024 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45 | 4.66  | 4.89 | 5.42  |       |       |       |       |       |
| 08-00237-05025 |             |                         | 5                                         |                         |                                   |                            |                      | 45                       | 5.31                                                                | 5.54 | 5.80  | 6.09 | 6.75  |       |       |       |       |       |
| 08-00237-05026 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.08  |       |       |       |       |       |
| 08-00237-05051 |             | R0.05                   | 1                                         |                         |                                   |                            |                      | 45                       | 1.13                                                                | 1.18 | 1.24  | 1.29 | 1.43  |       |       |       |       |       |
| 08-00237-05052 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.18                                                                | 2.27 | 2.38  | 2.49 | 2.76  |       |       |       |       |       |
| 08-00237-05053 |             |                         | 3                                         |                         |                                   |                            |                      | 45                       | 3.22                                                                | 3.36 | 3.52  | 3.69 | 4.09  |       |       |       |       |       |
| 08-00237-05054 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45 | 4.66  | 4.88 | 5.41  |       |       |       |       |       |
| 08-00237-05055 |             |                         | 5                                         |                         |                                   |                            |                      | 45                       | 5.31                                                                | 5.54 | 5.80  | 6.08 | 6.74  |       |       |       |       |       |
| 08-00237-05056 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.07  |       |       |       |       |       |
| 08-00237-05101 |             | R0.1                    | 1                                         |                         |                                   |                            |                      | 45                       | 1.13                                                                | 1.18 | 1.23  | 1.28 | 1.41  |       |       |       |       |       |
| 08-00237-05102 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.27 | 2.37  | 2.48 | 2.74  |       |       |       |       |       |
| 08-00237-05103 |             |                         | 3                                         |                         |                                   |                            |                      | 45                       | 3.22                                                                | 3.36 | 3.51  | 3.68 | 4.07  |       |       |       |       |       |
| 08-00237-05104 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45 | 4.65  | 4.87 | 5.40  |       |       |       |       |       |
| 08-00237-05105 |             |                         | 5                                         |                         |                                   |                            |                      | 45                       | 5.30                                                                | 5.54 | 5.79  | 6.07 | 6.72  |       |       |       |       |       |
| 08-00237-05106 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63 | 6.93  | 7.27 | 8.05  |       |       |       |       |       |
| 08-00237-06021 |             | 0.6                     | R0.02                                     |                         |                                   |                            |                      | 2                        | 0.5                                                                 | 0.56 | 12°   | 4    | 45    | 2.18  | 2.27  | 2.38  | 2.50  | 2.77  |
| 08-00237-06023 |             |                         |                                           |                         |                                   |                            |                      | 4                        |                                                                     |      |       |      | 45    | 4.26  | 4.45  | 4.66  | 4.89  | 5.42  |
| 08-00237-06025 |             |                         |                                           |                         |                                   |                            |                      | 6                        |                                                                     |      |       |      | 45    | 6.35  | 6.63  | 6.94  | 7.28  | 8.08  |
| 08-00237-06027 |             |                         |                                           |                         |                                   |                            |                      | 8                        |                                                                     |      |       |      | 50    | 8.43  | 8.81  | 9.22  | 9.68  | 10.73 |
| 08-00237-06029 |             |                         |                                           |                         |                                   |                            |                      | 10                       |                                                                     |      |       |      | 50    | 10.52 | 10.99 | 11.50 | 12.07 | 13.39 |
| 08-00237-06051 |             |                         |                                           |                         |                                   |                            |                      | 2                        |                                                                     |      |       |      | 45    | 2.18  | 2.27  | 2.38  | 2.49  | 2.76  |
| 08-00237-06053 | R0.05       |                         | 4                                         | 45                      | 4.26                              | 4.45                       | 4.66                 | 4.88                     |                                                                     |      |       |      | 5.41  |       |       |       |       |       |
| 08-00237-06055 |             |                         | 6                                         | 45                      | 6.35                              | 6.63                       | 6.94                 | 7.28                     |                                                                     |      |       |      | 8.07  |       |       |       |       |       |
| 08-00237-06057 |             |                         | 8                                         | 50                      | 8.43                              | 8.81                       | 9.22                 | 9.67                     |                                                                     |      |       |      | 10.72 |       |       |       |       |       |
| 08-00237-06059 |             |                         | 10                                        | 50                      | 10.52                             | 10.99                      | 11.50                | 12.06                    |                                                                     |      |       |      | 13.38 |       |       |       |       |       |
| 08-00237-06101 |             |                         | 2                                         | 45                      | 2.17                              | 2.27                       | 2.37                 | 2.48                     |                                                                     |      |       |      | 2.74  |       |       |       |       |       |
| 08-00237-06103 |             |                         | R0.1                                      | 4                       | 45                                | 4.26                       | 4.45                 | 4.65                     |                                                                     |      |       |      | 4.87  | 5.40  |       |       |       |       |
| 08-00237-06105 | 6           |                         |                                           | 45                      | 6.35                              | 6.63                       | 6.93                 | 7.27                     |                                                                     |      |       |      | 8.05  |       |       |       |       |       |
| 08-00237-06107 | 8           |                         |                                           | 50                      | 8.43                              | 8.80                       | 9.21                 | 9.66                     |                                                                     |      |       |      | 10.71 |       |       |       |       |       |
| 08-00237-06109 | 10          |                         |                                           | 50                      | 10.52                             | 10.98                      | 11.49                | 12.05                    |                                                                     |      |       |      | 13.36 |       |       |       |       |       |
| 08-00237-07020 | R0.02       |                         |                                           | 2                       | 45                                | 2.18                       | 2.27                 | 2.38                     |                                                                     |      |       |      | 2.50  | 2.77  |       |       |       |       |
| 08-00237-07021 |             |                         |                                           | 4                       | 45                                | 4.26                       | 4.45                 | 4.66                     |                                                                     |      |       |      | 4.89  | 5.42  |       |       |       |       |
| 08-00237-07023 |             |                         | 6                                         | 45                      | 6.35                              | 6.63                       | 6.94                 | 7.28                     |                                                                     |      |       |      | 8.08  |       |       |       |       |       |
| 08-00237-07050 |             | R0.05                   | 2                                         | 45                      | 2.18                              | 2.27                       | 2.38                 | 2.49                     | 2.76                                                                |      |       |      |       |       |       |       |       |       |
| 08-00237-07051 |             |                         | 4                                         | 45                      | 4.26                              | 4.45                       | 4.66                 | 4.88                     | 5.41                                                                |      |       |      |       |       |       |       |       |       |
| 08-00237-07053 |             |                         | 6                                         | 45                      | 6.35                              | 6.63                       | 6.94                 | 7.28                     | 8.07                                                                |      |       |      |       |       |       |       |       |       |
| 08-00237-07100 | R0.1        | 2                       | 45                                        | 2.17                    | 2.27                              | 2.37                       | 2.48                 | 2.74                     |                                                                     |      |       |      |       |       |       |       |       |       |
| 08-00237-07101 |             | 4                       | 45                                        | 4.26                    | 4.45                              | 4.65                       | 4.87                 | 5.40                     |                                                                     |      |       |      |       |       |       |       |       |       |
| 08-00237-07103 |             | 6                       | 45                                        | 6.35                    | 6.63                              | 6.93                       | 7.27                 | 8.05                     |                                                                     |      |       |      |       |       |       |       |       |       |
| 08-00237-08020 | 0.8         | R0.02                   | 2                                         | 0.65                    | 0.76                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27 | 2.38  | 2.50 | 2.77  |       |       |       |       |       |
| 08-00237-08021 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45 | 4.66  | 4.89 | 5.42  |       |       |       |       |       |
| 08-00237-08023 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.08  |       |       |       |       |       |
| 08-00237-08025 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.81 | 9.22  | 9.68 | 10.73 |       |       |       |       |       |



MHRH430R

MUGEN COATING PREMIUM 4-Flute Long Neck Radius End Mill for Hardened Steel

[Neck Shape]  
( $\gamma$ ) is reference value.Tool measurement  
required in order to avoid interference  
to the work material.



◆ New Size

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |       |
| 08-00237-08050 | 0.8         | R0.05                   | 2                                         | 0.65                    | 0.76                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.49  | 2.76  |       |
| 08-00237-08051 |             |                         | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.88  | 5.41  |       |
| 08-00237-08053 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.07  |       |
| 08-00237-08055 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.81  | 9.22  | 9.67  | 10.72 |       |
| 08-00237-08059 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.60                                                               | 13.17 | 13.78 | 14.46 | 16.03 |       |
| 08-00237-08100 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.27  | 2.37  | 2.48  | 2.74  |       |
| 08-00237-08101 |             | R0.1                    | 4                                         |                         |                                   |                            |                      | 45                       | 4.26                                                                | 4.45  | 4.65  | 4.87  | 5.40  |       |
| 08-00237-08103 |             |                         | 6                                         |                         |                                   |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.93  | 7.27  | 8.05  |       |
| 08-00237-08105 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.80  | 9.21  | 9.66  | 10.71 |       |
| 08-00237-08109 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.60                                                               | 13.16 | 13.77 | 14.45 | 16.01 |       |
| 08-00237-08200 |             |                         | 2                                         |                         |                                   |                            |                      | 45                       | 2.17                                                                | 2.26  | 2.36  | 2.46  | 2.71  |       |
| 08-00237-08201 |             |                         | R0.2                                      |                         |                                   |                            |                      | 4                        | 45                                                                  | 4.26  | 4.44  | 4.64  | 4.85  | 5.36  |
| 08-00237-08203 |             | 6                       |                                           |                         |                                   |                            |                      | 45                       | 6.34                                                                | 6.62  | 6.92  | 7.25  | 8.02  |       |
| 08-00237-08205 |             | 8                       |                                           |                         |                                   |                            |                      | 50                       | 8.43                                                                | 8.80  | 9.20  | 9.64  | 10.67 |       |
| 08-00237-08209 |             | 12                      |                                           |                         |                                   |                            |                      | 50                       | 12.60                                                               | 13.15 | 13.76 | 14.43 | 15.98 |       |
| 08-00237-09101 |             | R0.1                    |                                           |                         |                                   |                            |                      | 4                        | 45                                                                  | 4.28  | 4.47  | 4.68  | 4.90  | 5.43  |
| 08-00237-09105 |             |                         |                                           |                         |                                   |                            |                      | 8                        | 50                                                                  | 8.46  | 8.83  | 9.24  | 9.69  | 10.74 |
| 08-00237-10028 |             | 1                       | R0.02                                     |                         |                                   |                            |                      | 2                        | 0.8                                                                 | 0.95  | 12°   | 4     | 50    | 2.20  |
| 08-00237-10020 | 3           |                         |                                           | 50                      | 3.25                              | 3.39                       | 3.55                 | 3.72                     |                                                                     |       |       |       | 4.13  |       |
| 08-00237-10021 | 4           |                         |                                           | 50                      | 4.29                              | 4.48                       | 4.69                 | 4.92                     |                                                                     |       |       |       | 5.45  |       |
| 08-00237-10022 | 5           |                         |                                           | 50                      | 5.33                              | 5.57                       | 5.83                 | 6.11                     |                                                                     |       |       |       | 6.78  |       |
| 08-00237-10023 | 6           |                         |                                           | 50                      | 6.37                              | 6.66                       | 6.97                 | 7.31                     |                                                                     |       |       |       | 8.11  |       |
| 08-00237-10025 | 8           |                         |                                           | 50                      | 8.46                              | 8.84                       | 9.25                 | 9.70                     |                                                                     |       |       |       | 10.76 |       |
| 08-00237-10027 | 10          |                         |                                           | 50                      | 10.54                             | 11.02                      | 11.53                | 12.10                    |                                                                     |       |       |       | 13.42 |       |
| 08-00237-10058 | R0.05       |                         |                                           | 2                       | 50                                | 2.20                       | 2.30                 | 2.40                     |                                                                     |       |       |       | 2.52  | 2.79  |
| 08-00237-10050 |             |                         |                                           | 3                       | 50                                | 3.24                       | 3.39                 | 3.54                     |                                                                     |       |       |       | 3.72  | 4.12  |
| 08-00237-10051 |             |                         |                                           | 4                       | 50                                | 4.29                       | 4.48                 | 4.68                     |                                                                     |       |       |       | 4.91  | 5.44  |
| 08-00237-10052 |             |                         | 5                                         | 50                      | 5.33                              | 5.57                       | 5.82                 | 6.11                     |                                                                     |       |       |       | 6.77  |       |
| 08-00237-10053 |             |                         | 6                                         | 50                      | 6.37                              | 6.66                       | 6.97                 | 7.31                     |                                                                     |       |       |       | 8.10  |       |
| 08-00237-10055 |             |                         | 8                                         | 50                      | 8.46                              | 8.83                       | 9.25                 | 9.70                     |                                                                     |       |       |       | 10.75 |       |
| 08-00237-10057 |             |                         | 10                                        | 50                      | 10.54                             | 11.01                      | 11.53                | 12.09                    |                                                                     |       |       |       | 13.41 |       |
| 08-00237-10108 | R0.1        |                         | 2                                         | 50                      | 2.20                              | 2.29                       | 2.40                 | 2.51                     |                                                                     |       |       |       | 2.77  |       |
| 08-00237-10100 |             |                         | 3                                         | 50                      | 3.24                              | 3.38                       | 3.54                 | 3.71                     |                                                                     |       |       |       | 4.10  |       |
| 08-00237-10101 |             |                         | 4                                         | 50                      | 4.28                              | 4.47                       | 4.68                 | 4.90                     |                                                                     |       |       |       | 5.43  |       |
| 08-00237-10102 |             |                         | 5                                         | 50                      | 5.33                              | 5.56                       | 5.82                 | 6.10                     |                                                                     |       |       |       | 6.75  |       |
| 08-00237-10103 |             |                         | 6                                         | 50                      | 6.37                              | 6.65                       | 6.96                 | 7.30                     |                                                                     |       |       |       | 8.08  |       |
| 08-00237-10105 |             |                         | 8                                         | 50                      | 8.46                              | 8.83                       | 9.24                 | 9.69                     |                                                                     |       |       |       | 10.74 |       |
| 08-00237-10107 |             |                         | 10                                        | 50                      | 10.54                             | 11.01                      | 11.52                | 12.08                    |                                                                     |       |       |       | 13.39 |       |
| 08-00237-10208 | R0.2        |                         | 2                                         | 50                      | 2.19                              | 2.28                       | 2.38                 | 2.49                     |                                                                     |       |       |       | 2.74  |       |
| 08-00237-10200 |             |                         | 3                                         | 50                      | 3.24                              | 3.37                       | 3.52                 | 3.69                     |                                                                     |       |       |       | 4.07  |       |
| 08-00237-10201 |             |                         | 4                                         | 50                      | 4.28                              | 4.46                       | 4.66                 | 4.88                     |                                                                     |       |       |       | 5.39  |       |
| 08-00237-10202 |             |                         | 5                                         | 50                      | 5.32                              | 5.55                       | 5.80                 | 6.08                     |                                                                     |       |       |       | 6.72  |       |
| 08-00237-10203 |             |                         | 6                                         | 50                      | 6.37                              | 6.64                       | 6.94                 | 7.28                     |                                                                     |       |       |       | 8.05  |       |
| 08-00237-10205 |             |                         | 8                                         | 50                      | 8.45                              | 8.82                       | 9.23                 | 9.67                     |                                                                     |       |       |       | 10.70 |       |
| 08-00237-10207 |             |                         | 10                                        | 50                      | 10.54                             | 11.00                      | 11.51                | 12.06                    |                                                                     |       |       |       | 13.36 |       |
| 08-00237-10308 | R0.3        |                         | 2                                         | 50                      | 2.19                              | 2.28                       | 2.37                 | 2.47                     |                                                                     |       |       |       | 2.71  |       |
| 08-00237-10300 |             |                         | 3                                         | 50                      | 3.23                              | 3.36                       | 3.51                 | 3.67                     |                                                                     |       |       |       | 4.03  |       |
| 08-00237-10301 |             | 4                       | 50                                        | 4.28                    | 4.45                              | 4.65                       | 4.86                 | 5.36                     |                                                                     |       |       |       |       |       |
| 08-00237-10302 |             | 5                       | 50                                        | 5.32                    | 5.54                              | 5.79                       | 6.06                 | 6.69                     |                                                                     |       |       |       |       |       |
| 08-00237-10303 |             | 6                       | 50                                        | 6.36                    | 6.63                              | 6.93                       | 7.26                 | 8.02                     |                                                                     |       |       |       |       |       |
| 08-00237-10305 |             | 8                       | 50                                        | 8.45                    | 8.81                              | 9.21                       | 9.65                 | 10.67                    |                                                                     |       |       |       |       |       |
| 08-00237-10307 |             | 10                      | 50                                        | 10.53                   | 10.99                             | 11.49                      | 12.04                | 13.33                    |                                                                     |       |       |       |       |       |
| 08-00237-12101 | 1.2         | R0.1                    | 5                                         | 1                       | 1.14                              | 12°                        | 4                    | 50                       | 5.35                                                                | 5.59  | 5.84  | 6.13  | 6.79  |       |
| 08-00237-12103 |             |                         | 10                                        |                         |                                   |                            |                      | 50                       | 10.57                                                               | 11.03 | 11.55 | 12.11 | 13.42 |       |
| 08-00237-12201 |             | R0.2                    | 5                                         |                         |                                   |                            |                      | 50                       | 5.35                                                                | 5.58  | 5.83  | 6.11  | 6.75  |       |
| 08-00237-12203 |             |                         | 10                                        |                         |                                   |                            |                      | 50                       | 10.56                                                               | 11.03 | 11.53 | 12.09 | 13.39 |       |
| 08-00237-12301 |             | R0.3                    | 5                                         |                         |                                   |                            |                      | 50                       | 5.34                                                                | 5.57  | 5.82  | 6.09  | 6.72  |       |
| 08-00237-12303 |             |                         | 10                                        |                         |                                   |                            |                      | 50                       | 10.56                                                               | 11.02 | 11.52 | 12.07 | 13.36 |       |

How to Order

When you order, indicate MHRH430R (D)×(R)×( $\varnothing_1$ ).

※( $\gamma$ ) is reference value.

MHRH430R

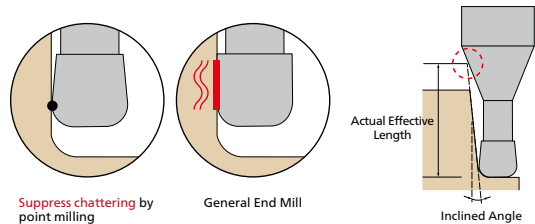
MUGEN COATING PREMIUM 4-Flute Long Neck Radius End Mill for Hardened Steel

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 08-00237-15020 | 1.5         | R0.02                   | 3                                         | 1.2                     | 1.43                              | 12°                        | 4                    | 50                       | 3.29                                                                | 3.44  | 3.60  | 3.78  | 4.19  |
| 08-00237-15021 |             |                         | 4                                         |                         |                                   |                            |                      | 50                       | 4.34                                                                | 4.53  | 4.74  | 4.97  | 5.52  |
| 08-00237-15023 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.42                                                                | 6.71  | 7.02  | 7.37  | 8.17  |
| 08-00237-15025 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.51                                                                | 8.89  | 9.30  | 9.76  | 10.82 |
| 08-00237-15027 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.68                                                               | 13.25 | 13.87 | 14.55 | 16.13 |
| 08-00237-15029 |             |                         | 15                                        |                         |                                   |                            |                      | 50                       | 15.81                                                               | 16.51 | 17.29 | 18.14 | 20.12 |
| 08-00237-15050 |             | R0.05                   | 3                                         |                         |                                   |                            |                      | 50                       | 3.29                                                                | 3.44  | 3.60  | 3.77  | 4.18  |
| 08-00237-15051 |             |                         | 4                                         |                         |                                   |                            |                      | 50                       | 4.34                                                                | 4.53  | 4.74  | 4.97  | 5.51  |
| 08-00237-15053 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.42                                                                | 6.71  | 7.02  | 7.36  | 8.16  |
| 08-00237-15055 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.51                                                                | 8.89  | 9.30  | 9.75  | 10.82 |
| 08-00237-15057 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.68                                                               | 13.24 | 13.86 | 14.54 | 16.12 |
| 08-00237-15059 |             |                         | 15                                        |                         |                                   |                            |                      | 50                       | 15.81                                                               | 16.51 | 17.28 | 18.13 | 20.11 |
| 08-00237-15100 |             | R0.1                    | 3                                         |                         |                                   |                            |                      | 50                       | 3.29                                                                | 3.43  | 3.59  | 3.76  | 4.16  |
| 08-00237-15101 |             |                         | 4                                         |                         |                                   |                            |                      | 50                       | 4.33                                                                | 4.52  | 4.73  | 4.96  | 5.49  |
| 08-00237-15103 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.42                                                                | 6.70  | 7.01  | 7.35  | 8.14  |
| 08-00237-15105 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.50                                                                | 8.88  | 9.29  | 9.75  | 10.80 |
| 08-00237-15107 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.68                                                               | 13.24 | 13.85 | 14.53 | 16.11 |
| 08-00237-15109 |             |                         | 15                                        |                         |                                   |                            |                      | 60                       | 15.80                                                               | 16.51 | 17.28 | 18.12 | 20.09 |
| 08-00237-15200 |             | R0.2                    | 3                                         |                         |                                   |                            |                      | 50                       | 3.29                                                                | 3.42  | 3.58  | 3.74  | 4.13  |
| 08-00237-15201 |             |                         | 4                                         |                         |                                   |                            |                      | 50                       | 4.33                                                                | 4.51  | 4.72  | 4.94  | 5.46  |
| 08-00237-15203 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.42                                                                | 6.69  | 7.00  | 7.33  | 8.11  |
| 08-00237-15205 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.50                                                                | 8.87  | 9.28  | 9.73  | 10.77 |
| 08-00237-15207 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.67                                                               | 13.23 | 13.84 | 14.51 | 16.08 |
| 08-00237-15209 |             |                         | 15                                        |                         |                                   |                            |                      | 60                       | 15.80                                                               | 16.50 | 17.26 | 18.10 | 20.06 |
| 08-00237-15300 |             | R0.3                    | 3                                         |                         |                                   |                            |                      | 50                       | 3.28                                                                | 3.42  | 3.56  | 3.72  | 4.10  |
| 08-00237-15301 |             |                         | 4                                         |                         |                                   |                            |                      | 50                       | 4.33                                                                | 4.51  | 4.70  | 4.92  | 5.42  |
| 08-00237-15303 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.41                                                                | 6.68  | 6.98  | 7.31  | 8.08  |
| 08-00237-15305 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.50                                                                | 8.86  | 9.26  | 9.71  | 10.73 |
| 08-00237-15307 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.67                                                               | 13.22 | 13.83 | 14.49 | 16.04 |
| 08-00237-15309 |             |                         | 15                                        |                         |                                   |                            |                      | 60                       | 15.80                                                               | 16.49 | 17.25 | 18.08 | 20.02 |
| 08-00237-15500 |             | R0.5                    | 3                                         |                         |                                   |                            |                      | 50                       | 3.27                                                                | 3.40  | 3.53  | 3.68  | 4.03  |
| 08-00237-15501 |             |                         | 4                                         |                         |                                   |                            |                      | 50                       | 4.32                                                                | 4.49  | 4.67  | 4.88  | 5.36  |
| 08-00237-15503 | 6           |                         | 50                                        | 6.40                    | 6.67                              | 6.96                       | 7.27                 | 8.01                     |                                                                     |       |       |       |       |
| 08-00237-15505 | 8           |                         | 50                                        | 8.49                    | 8.85                              | 9.24                       | 9.67                 | 10.67                    |                                                                     |       |       |       |       |
| 08-00237-15507 | 12          |                         | 50                                        | 12.66                   | 13.20                             | 13.80                      | 14.45                | 15.98                    |                                                                     |       |       |       |       |
| 08-00237-15509 | 15          |                         | 60                                        | 15.79                   | 16.47                             | 17.22                      | 18.04                | 19.96                    |                                                                     |       |       |       |       |
| 08-00237-20020 | 2           | R0.02                   | 4                                         | 1.6                     | 1.91                              | 12°                        | 4                    | 50                       | 4.39                                                                | 4.58  | 4.80  | 5.03  | 5.58  |
| 08-00237-20021 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.47                                                                | 6.76  | 7.08  | 7.42  | 8.23  |
| 08-00237-20023 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.56                                                                | 8.94  | 9.36  | 9.82  | 10.89 |
| 08-00237-20025 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.73                                                               | 13.30 | 13.92 | 14.60 | 16.20 |
| 08-00237-20027 |             |                         | 16                                        |                         |                                   |                            |                      | 60                       | 16.90                                                               | 17.66 | 18.48 | 19.39 | 21.51 |
| 08-00237-20029 |             |                         | 20                                        |                         |                                   |                            |                      | 60                       | 21.07                                                               | 22.01 | 23.04 | 24.18 | Free  |
| 08-00237-20050 |             | R0.05                   | 4                                         |                         |                                   |                            |                      | 50                       | 4.38                                                                | 4.58  | 4.79  | 5.02  | 5.57  |
| 08-00237-20051 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.47                                                                | 6.76  | 7.07  | 7.42  | 8.22  |
| 08-00237-20053 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.56                                                                | 8.94  | 9.35  | 9.81  | 10.88 |
| 08-00237-20055 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.73                                                               | 13.29 | 13.92 | 14.60 | 16.19 |
| 08-00237-20057 |             |                         | 16                                        |                         |                                   |                            |                      | 60                       | 16.90                                                               | 17.65 | 18.48 | 19.38 | 21.50 |
| 08-00237-20059 |             |                         | 20                                        |                         |                                   |                            |                      | 60                       | 21.07                                                               | 22.01 | 23.04 | 24.17 | Free  |
| 08-00237-20100 |             | R0.1                    | 4                                         |                         |                                   |                            |                      | 50                       | 4.38                                                                | 4.57  | 4.78  | 5.02  | 5.55  |
| 08-00237-20101 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.47                                                                | 6.75  | 7.07  | 7.41  | 8.21  |
| 08-00237-20103 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.55                                                                | 8.93  | 9.35  | 9.80  | 10.86 |
| 08-00237-20105 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.73                                                               | 13.29 | 13.91 | 14.59 | 16.17 |
| 08-00237-20107 |             |                         | 16                                        |                         |                                   |                            |                      | 60                       | 16.90                                                               | 17.65 | 18.47 | 19.37 | 21.48 |
| 08-00237-20109 |             |                         | 20                                        |                         |                                   |                            |                      | 60                       | 21.07                                                               | 22.01 | 23.03 | 24.16 | Free  |
| 08-00237-20200 |             | R0.2                    | 4                                         |                         |                                   |                            |                      | 50                       | 4.38                                                                | 4.57  | 4.77  | 5.00  | 5.52  |
| 08-00237-20201 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.46                                                                | 6.74  | 7.05  | 7.39  | 8.17  |
| 08-00237-20203 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.55                                                                | 8.92  | 9.33  | 9.78  | 10.83 |
| 08-00237-20205 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.72                                                               | 13.28 | 13.89 | 14.57 | 16.14 |
| 08-00237-20207 |             |                         | 16                                        |                         |                                   |                            |                      | 60                       | 16.89                                                               | 17.64 | 18.46 | 19.35 | 21.45 |
| 08-00237-20209 |             |                         | 20                                        |                         |                                   |                            |                      | 60                       | 21.06                                                               | 22.00 | 23.02 | 24.14 | Free  |
| 08-00237-20300 |             | R0.3                    | 4                                         |                         |                                   |                            |                      | 50                       | 4.37                                                                | 4.56  | 4.76  | 4.98  | 5.49  |
| 08-00237-20301 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.46                                                                | 6.74  | 7.04  | 7.37  | 8.14  |
| 08-00237-20303 |             |                         | 8                                         |                         |                                   |                            |                      | 50                       | 8.55                                                                | 8.91  | 9.32  | 9.76  | 10.80 |
| 08-00237-20305 |             |                         | 12                                        |                         |                                   |                            |                      | 50                       | 12.72                                                               | 13.27 | 13.88 | 14.55 | 16.10 |
| 08-00237-20307 |             |                         | 16                                        |                         |                                   |                            |                      | 60                       | 16.89                                                               | 17.63 | 18.44 | 19.33 | 21.41 |
| 08-00237-20309 |             |                         | 20                                        |                         |                                   |                            |                      | 60                       | 21.06                                                               | 21.99 | 23.00 | 24.12 | Free  |
| 08-00237-20500 |             | R0.5                    | 4                                         |                         |                                   |                            |                      | 50                       | 4.37                                                                | 4.54  | 4.73  | 4.94  | 5.42  |
| 08-00237-20501 |             |                         | 6                                         |                         |                                   |                            |                      | 50                       | 6.45                                                                | 6.72  | 7.01  | 7.33  | 8.08  |
| 08-00237-20503 | 8           |                         | 50                                        | 8.54                    | 8.90                              | 9.29                       | 9.72                 | 10.73                    |                                                                     |       |       |       |       |
| 08-00237-20505 | 12          |                         | 50                                        | 12.71                   | 13.25                             | 13.85                      | 14.51                | 16.04                    |                                                                     |       |       |       |       |
| 08-00237-20507 | 16          |                         | 60                                        | 16.88                   | 17.61                             | 18.41                      | 19.30                | 21.35                    |                                                                     |       |       |       |       |
| 08-00237-20509 | 20          |                         | 60                                        | 21.05                   | 21.97                             | 22.98                      | 24.08                | Free                     |                                                                     |       |       |       |       |

MHRH430R

MUGEN COATING PREMIUM 4-Flute Long Neck Radius End Mill for Hardened Steel

(Neck Shape)  
( $\gamma$ ) is reference value.Tool measurement  
required in order to avoid interference  
to the work material.



◆ New Size

Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|-------------------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                                     |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00237-25101 | 2.5         | R0.1                    | 10                           | 2                       | 2.39                 | 12°                                 | 4                    | 50                       | 10.69                                                               | 11.16 | 11.68 | 12.25 | 13.58 |
| 08-00237-25103 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.12                                                               | 22.06 | 23.09 | 24.22 | Free  |
| 08-00237-25105 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.95 | 34.49 | Free  | Free  |
| 08-00237-25201 |             | R0.2                    | 10                           |                         |                      |                                     |                      | 50                       | 10.68                                                               | 11.15 | 11.67 | 12.23 | 13.55 |
| 08-00237-25203 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.11                                                               | 22.05 | 23.07 | 24.20 | Free  |
| 08-00237-25205 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.94 | 34.48 | Free  | Free  |
| 08-00237-25301 |             | R0.3                    | 10                           |                         |                      |                                     |                      | 50                       | 10.68                                                               | 11.14 | 11.65 | 12.21 | 13.51 |
| 08-00237-25303 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.11                                                               | 22.04 | 23.06 | 24.18 | Free  |
| 08-00237-25305 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.93 | 34.46 | Free  | Free  |
| 08-00237-25501 |             | R0.5                    | 10                           |                         |                      |                                     |                      | 50                       | 10.67                                                               | 11.13 | 11.62 | 12.17 | 13.45 |
| 08-00237-25503 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.10                                                               | 22.02 | 23.03 | 24.14 | Free  |
| 08-00237-25505 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.53                                                               | 32.92 | 34.43 | Free  | Free  |
| 08-00237-30058 | 3           | R0.05                   | 4                            | 2.5                     | 2.85                 | 12°                                 | 6                    | 50                       | 4.53                                                                | 4.73  | 4.95  | 5.19  | 5.76  |
| 08-00237-30050 |             |                         | 6                            |                         |                      |                                     |                      | 50                       | 6.62                                                                | 6.91  | 7.23  | 7.59  | 8.41  |
| 08-00237-30051 |             |                         | 8                            |                         |                      |                                     |                      | 50                       | 8.70                                                                | 9.09  | 9.51  | 9.98  | 11.06 |
| 08-00237-30053 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 12.87                                                               | 13.45 | 14.08 | 14.77 | 16.37 |
| 08-00237-30055 |             |                         | 16                           |                         |                      |                                     |                      | 60                       | 17.05                                                               | 17.81 | 18.64 | 19.55 | 21.68 |
| 08-00237-30057 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.22                                                               | 22.16 | 23.20 | 24.34 | 26.99 |
| 08-00237-30112 |             | R0.1                    | 4                            |                         |                      |                                     |                      | 50                       | 4.53                                                                | 4.73  | 4.95  | 5.18  | 5.74  |
| 08-00237-30100 |             |                         | 6                            |                         |                      |                                     |                      | 50                       | 6.62                                                                | 6.91  | 7.23  | 7.58  | 8.39  |
| 08-00237-30101 |             |                         | 8                            |                         |                      |                                     |                      | 50                       | 8.70                                                                | 9.09  | 9.51  | 9.97  | 11.05 |
| 08-00237-30103 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 12.87                                                               | 13.44 | 14.07 | 14.76 | 16.36 |
| 08-00237-30105 |             |                         | 16                           |                         |                      |                                     |                      | 60                       | 17.04                                                               | 17.80 | 18.63 | 19.54 | 21.67 |
| 08-00237-30107 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.21                                                               | 22.16 | 23.19 | 24.33 | 26.98 |
| 08-00237-30109 |             | R0.2                    | 25                           |                         |                      |                                     |                      | 70                       | 26.43                                                               | 27.61 | 28.90 | 30.31 | Free  |
| 08-00237-30111 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.64                                                               | 33.05 | 34.60 | 36.30 | Free  |
| 08-00237-30212 |             |                         | 4                            |                         |                      |                                     |                      | 50                       | 4.53                                                                | 4.72  | 4.93  | 5.16  | 5.71  |
| 08-00237-30200 |             |                         | 6                            |                         |                      |                                     |                      | 50                       | 6.61                                                                | 6.90  | 7.21  | 7.56  | 8.36  |
| 08-00237-30201 |             |                         | 8                            |                         |                      |                                     |                      | 50                       | 8.70                                                                | 9.08  | 9.49  | 9.95  | 11.02 |
| 08-00237-30203 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 12.87                                                               | 13.44 | 14.06 | 14.74 | 16.32 |
| 08-00237-30205 |             | R0.3                    | 16                           |                         |                      |                                     |                      | 60                       | 17.04                                                               | 17.79 | 18.62 | 19.52 | 21.63 |
| 08-00237-30207 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.21                                                               | 22.15 | 23.18 | 24.31 | 26.94 |
| 08-00237-30209 |             |                         | 25                           |                         |                      |                                     |                      | 70                       | 26.42                                                               | 27.60 | 28.88 | 30.29 | Free  |
| 08-00237-30211 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.64                                                               | 33.05 | 34.58 | 36.28 | Free  |
| 08-00237-30312 |             |                         | 4                            |                         |                      |                                     |                      | 50                       | 4.52                                                                | 4.71  | 4.92  | 5.14  | 5.67  |
| 08-00237-30300 |             |                         | 6                            |                         |                      |                                     |                      | 50                       | 6.61                                                                | 6.89  | 7.20  | 7.54  | 8.33  |
| 08-00237-30301 |             | R0.5                    | 8                            |                         |                      |                                     |                      | 50                       | 8.69                                                                | 9.07  | 9.48  | 9.93  | 10.98 |
| 08-00237-30303 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 12.86                                                               | 13.43 | 14.04 | 14.72 | 16.29 |
| 08-00237-30305 |             |                         | 16                           |                         |                      |                                     |                      | 60                       | 17.04                                                               | 17.78 | 18.60 | 19.50 | 21.60 |
| 08-00237-30307 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.21                                                               | 22.14 | 23.17 | 24.29 | 26.91 |
| 08-00237-30309 |             |                         | 25                           |                         |                      |                                     |                      | 70                       | 26.42                                                               | 27.59 | 28.87 | 30.27 | Free  |
| 08-00237-30311 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.63                                                               | 33.04 | 34.57 | 36.26 | Free  |
| 08-00237-30512 |             | R1                      | 4                            |                         |                      |                                     |                      | 50                       | 4.51                                                                | 4.69  | 4.89  | 5.11  | 5.61  |
| 08-00237-30500 |             |                         | 6                            |                         |                      |                                     |                      | 50                       | 6.60                                                                | 6.87  | 7.17  | 7.50  | 8.26  |
| 08-00237-30501 |             |                         | 8                            |                         |                      |                                     |                      | 50                       | 8.68                                                                | 9.05  | 9.45  | 9.89  | 10.92 |
| 08-00237-30503 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 12.86                                                               | 13.41 | 14.01 | 14.68 | 16.23 |
| 08-00237-30505 |             |                         | 16                           |                         |                      |                                     |                      | 60                       | 17.03                                                               | 17.77 | 18.58 | 19.46 | 21.54 |
| 08-00237-30507 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.20                                                               | 22.12 | 23.14 | 24.25 | 26.84 |
| 08-00237-30509 | 6           | R0.3                    | 25                           | 5                       | 5.7                  | -                                   | 6                    | 70                       | 26.41                                                               | 27.57 | 28.84 | 30.23 | Free  |
| 08-00237-30511 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.63                                                               | 33.02 | 34.54 | 36.22 | Free  |
| 08-00237-31001 |             |                         | 8                            |                         |                      |                                     |                      | 50                       | 8.66                                                                | 9.01  | 9.38  | 9.79  | 10.75 |
| 08-00237-31003 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 12.83                                                               | 13.36 | 13.94 | 14.58 | 16.06 |
| 08-00237-31005 |             |                         | 16                           |                         |                      |                                     |                      | 60                       | 17.01                                                               | 17.72 | 18.50 | 19.37 | 21.37 |
| 08-00237-31007 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.18                                                               | 22.08 | 23.07 | 24.15 | 26.68 |
| 08-00237-31009 |             | R1                      | 25                           |                         |                      |                                     |                      | 70                       | 26.39                                                               | 27.53 | 28.77 | 30.14 | 33.32 |
| 08-00237-31011 |             |                         | 30                           |                         |                      |                                     |                      | 70                       | 31.60                                                               | 32.97 | 34.47 | 36.12 | Free  |
| 08-00237-60106 | 4           | R0.1                    | 8                            | 3.2                     | 3.8                  | 12°                                 | 6                    | 60                       | 10.69                                                               | 11.16 | 11.68 | 12.25 | 13.58 |
| 08-00237-60100 |             |                         | 12                           |                         |                      |                                     |                      | 60                       | 21.12                                                               | 22.06 | 23.09 | 24.22 | Free  |
| 08-00237-60101 |             |                         | 16                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.95 | 34.49 | Free  | Free  |
| 08-00237-60103 |             |                         | 24                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.95 | 34.49 | Free  | Free  |
| 08-00237-60105 |             | R0.2                    | 32                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.94 | 34.48 | Free  | Free  |
| 08-00237-60206 |             |                         | 8                            |                         |                      |                                     |                      | 60                       | 10.68                                                               | 11.15 | 11.67 | 12.23 | 13.55 |
| 08-00237-60200 |             |                         | 12                           |                         |                      |                                     |                      | 60                       | 21.11                                                               | 22.05 | 23.07 | 24.20 | Free  |
| 08-00237-60201 |             |                         | 16                           |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.94 | 34.48 | Free  | Free  |
| 08-00237-60203 |             |                         | 24                           |                         |                      |                                     |                      | 50                       | 10.68                                                               | 11.14 | 11.65 | 12.21 | 13.51 |
| 08-00237-60205 |             | R0.3                    | 32                           |                         |                      |                                     |                      | 60                       | 21.11                                                               | 22.04 | 23.06 | 24.18 | Free  |
| 08-00237-60306 |             |                         | 8                            |                         |                      |                                     |                      | 70                       | 31.54                                                               | 32.93 | 34.46 | Free  | Free  |
| 08-00237-60300 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 10.67                                                               | 11.13 | 11.62 | 12.17 | 13.45 |
| 08-00237-60301 | 5           | R0.5                    | 16                           | 4                       | 4.75                 | 12°                                 | 6                    | 60                       | 21.10                                                               | 22.02 | 23.03 | 24.14 | Free  |
| 08-00237-60303 |             |                         | 24                           |                         |                      |                                     |                      | 70                       | 31.53                                                               | 32.92 | 34.43 | Free  | Free  |
| 08-00237-60305 |             |                         | 32                           |                         |                      |                                     |                      | 50                       | 4.53                                                                | 4.73  | 4.95  | 5.19  | 5.76  |
| 08-00237-60500 |             |                         | 8                            |                         |                      |                                     |                      | 50                       | 6.62                                                                | 6.91  | 7.23  | 7.59  | 8.41  |
| 08-00237-60501 |             | R1                      | 12                           |                         |                      |                                     |                      | 50                       | 8.70                                                                | 9.09  | 9.51  | 9.98  | 11.06 |
| 08-00237-60503 |             |                         | 16                           |                         |                      |                                     |                      | 50                       | 12.87                                                               | 13.45 | 14.08 | 14.77 | 16.37 |
| 08-00237-60505 |             |                         | 24                           |                         |                      |                                     |                      | 60                       | 17.05                                                               | 17.81 | 18.64 | 19.55 | 21.68 |
| 08-00237-60507 |             |                         | 32                           |                         |                      |                                     |                      | 60                       | 21.22                                                               | 22.16 | 23.20 | 24.34 | 26.99 |
| 08-00237-60509 |             | R0.1                    | 8                            |                         |                      |                                     |                      | 50                       | 4.53                                                                | 4.73  | 4.95  | 5.18  | 5.74  |
| 08-00237-60510 |             |                         | 12                           |                         |                      |                                     |                      | 50                       | 6.62                                                                | 6.91  | 7.23  | 7.58  | 8.39  |
| 08-00237-60511 |             |                         | 16                           |                         |                      |                                     |                      | 50                       | 8.70                                                                | 9.09  | 9.51  | 9.97  | 11.05 |
| 08-00237-60512 |             |                         | 24                           |                         |                      |                                     |                      | 50                       | 12.87                                                               | 13.44 | 14.07 | 14.76 | 16.36 |
| 08-00237-60513 | 6           | R0.2                    | 16                           | 5                       | 5.7                  | -                                   | 6                    | 60                       | 17.04                                                               | 17.80 | 18.63 | 19.54 | 21.67 |
| 08-00237-60514 |             |                         | 20                           |                         |                      |                                     |                      | 60                       | 21.21                                                               | 22.16 | 23.19 | 24.33 | 26.98 |
| 08-00237-60515 |             |                         | 25                           |                         |                      |                                     |                      | 70                       | 26.43                                                               | 27.61 | 28.90 | 30.31 | Free  |



MHRH430R

Recommended Milling Conditions

MHRH430R

Recommended Milling Conditions

| Work Material |               |                   | Prehardened Steels<br>HPM・NAK<br>(~42HRC) |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |              |       | High Speed Steels<br>SKH<br>(~65HRC) |        |              |       |
|---------------|---------------|-------------------|-------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Corner Radius | Under Neck Length | Spindle Speed                             | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |               |                   | min <sup>-1</sup>                         | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 0.1           | 0.01          | 0.3               | 40,000                                    | 240    | 0.004        | 0.03  | 40,000                                            | 200    | 0.003        | 0.02  | 40,000                                     | 160    | 0.002        | 0.01  | 40,000                               | 120    | 0.002        | 0.01  |
|               |               | 0.5               | 40,000                                    | 180    | 0.003        | 0.03  | 40,000                                            | 150    | 0.002        | 0.02  | 40,000                                     | 120    | 0.001        | 0.01  | 40,000                               | 90     | 0.001        | 0.01  |
| 0.15          | 0.01          | 0.3               | 40,000                                    | 360    | 0.004        | 0.04  | 40,000                                            | 300    | 0.003        | 0.03  | 40,000                                     | 240    | 0.002        | 0.015 | 40,000                               | 180    | 0.002        | 0.01  |
|               |               | 0.5               | 40,000                                    | 240    | 0.004        | 0.04  | 40,000                                            | 200    | 0.003        | 0.03  | 40,000                                     | 160    | 0.002        | 0.015 | 40,000                               | 120    | 0.002        | 0.01  |
|               |               | 0.75              | 40,000                                    | 180    | 0.003        | 0.04  | 40,000                                            | 150    | 0.002        | 0.03  | 40,000                                     | 120    | 0.001        | 0.015 | 40,000                               | 90     | 0.001        | 0.01  |
|               |               | 1                 | 40,000                                    | 100    | 0.003        | 0.04  | 40,000                                            | 80     | 0.002        | 0.03  | 40,000                                     | 65     | 0.001        | 0.015 | 40,000                               | 50     | 0.001        | 0.01  |
|               | 0.02          | 0.3               | 40,000                                    | 360    | 0.004        | 0.04  | 40,000                                            | 300    | 0.003        | 0.03  | 40,000                                     | 240    | 0.002        | 0.015 | 40,000                               | 180    | 0.002        | 0.01  |
|               |               | 0.5               | 40,000                                    | 240    | 0.004        | 0.04  | 40,000                                            | 200    | 0.003        | 0.03  | 40,000                                     | 160    | 0.002        | 0.015 | 40,000                               | 120    | 0.002        | 0.01  |
|               |               | 0.75              | 40,000                                    | 180    | 0.003        | 0.04  | 40,000                                            | 150    | 0.002        | 0.03  | 40,000                                     | 120    | 0.001        | 0.015 | 40,000                               | 90     | 0.001        | 0.01  |
|               |               | 1                 | 40,000                                    | 100    | 0.003        | 0.04  | 40,000                                            | 80     | 0.002        | 0.03  | 40,000                                     | 65     | 0.001        | 0.015 | 40,000                               | 50     | 0.001        | 0.01  |
|               |               | 0.5               | 30,000                                    | 480    | 0.005        | 0.05  | 30,000                                            | 400    | 0.003        | 0.04  | 30,000                                     | 320    | 0.003        | 0.02  | 30,000                               | 240    | 0.003        | 0.01  |
|               |               | 1                 | 30,000                                    | 360    | 0.005        | 0.05  | 30,000                                            | 300    | 0.003        | 0.04  | 30,000                                     | 240    | 0.002        | 0.02  | 30,000                               | 160    | 0.002        | 0.01  |
| 0.2           | 0.02          | 1.5               | 30,000                                    | 240    | 0.004        | 0.05  | 30,000                                            | 200    | 0.002        | 0.04  | 30,000                                     | 160    | 0.002        | 0.02  | 30,000                               | 120    | 0.001        | 0.01  |
|               |               | 2                 | 30,000                                    | 140    | 0.003        | 0.05  | 30,000                                            | 100    | 0.002        | 0.04  | 30,000                                     | 80     | 0.001        | 0.02  | 30,000                               | 60     | 0.001        | 0.01  |
|               |               | 0.5               | 30,000                                    | 480    | 0.01         | 0.05  | 30,000                                            | 400    | 0.003        | 0.04  | 30,000                                     | 320    | 0.003        | 0.02  | 30,000                               | 240    | 0.003        | 0.01  |
|               |               | 1                 | 30,000                                    | 360    | 0.007        | 0.05  | 30,000                                            | 300    | 0.003        | 0.04  | 30,000                                     | 240    | 0.003        | 0.02  | 30,000                               | 160    | 0.003        | 0.01  |
|               | 0.05          | 1.5               | 30,000                                    | 240    | 0.005        | 0.05  | 30,000                                            | 200    | 0.002        | 0.04  | 30,000                                     | 160    | 0.002        | 0.02  | 30,000                               | 120    | 0.002        | 0.01  |
|               |               | 2                 | 30,000                                    | 140    | 0.003        | 0.05  | 30,000                                            | 100    | 0.002        | 0.04  | 30,000                                     | 80     | 0.002        | 0.02  | 30,000                               | 60     | 0.002        | 0.01  |
|               |               | 1                 | 30,000                                    | 700    | 0.015        | 0.1   | 30,000                                            | 600    | 0.003        | 0.08  | 30,000                                     | 500    | 0.003        | 0.04  | 30,000                               | 400    | 0.003        | 0.03  |
|               |               | 1.5               | 30,000                                    | 480    | 0.01         | 0.1   | 30,000                                            | 400    | 0.003        | 0.08  | 30,000                                     | 320    | 0.003        | 0.04  | 30,000                               | 240    | 0.003        | 0.03  |
|               |               | 2                 | 30,000                                    | 360    | 0.007        | 0.1   | 30,000                                            | 300    | 0.003        | 0.08  | 30,000                                     | 240    | 0.003        | 0.04  | 25,000                               | 200    | 0.003        | 0.03  |
|               |               | 2.5               | 30,000                                    | 300    | 0.007        | 0.1   | 25,000                                            | 200    | 0.002        | 0.08  | 25,000                                     | 160    | 0.002        | 0.04  | 20,000                               | 120    | 0.002        | 0.03  |
| 0.3           | 0.02          | 3                 | 30,000                                    | 140    | 0.004        | 0.1   | 25,000                                            | 100    | 0.002        | 0.08  | 25,000                                     | 80     | 0.002        | 0.04  | 20,000                               | 60     | 0.002        | 0.03  |
|               |               | 1                 | 30,000                                    | 700    | 0.02         | 0.1   | 30,000                                            | 600    | 0.003        | 0.08  | 30,000                                     | 500    | 0.003        | 0.04  | 30,000                               | 400    | 0.003        | 0.03  |
|               |               | 1.5               | 30,000                                    | 480    | 0.015        | 0.1   | 30,000                                            | 400    | 0.003        | 0.08  | 30,000                                     | 320    | 0.003        | 0.04  | 30,000                               | 240    | 0.003        | 0.03  |
|               |               | 2                 | 30,000                                    | 360    | 0.01         | 0.1   | 30,000                                            | 300    | 0.003        | 0.08  | 30,000                                     | 240    | 0.003        | 0.04  | 25,000                               | 200    | 0.003        | 0.03  |
|               | 0.05          | 2.5               | 30,000                                    | 300    | 0.007        | 0.1   | 25,000                                            | 200    | 0.002        | 0.08  | 25,000                                     | 160    | 0.002        | 0.04  | 20,000                               | 120    | 0.002        | 0.03  |
|               |               | 3                 | 30,000                                    | 140    | 0.005        | 0.1   | 25,000                                            | 100    | 0.002        | 0.08  | 25,000                                     | 80     | 0.002        | 0.04  | 20,000                               | 60     | 0.002        | 0.03  |
|               |               | 1                 | 30,000                                    | 900    | 0.015        | 0.12  | 30,000                                            | 800    | 0.005        | 0.1   | 28,000                                     | 700    | 0.005        | 0.05  | 25,000                               | 600    | 0.004        | 0.04  |
|               |               | 1.5               | 30,000                                    | 800    | 0.012        | 0.12  | 30,000                                            | 700    | 0.005        | 0.1   | 28,000                                     | 600    | 0.005        | 0.05  | 25,000                               | 520    | 0.004        | 0.04  |
|               |               | 2                 | 30,000                                    | 720    | 0.01         | 0.12  | 30,000                                            | 600    | 0.005        | 0.1   | 25,000                                     | 500    | 0.005        | 0.05  | 25,000                               | 440    | 0.003        | 0.04  |
|               |               | 2.5               | 30,000                                    | 680    | 0.008        | 0.12  | 28,000                                            | 560    | 0.004        | 0.1   | 25,000                                     | 480    | 0.004        | 0.05  | 20,000                               | 360    | 0.003        | 0.04  |
| 0.4           | 0.02          | 3                 | 30,000                                    | 640    | 0.008        | 0.12  | 25,000                                            | 500    | 0.004        | 0.1   | 23,000                                     | 440    | 0.003        | 0.05  | 18,000                               | 320    | 0.002        | 0.04  |
|               |               | 4                 | 30,000                                    | 500    | 0.006        | 0.12  | 25,000                                            | 400    | 0.003        | 0.1   | 20,000                                     | 320    | 0.002        | 0.05  | 18,000                               | 240    | 0.002        | 0.04  |
|               |               | 1                 | 30,000                                    | 900    | 0.025        | 0.12  | 30,000                                            | 800    | 0.005        | 0.1   | 28,000                                     | 700    | 0.005        | 0.05  | 25,000                               | 600    | 0.005        | 0.04  |
|               |               | 1.5               | 30,000                                    | 800    | 0.022        | 0.12  | 30,000                                            | 700    | 0.005        | 0.1   | 28,000                                     | 600    | 0.005        | 0.05  | 25,000                               | 520    | 0.005        | 0.04  |
|               | 0.05          | 2                 | 30,000                                    | 720    | 0.02         | 0.12  | 30,000                                            | 600    | 0.005        | 0.1   | 25,000                                     | 500    | 0.005        | 0.05  | 25,000                               | 440    | 0.005        | 0.04  |
|               |               | 2.5               | 30,000                                    | 680    | 0.015        | 0.12  | 28,000                                            | 560    | 0.004        | 0.1   | 25,000                                     | 480    | 0.004        | 0.05  | 20,000                               | 360    | 0.004        | 0.04  |
|               |               | 3                 | 30,000                                    | 640    | 0.015        | 0.12  | 25,000                                            | 500    | 0.004        | 0.1   | 23,000                                     | 440    | 0.003        | 0.05  | 18,000                               | 320    | 0.003        | 0.04  |
|               |               | 4                 | 30,000                                    | 500    | 0.01         | 0.12  | 25,000                                            | 400    | 0.003        | 0.1   | 20,000                                     | 320    | 0.002        | 0.05  | 18,000                               | 240    | 0.002        | 0.04  |
|               |               | 1                 | 30,000                                    | 900    | 0.025        | 0.12  | 30,000                                            | 800    | 0.005        | 0.1   | 28,000                                     | 700    | 0.005        | 0.05  | 25,000                               | 600    | 0.005        | 0.04  |
|               |               | 2                 | 30,000                                    | 720    | 0.02         | 0.12  | 30,000                                            | 600    | 0.005        | 0.1   | 25,000                                     | 500    | 0.005        | 0.05  | 25,000                               | 440    | 0.005        | 0.04  |
| 0.5           | 0.02          | 3                 | 30,000                                    | 640    | 0.015        | 0.12  | 25,000                                            | 500    | 0.004        | 0.1   | 23,000                                     | 440    | 0.003        | 0.05  | 18,000                               | 320    | 0.003        | 0.04  |
|               |               | 4                 | 30,000                                    | 500    | 0.01         | 0.12  | 25,000                                            | 400    | 0.003        | 0.1   | 20,000                                     | 320    | 0.002        | 0.05  | 18,000                               | 240    | 0.002        | 0.04  |
|               |               | 1                 | 30,000                                    | 1,200  | 0.016        | 0.14  | 25,000                                            | 1,000  | 0.008        | 0.15  | 23,000                                     | 900    | 0.006        | 0.1   | 20,000                               | 800    | 0.004        | 0.08  |
|               |               | 2                 | 30,000                                    | 1,000  | 0.014        | 0.14  | 25,000                                            | 840    | 0.007        | 0.15  | 23,000                                     | 720    | 0.005        | 0.1   | 20,000                               | 600    | 0.003        | 0.08  |
|               | 0.05          | 3                 | 30,000                                    | 840    | 0.012        | 0.14  | 25,000                                            | 700    | 0.006        | 0.15  | 23,000                                     | 640    | 0.004        | 0.1   | 20,000                               | 560    | 0.003        | 0.08  |
|               |               | 4                 | 25,000                                    | 760    | 0.01         | 0.14  | 25,000                                            | 600    | 0.004        | 0.15  | 23,000                                     | 480    | 0.002        | 0.1   | 20,000                               | 360    | 0.002        | 0.08  |
|               |               | 5                 | 25,000                                    | 600    | 0.008        | 0.14  | 20,000                                            | 400    | 0.003        | 0.15  | 18,000                                     | 300    | 0.002        | 0.1   | 16,000                               | 200    | 0.002        | 0.08  |
|               |               | 6                 | 25,000                                    | 500    | 0.004        | 0.14  | 20,000                                            | 320    | 0.002        | 0.15  | 18,000                                     | 200    | 0.001        | 0.1   | 16,000                               | 140    | 0.001        | 0.08  |
|               |               | 1                 | 30,000                                    | 1,200  | 0.03         | 0.14  | 25,000                                            | 1,000  | 0.01         | 0.15  | 23,000                                     | 900    | 0.007        | 0.1   | 20,000                               | 800    | 0.005        | 0.08  |
|               |               | 2                 | 30,000                                    | 1,000  | 0.025        | 0.14  | 25,000                                            | 840    | 0.01         | 0.15  | 23,000                                     | 720    | 0.007        | 0.1   | 20,000                               | 600    | 0.005        | 0.08  |
| 0.6           | 0.02          | 3                 | 30,000                                    | 840    | 0.02         | 0.14  | 25,000                                            | 700    | 0.008        | 0.15  | 23,000                                     | 640    | 0.005        | 0.1   | 20,000                               | 560    | 0.003        | 0.08  |
|               |               | 4                 | 25,000                                    | 760    | 0.015        | 0.14  | 25,000                                            | 600    | 0.005        | 0.15  | 23,000                                     | 480    | 0.003        | 0.1   | 20,000                               | 360    | 0.002        | 0.08  |
|               |               | 5                 | 25,000                                    | 600    | 0.01         | 0.14  | 20,000                                            | 400    | 0.004        | 0.15  | 18,000                                     | 300    | 0.003        | 0.1   | 16,000                               | 200    | 0.002        | 0.08  |
|               |               | 6                 | 25,000                                    | 500    | 0.008        | 0.14  | 20,000                                            | 320    | 0.003        | 0.15  | 18,000                                     | 200    | 0.002        | 0.1   | 16,000                               | 140    | 0.001        | 0.08  |
|               | 0.05          | 1                 | 30,000                                    | 1,200  | 0.016        | 0.2   | 25,000                                            | 1,000  | 0.012        | 0.2   | 23,000                                     | 800    | 0.006        | 0.15  | 20,000                               | 640    | 0.004        | 0.1   |
|               |               | 4                 | 25,000                                    | 900    | 0.012        | 0.2   | 23,000                                            | 800    | 0.007        | 0.2   | 20,000                                     | 600    | 0.004        | 0.15  | 18,000                               | 400    | 0.003        | 0.1   |
|               |               | 6                 | 23,000                                    | 600    | 0.008        | 0.2   | 20,000                                            | 400    | 0.005        | 0.2   | 18,000                                     | 300    | 0.003        | 0.15  | 12,000                               | 200    | 0.002        | 0.1   |
|               |               | 8                 | 18,000                                    | 400    | 0.006        | 0.2   | 16,000                                            | 300    | 0.003        | 0.2   | 14,000                                     | 200    | 0.001        | 0.15  | 10,000                               | 160    | 0.001        | 0.1   |
|               |               | 10                | 16,000                                    | 240    | 0.003        | 0.2   | 14,000                                            | 200    | 0.001        | 0.2   | 12,000                                     | 160    | 0.001        | 0.15  | 8,000                                | 100    | 0.001        | 0.1   |
|               |               | 2                 | 30,000                                    | 1,200  | 0.035        | 0.2   | 25,000                                            | 1,000  | 0.02         | 0.2   | 23,000                                     | 800    | 0.01         | 0.15  | 20,000                               | 640    | 0.007        | 0.1   |

MHRH430R

Recommended Milling Conditions

Prehardened Steel P

Stainless Steel M

Titanium Alloy  
Heat Resistant Alloy S

Hardened Steel H  
~ 55 HRC  
~ 65 HRC

Coating  
Long Neck  
Corner Radius

| Work Material |                                  |                   | Prehardened Steels<br>HPM・NAK<br>(~42HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Hardened Steels<br>SKD11・PD613<br>(~62HRC) |        |              |       | High Speed Steels<br>SKH<br>(~65HRC) |        |              |       |
|---------------|----------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|--------------------------------------------|--------|--------------|-------|--------------------------------------|--------|--------------|-------|
| Dia.          | Corner Radius                    | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed                              | Feed   | Depth of Cut |       | Spindle Speed                        | Feed   | Depth of Cut |       |
|               |                                  |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>                          | mm/min | ap mm        | ae mm | min <sup>-1</sup>                    | mm/min | ap mm        | ae mm |
| 2             | 0.05<br>0.1<br>0.2<br>0.3<br>0.5 | 4                 | 24,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,800  | 0.13         | 0.7   | 20,000                                            | 2,300  | 0.06         | 0.6   | 17,000                                     | 2,000  | 0.05         | 0.5   | 14,000                               | 1,400  | 0.03         | 0.35  |
|               |                                  | 6                 | 22,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,500  | 0.12         | 0.7   | 18,000                                            | 2,100  | 0.06         | 0.6   | 15,000                                     | 1,800  | 0.05         | 0.5   | 12,000                               | 1,300  | 0.03         | 0.35  |
|               |                                  | 8                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,200  | 0.11         | 0.7   | 16,000                                            | 1,800  | 0.05         | 0.6   | 14,000                                     | 1,500  | 0.04         | 0.5   | 11,000                               | 1,100  | 0.02         | 0.35  |
|               |                                  | 12                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,700  | 0.09         | 0.7   | 13,000                                            | 1,400  | 0.04         | 0.6   | 11,000                                     | 1,200  | 0.03         | 0.5   | 9,000                                | 850    | 0.01         | 0.35  |
|               |                                  | 16                | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.07         | 0.7   | 11,000                                            | 1,100  | 0.03         | 0.6   | 9,500                                      | 950    | 0.02         | 0.5   | 7,500                                | 650    | 0.007        | 0.35  |
|               |                                  | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 800    | 0.05         | 0.7   | 8,000                                             | 650    | 0.02         | 0.6   | 7,000                                      | 550    | 0.01         | 0.5   | 5,500                                | 400    | 0.005        | 0.35  |
| 2.5           | 0.1<br>0.2<br>0.3<br>0.5         | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,200  | 0.14         | 0.85  | 13,000                                            | 1,800  | 0.07         | 0.7   | 11,000                                     | 1,500  | 0.05         | 0.5   | 9,000                                | 1,100  | 0.03         | 0.5   |
|               |                                  | 20                | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.08         | 0.85  | 9,000                                             | 1,100  | 0.04         | 0.7   | 7,500                                      | 950    | 0.02         | 0.5   | 6,000                                | 650    | 0.01         | 0.5   |
|               |                                  | 30                | 7,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 800    | 0.03         | 0.85  | 5,500                                             | 650    | 0.01         | 0.7   | 4,500                                      | 550    | 0.01         | 0.5   | 3,500                                | 400    | 0.005        | 0.5   |
| 3             | 0.05                             | 4                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,800  | 0.18         | 1     | 15,000                                            | 2,300  | 0.1          | 0.8   | 13,000                                     | 2,000  | 0.07         | 0.7   | 10,000                               | 1,400  | 0.05         | 0.6   |
|               |                                  | 6                 | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,500  | 0.17         | 1     | 13,000                                            | 2,100  | 0.1          | 0.8   | 11,000                                     | 1,800  | 0.07         | 0.7   | 9,000                                | 1,300  | 0.05         | 0.6   |
|               |                                  | 8                 | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,200  | 0.16         | 1     | 11,000                                            | 1,800  | 0.1          | 0.8   | 9,500                                      | 1,500  | 0.07         | 0.7   | 7,500                                | 1,100  | 0.05         | 0.6   |
|               |                                  | 12                | 13,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,000  | 0.16         | 1     | 11,000                                            | 1,600  | 0.08         | 0.8   | 9,500                                      | 1,400  | 0.06         | 0.7   | 7,500                                | 1,000  | 0.04         | 0.6   |
|               |                                  | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,800  | 0.14         | 1     | 10,000                                            | 1,500  | 0.07         | 0.8   | 8,500                                      | 1,300  | 0.05         | 0.7   | 7,000                                | 900    | 0.03         | 0.6   |
|               |                                  | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.12         | 1     | 8,000                                             | 1,100  | 0.05         | 0.8   | 7,000                                      | 950    | 0.04         | 0.7   | 5,500                                | 700    | 0.02         | 0.6   |
|               | 0.1<br>0.2<br>0.3<br>0.5         | 4                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,800  | 0.18         | 1     | 15,000                                            | 2,300  | 0.1          | 0.8   | 13,000                                     | 2,000  | 0.07         | 0.7   | 10,000                               | 1,400  | 0.05         | 0.6   |
|               |                                  | 6                 | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,500  | 0.17         | 1     | 13,000                                            | 2,100  | 0.1          | 0.8   | 11,000                                     | 1,800  | 0.07         | 0.7   | 9,000                                | 1,300  | 0.05         | 0.6   |
|               |                                  | 8                 | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,200  | 0.16         | 1     | 11,000                                            | 1,800  | 0.1          | 0.8   | 9,500                                      | 1,500  | 0.07         | 0.7   | 7,500                                | 1,100  | 0.05         | 0.6   |
|               |                                  | 12                | 13,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,000  | 0.16         | 1     | 11,000                                            | 1,600  | 0.08         | 0.8   | 9,500                                      | 1,400  | 0.06         | 0.7   | 7,500                                | 1,000  | 0.04         | 0.6   |
|               |                                  | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,800  | 0.14         | 1     | 10,000                                            | 1,500  | 0.07         | 0.8   | 8,500                                      | 1,300  | 0.05         | 0.7   | 7,000                                | 900    | 0.03         | 0.6   |
|               |                                  | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.12         | 1     | 8,000                                             | 1,100  | 0.05         | 0.8   | 7,000                                      | 950    | 0.04         | 0.7   | 5,500                                | 700    | 0.02         | 0.6   |
|               |                                  | 25                | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,200  | 0.08         | 1     | 7,500                                             | 1,000  | 0.04         | 0.8   | 6,500                                      | 850    | 0.02         | 0.7   | 5,000                                | 600    | 0.01         | 0.6   |
|               |                                  | 30                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 800    | 0.06         | 1     | 6,500                                             | 650    | 0.03         | 0.8   | 5,500                                      | 550    | 0.02         | 0.7   | 4,500                                | 400    | 0.007        | 0.6   |
|               | 1                                | 8                 | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,200  | 0.16         | 1     | 11,000                                            | 1,800  | 0.1          | 0.8   | 9,500                                      | 1,500  | 0.07         | 0.7   | 7,500                                | 1,100  | 0.05         | 0.6   |
|               |                                  | 12                | 13,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,000  | 0.16         | 1     | 11,000                                            | 1,600  | 0.08         | 0.8   | 9,500                                      | 1,400  | 0.06         | 0.7   | 7,500                                | 1,000  | 0.04         | 0.6   |
|               |                                  | 16                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,800  | 0.14         | 1     | 10,000                                            | 1,500  | 0.07         | 0.8   | 8,500                                      | 1,300  | 0.05         | 0.7   | 7,000                                | 900    | 0.03         | 0.6   |
|               |                                  | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1,400  | 0.12         | 1     | 8,000                                             | 1,100  | 0.05         | 0.8   | 7,000                                      | 950    | 0.04         | 0.7   | 5,500                                | 700    | 0.02         | 0.6   |
|               |                                  | 25                | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,200  | 0.08         | 1     | 7,500                                             | 1,000  | 0.04         | 0.8   | 6,500                                      | 850    | 0.02         | 0.7   | 5,000                                | 600    | 0.01         | 0.6   |
| 4             | 0.1<br>0.2<br>0.3<br>0.5<br>1    | 30                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 800    | 0.06         | 1     | 6,500                                             | 650    | 0.03         | 0.8   | 5,500                                      | 550    | 0.02         | 0.7   | 4,500                                | 400    | 0.007        | 0.6   |
|               |                                  | 8                 | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,600  | 0.25         | 1.4   | 10,000                                            | 2,100  | 0.15         | 1.2   | 8,500                                      | 1,800  | 0.08         | 1     | 7,000                                | 1,300  | 0.06         | 0.8   |
|               |                                  | 12                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,600  | 0.25         | 1.4   | 10,000                                            | 2,100  | 0.15         | 1.2   | 8,500                                      | 1,800  | 0.08         | 1     | 7,000                                | 1,300  | 0.06         | 0.8   |
|               |                                  | 16                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2,200  | 0.17         | 1.4   | 8,000                                             | 1,800  | 0.1          | 1.2   | 7,000                                      | 1,500  | 0.06         | 1     | 5,500                                | 1,100  | 0.05         | 0.8   |
|               |                                  | 24                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,600  | 0.14         | 1.4   | 6,500                                             | 1,300  | 0.08         | 1.2   | 5,500                                      | 1,100  | 0.05         | 1     | 4,500                                | 750    | 0.03         | 0.8   |
|               |                                  | 32                | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,300  | 0.08         | 1.4   | 5,500                                             | 1,100  | 0.04         | 1.2   | 4,500                                      | 950    | 0.02         | 1     | 3,500                                | 650    | 0.01         | 0.8   |
| 5             | 0.1<br>0.2<br>0.3<br>0.5<br>1    | 15                | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2,400  | 0.25         | 2.2   | 8,000                                             | 2,000  | 0.15         | 2     | 7,000                                      | 1,700  | 0.08         | 1.6   | 5,500                                | 1,200  | 0.06         | 1.2   |
|               |                                  | 20                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2,000  | 0.18         | 2.2   | 6,500                                             | 1,600  | 0.1          | 2     | 5,500                                      | 1,400  | 0.07         | 1.6   | 4,500                                | 1,000  | 0.05         | 1.2   |
|               |                                  | 40                | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,200  | 0.09         | 2.2   | 4,000                                             | 1,000  | 0.05         | 2     | 3,500                                      | 850    | 0.02         | 1.6   | 3,000                                | 600    | 0.01         | 1.2   |
| 6             | 0.1<br>0.2<br>0.3<br>0.5<br>1    | 12                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2,500  | 0.35         | 2.7   | 6,500                                             | 2,100  | 0.18         | 2.5   | 5,500                                      | 1,800  | 0.08         | 2     | 4,500                                | 1,300  | 0.06         | 1.5   |
|               |                                  | 18                | 7,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2,200  | 0.3          | 2.7   | 5,500                                             | 1,800  | 0.18         | 2.5   | 4,500                                      | 1,500  | 0.08         | 2     | 3,500                                | 1,100  | 0.06         | 1.5   |
|               |                                  | 24                | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1,800  | 0.2          | 2.7   | 5,000                                             | 1,500  | 0.15         | 2.5   | 4,000                                      | 1,300  | 0.07         | 2     | 3,000                                | 900    | 0.05         | 1.5   |
|               |                                  | 48                | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 900    | 0.1          | 2.7   | 2,500                                             | 750    | 0.05         | 2.5   | 2,000                                      | 650    | 0.03         | 2     | 2,000                                | 450    | 0.02         | 1.5   |
| Notes         |                                  |                   | ※ 1 Adjust milling conditions according to milling shape and machine type.<br>※ 2 ap : Axial Depth of Cut, ae : Radial Depth of Cut.<br>※ 3 Recommend to use oil mist coolant for machining hardened steels.<br>※ 4 Recommend to apply helical or ramping for approaching into axial direction.<br>※ 5 Adjust feed rate 50% lower and cutting depth (ae) 30% lower for milling deep wall area when L/D exceeds 8 for stable milling.<br>※ 6 For slotting, recommend reciprocating milling by adjusting feed & ap in below 50% of recommended milling condition.<br>※ 7 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine. |        |              |       |                                                   |        |              |       |                                            |        |              |       |                                      |        |              |       |

Regular Line  
MUGEN COATING PREMIUM

Prehardened Steel P

Stainless Steel M

Titanium Alloy  
Heat Resistant Alloy S

Hardened Steel H  
~ 55 HRC  
~ 65 HRC

Coating  
Long Neck  
Corner Radius

| Model | Size | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Work Material |             |                   |                 |                 |        |       |          |                       |                          |                | Number of Sizes | Page |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
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|       |      |               |         |                 |             |              |              |              | P             | P           | P                 | M               | N               | N      | N     | N        | S                     | H                        |                |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|       |      |               |         |                 |             |              |              |              | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|       |      |               |         |                 |             |              |              |              |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | </ |

| Model | Size | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Work Material |             |                   |                 |                |        |       |          |                       |                          |                | Number of Sizes | Page |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
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|       |      |               |         |                 |             |              |              |              | P             | P           | M                 | N               | N              | N      | N     | S        | H                     |                          |                |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|       |      |               |         |                 |             |              |              |              | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|       |      |               |         |                 |             |              |              |              |               |             |                   |                 |                |        |       |          |                       |                          |                |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | </ |



| Model                                                                                             | Size                  | Length of Cut | Coating                                                                             | Number of Flute                                                                     | Helix Angle | Side Milling                                                                        | Slot Milling                                                                        | Face Milling                                                                        | 3D Milling                                                                          | Work Material                                                                       |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Number of Sizes | Page  |
|---------------------------------------------------------------------------------------------------|-----------------------|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|-------|
|                                                                                                   |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P                                                                                   | P                                                                                   | P                                                                                    | M                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | S                                                                                     | H                                                                                     |                                                                                       |                                                                                       |                                                                                       |                 |       |
|                                                                                                   |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     | Carbon Steel                                                                        | Alloy Steel                                                                         | Prehardened Steel                                                                    | Stainless Steel                                                                       | Aluminum Alloy                                                                        | Copper                                                                                | Resin                                                                                 | Graphite                                                                              | Hard Brittle Material                                                                 | Heat Resistant Alloy etc                                                              | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |                 |       |
| Square                                                                                            |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MSE345                                                                                            | $\phi 3 \sim \phi 20$ | $\pm 2.5D$    |    |    | 45°         |    |    |    | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | 9               | H-042 |
| 3-flute with high helix angle 45°. For high feed rate milling                                     |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MSE430P                                                                                           | $\phi 1 \sim \phi 12$ | $\pm 2.5D$    |    |    | 30°         |    | -                                                                                   |    | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | 11              | H-044 |
| 4-flute sharp edge type with helix angle 30°                                                      |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MSE430                                                                                            | $\phi 1 \sim \phi 20$ | $\pm 2.5D$    |    |    | 30°         |    | -                                                                                   |    | -                                                                                   |    |    |    |    |    |    |    |    |    |    |    |    |    | 25              | H-046 |
| 4-flute standard type with helix angle 30°. For multi-purpose from roughing to finishing          |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MSE445                                                                                            | $\phi 2 \sim \phi 20$ | $\pm 2.5D$    |  |  | 45°         |  | -                                                                                   |  | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  | 11              | H-048 |
| 4-flute with high helix angle 45°. Suitable for side milling of tough work materials              |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MSEM430                                                                                           | $\phi 1 \sim \phi 20$ | 4D            |  |  | 30°         |  | -                                                                                   |  | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  | 13              | H-050 |
| 4-flute with helix angle 30°. L/D=4                                                               |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MHD445                                                                                            | $\phi 1 \sim \phi 4$  | 2D            |  |  | 45°         |  |  |  | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  | 5               | H-052 |
| 4-flute with high helix angle. For finishing of prehardened steels and hardened steels ( ~ 55HRC) |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MHD645                                                                                            | $\phi 5 \sim \phi 12$ | 2.5D          |  |  | 45°         |  |  |  | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  | 5               | H-054 |
| 6-flute with high helix angle. For finishing of prehardened steels and Hardened steels ( ~ 55HRC) |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| Ball                                                                                              |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| MSB230                                                                                            | R0.05 ~ R10           | $\pm 1.5D$    |  |  | 30°         | -                                                                                   | -                                                                                   | -                                                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 87              | H-056 |
| 2-flute standard type with helix angle 30°. For multi-purpose, from roughing to finishing         |                       |               |                                                                                     |                                                                                     |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |

| Model                                                                                                           | Size                                          | Length of Cut | Coating                                                                               | Number of Flute                                                                       | Helix Angle                                                                           | Side Milling                                                                          | Slot Milling                                                                          | Face Milling                                                                          | 3D Milling                                                                            | Work Material                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Number of Sizes | Page  |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|-------|
|                                                                                                                 |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | P                                                                                     | P                                                                                     | P                                                                                     | M                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | N                                                                                     | S                                                                                     | H                                                                                     |                                                                                       |                                                                                       |                 |       |
|                                                                                                                 |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Carbon Steel                                                                          | Alloy Steel                                                                           | Prehardened Steel                                                                     | Stainless Steel                                                                       | Aluminum Alloy                                                                        | Copper                                                                                | Resin                                                                                 | Graphite                                                                              | Hard Brittle Material                                                                 | Heat Resistant Alloy etc                                                              | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |                 |       |
| Ball                                                                                                            |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSB345                      | R0.5 ~ R6                                     | 1.5D          |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 56              | H-060 |
| 3-flute ball end mill. Realized to control chattering by unequal flute spacing                                  |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSB230G2                    | R0.05 ~ R3                                    | $\pm 1.5D$    |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 14              | H-062 |
| Radius tolerance $\pm 0.002\text{mm}$ . 2-flute high accurate end mill                                          |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSB230S                     | R0.1 ~ R6                                     | 1D            |    |    |    | -                                                                                     | -                                                                                     | -                                                                                     |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 24              | H-064 |
| 2-flute standard type with helix angle 30°. L/D=1 to increase rigidity                                          |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSB230SF                  | R0.1 ~ R6                                     | 1D            |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |    |    |    | 15              | H-068 |
| 2-flute standard type with helix angle 30°. Suitable for shrink fit holder                                      |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSBL230                   | R0.1 ~ R5                                     | 2.5D          |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 42              | H-072 |
| 2-flute long ball end mill. Overall length is 150mm at R3                                                       |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSBXL230                  | R0.5 ~ R5                                     | 2.5D          |  |  |  | -                                                                                     | -                                                                                     | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 8               | H-073 |
| Long overall length allows deeper area milling                                                                  |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
| Corner Radius                                                                                                   |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSRS230                   | $\phi 1 \times R0.1$<br>~ $\phi 6 \times R2$  | 2D            |  |  |  |  |  |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  | 38              | H-074 |
| 2-flute standard type corner radius end mill with helix angle 30°. For multi-purpose from roughing to finishing |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |
|  MSRS430                   | $\phi 1 \times R0.1$<br>~ $\phi 12 \times R3$ | 2D            |  |  |  |  |  |  | -                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  | 64              | H-076 |
| 4-flute standard type corner radius end mill with helix angle 30°. For multi-purpose from roughing to finishing |                                               |               |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |

## MX225

## Recommended Milling Conditions

Unit : mm

**How to Order** When you order, indicate MX225 (D). ※(γ) is reference value.

- ※1 Use cutting fluid.
- ※2 Use cutting fluid with smoke retardant.
- ※3 Recommend to use oil mist coolant for machining hardened steels.
- ※4 Adjust both spindle speed and feed at the same rate.
- ※5 Adjust milling conditions according to the volume of depth of cut and rigidity of the machine.



# MX230

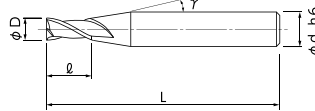
## MUGEN COATING 2-Flute LEAD30 End Mill

## Recommended Milling Conditions

For various work materials.  $L/D=2$ .  
Applicable to both slotting and side milling



$D \leq 3$   $\phi$   $D$   $\begin{matrix} 0 \\ -0.01 \end{matrix}$   
 $3 < D < 6$   $\phi$   $D$   $\begin{matrix} 0 \\ -0.015 \end{matrix}$   
 $D = 6$   $\phi$   $D$   $\begin{matrix} -0.01 \\ -0.025 \end{matrix}$   
 $D > 6$   $\phi$   $D$   $\begin{matrix} -0.01 \\ -0.03 \end{matrix}$



- L/D=2 and helix 30° standard type applicable for both slotting and side milling.

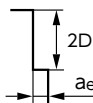
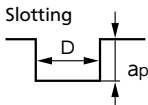
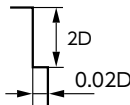
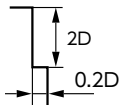
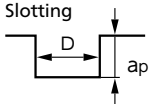
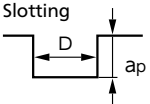
| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00030-00010 | 0.1      | 0.2               | 12°                  | 4              | 45                 |
| 08-00030-00020 | 0.2      | 0.4               | 12°                  | 4              | 45                 |
| 08-00030-00030 | 0.3      | 0.6               | 12°                  | 4              | 45                 |
| 08-00030-00040 | 0.4      | 0.8               | 12°                  | 4              | 45                 |
| 08-00030-00050 | 0.5      | 1                 | 12°                  | 4              | 45                 |
| 08-00030-00060 | 0.6      | 1.2               | 12°                  | 4              | 45                 |
| 08-00030-00070 | 0.7      | 1.4               | 12°                  | 4              | 45                 |
| 08-00030-00080 | 0.8      | 1.6               | 12°                  | 4              | 45                 |
| 08-00030-00090 | 0.9      | 1.8               | 12°                  | 4              | 45                 |
| 08-00030-00100 | 1        | 2                 | 12°                  | 4              | 45                 |
| 08-00030-00110 | 1.1      | 2.2               | 12°                  | 4              | 45                 |
| 08-00030-00120 | 1.2      | 2.4               | 12°                  | 4              | 45                 |
| 08-00030-00130 | 1.3      | 2.6               | 12°                  | 4              | 45                 |
| 08-00030-00140 | 1.4      | 2.8               | 12°                  | 4              | 45                 |
| 08-00030-00150 | 1.5      | 3                 | 12°                  | 4              | 45                 |
| 08-00030-00160 | 1.6      | 3.2               | 12°                  | 4              | 45                 |
| 08-00030-00170 | 1.7      | 3.4               | 12°                  | 4              | 45                 |
| 08-00030-00180 | 1.8      | 3.6               | 12°                  | 4              | 45                 |
| 08-00030-00190 | 1.9      | 3.8               | 12°                  | 4              | 45                 |
| 08-00030-00200 | 2        | 4                 | 12°                  | 4              | 45                 |
| 08-00030-00210 | 2.1      | 4.2               | 12°                  | 4              | 45                 |
| 08-00030-00220 | 2.2      | 4.4               | 12°                  | 4              | 45                 |
| 08-00030-00230 | 2.3      | 4.6               | 12°                  | 4              | 45                 |
| 08-00030-00240 | 2.4      | 4.8               | 12°                  | 4              | 45                 |
| 08-00030-00250 | 2.5      | 5                 | 12°                  | 4              | 45                 |
| 08-00030-00260 | 2.6      | 5.2               | 12°                  | 4              | 45                 |
| 08-00030-00270 | 2.7      | 5.4               | 12°                  | 4              | 45                 |
| 08-00030-00280 | 2.8      | 5.6               | 12°                  | 4              | 45                 |
| 08-00030-00290 | 2.9      | 5.8               | 12°                  | 4              | 45                 |
| 08-00030-00300 | 3        | 6                 | 12°                  | 6              | 45                 |
| 08-00030-00310 | 3.1      | 6.2               | 12°                  | 6              | 45                 |
| 08-00030-00320 | 3.2      | 6.4               | 12°                  | 6              | 45                 |
| 08-00030-00330 | 3.3      | 6.6               | 12°                  | 6              | 45                 |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00030-00340 | 3.4      | 6.8               | 12°                  | 6              | 45                 |
| 08-00030-00350 | 3.5      | 7                 | 12°                  | 6              | 45                 |
| 08-00030-00360 | 3.6      | 7.2               | 12°                  | 6              | 45                 |
| 08-00030-00370 | 3.7      | 7.4               | 12°                  | 6              | 45                 |
| 08-00030-00380 | 3.8      | 7.6               | 12°                  | 6              | 45                 |
| 08-00030-00390 | 3.9      | 7.8               | 12°                  | 6              | 45                 |
| 08-00030-00400 | 4        | 8                 | 12°                  | 6              | 45                 |
| 08-00030-00410 | 4.1      | 8.2               | 12°                  | 6              | 45                 |
| 08-00030-00420 | 4.2      | 8.4               | 12°                  | 6              | 45                 |
| 08-00030-00430 | 4.3      | 8.6               | 12°                  | 6              | 45                 |
| 08-00030-00440 | 4.4      | 8.8               | 12°                  | 6              | 45                 |
| 08-00030-00450 | 4.5      | 9                 | 12°                  | 6              | 50                 |
| 08-00030-00460 | 4.6      | 9.2               | 12°                  | 6              | 50                 |
| 08-00030-00470 | 4.7      | 9.4               | 12°                  | 6              | 50                 |
| 08-00030-00480 | 4.8      | 9.6               | 12°                  | 6              | 50                 |
| 08-00030-00490 | 4.9      | 9.8               | 12°                  | 6              | 50                 |
| 08-00030-00500 | 5        | 10                | 12°                  | 6              | 50                 |
| 08-00030-00510 | 5.1      | 10.2              | 12°                  | 6              | 50                 |
| 08-00030-00520 | 5.2      | 10.4              | 12°                  | 6              | 50                 |
| 08-00030-00530 | 5.3      | 10.6              | 12°                  | 6              | 50                 |
| 08-00030-00540 | 5.4      | 10.8              | 12°                  | 6              | 50                 |
| 08-00030-00550 | 5.5      | 11                | 12°                  | 6              | 50                 |
| 08-00030-00560 | 5.6      | 11.2              | 12°                  | 6              | 50                 |
| 08-00030-00570 | 5.7      | 11.4              | 12°                  | 6              | 50                 |
| 08-00030-00580 | 5.8      | 11.6              | 12°                  | 6              | 50                 |
| 08-00030-00590 | 5.9      | 11.8              | 12°                  | 6              | 50                 |
| 08-00030-00600 | 6        | 12                | —                    | 6              | 50                 |
| 08-00030-00700 | 7        | 14                | 12°                  | 8              | 65                 |
| 08-00030-00800 | 8        | 16                | —                    | 8              | 65                 |
| 08-00030-00900 | 9        | 18                | 12°                  | 10             | 75                 |
| 08-00030-01000 | 10       | 20                | —                    | 10             | 75                 |
| 08-00030-01200 | 12       | 24                | —                    | 12             | 80                 |

## How to Order

When you order, indicate MX230 (D). ※(γ) is reference value.

| Work Material | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |          | Alloy Steels<br>SCM・SKD・SUS |                 |          | Prehardened Steels<br>HPM・NAK |                 |          | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                                                                                                                                    |                 |          | Copper                                                                                                                                                |                 |          |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|-------------------------------|-----------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|
| Cutting Speed | 50～80m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |          | 50～70m/min                  |                 |          | 40～60m/min                    |                 |          | 20～40m/min                                                                                                                                                                                                                                                           |                 |          | 60～80m/min                                                                                                                                            |                 |          |
| Dia.          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed              | Feed            |          | Spindle<br>Speed                                                                                                                                                                                                                                                     | Feed            |          | Spindle<br>Speed                                                                                                                                      | Feed            |          |
|               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>             | mm/min          |          | min <sup>-1</sup>                                                                                                                                                                                                                                                    | mm/min          |          | min <sup>-1</sup>                                                                                                                                     | mm/min          |          |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                               | Side<br>Milling | Slotting |                                                                                                                                                                                                                                                                      | Side<br>Milling | Slotting |                                                                                                                                                       | Side<br>Milling | Slotting |
| 0.1           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | —               | 25       | 50,000                      | —               | 15       | 50,000                        | —               | 20       | 50,000                                                                                                                                                                                                                                                               | —               | 15       | 50,000                                                                                                                                                | 60              | 25       |
| 0.2           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | —               | 40       | 50,000                      | —               | 25       | 50,000                        | —               | 30       | 47,700                                                                                                                                                                                                                                                               | —               | 20       | 50,000                                                                                                                                                | 90              | 35       |
| 0.3           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100             | 50       | 50,000                      | 90              | 35       | 50,000                        | 85              | 40       | 31,800                                                                                                                                                                                                                                                               | —               | 20       | 50,000                                                                                                                                                | 150             | 60       |
| 0.4           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 150             | 75       | 47,700                      | 130             | 50       | 39,800                        | 110             | 55       | 23,900                                                                                                                                                                                                                                                               | 50              | 25       | 50,000                                                                                                                                                | 200             | 80       |
| 0.5           | 41,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 170             | 85       | 38,200                      | 130             | 50       | 31,800                        | 110             | 55       | 19,100                                                                                                                                                                                                                                                               | 60              | 30       | 44,600                                                                                                                                                | 220             | 90       |
| 1             | 20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 210             | 100      | 19,100                      | 150             | 55       | 15,900                        | 130             | 65       | 9,500                                                                                                                                                                                                                                                                | 75              | 40       | 22,300                                                                                                                                                | 270             | 95       |
| 1.5           | 13,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 210             | 100      | 12,700                      | 150             | 55       | 10,600                        | 130             | 65       | 6,400                                                                                                                                                                                                                                                                | 75              | 40       | 14,900                                                                                                                                                | 300             | 100      |
| 2             | 10,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 210             | 100      | 9,500                       | 170             | 60       | 8,000                         | 150             | 75       | 4,800                                                                                                                                                                                                                                                                | 75              | 40       | 11,100                                                                                                                                                | 330             | 120      |
| 2.5           | 8,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 250             | 120      | 7,600                       | 180             | 65       | 6,400                         | 160             | 80       | 3,800                                                                                                                                                                                                                                                                | 75              | 40       | 8,900                                                                                                                                                 | 360             | 120      |
| 3             | 6,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 280             | 140      | 6,400                       | 190             | 70       | 5,300                         | 170             | 85       | 3,200                                                                                                                                                                                                                                                                | 80              | 40       | 7,400                                                                                                                                                 | 370             | 130      |
| 3.5           | 5,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 300             | 150      | 5,500                       | 190             | 70       | 4,500                         | 170             | 85       | 2,700                                                                                                                                                                                                                                                                | 85              | 45       | 6,400                                                                                                                                                 | 380             | 130      |
| 4             | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 310             | 160      | 4,800                       | 190             | 70       | 4,000                         | 170             | 85       | 2,400                                                                                                                                                                                                                                                                | 95              | 50       | 5,600                                                                                                                                                 | 390             | 130      |
| 4.5           | 4,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 320             | 160      | 4,200                       | 210             | 75       | 3,500                         | 190             | 95       | 2,100                                                                                                                                                                                                                                                                | 95              | 50       | 5,000                                                                                                                                                 | 400             | 130      |
| 5             | 4,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 330             | 160      | 3,800                       | 230             | 75       | 3,200                         | 210             | 110      | 1,900                                                                                                                                                                                                                                                                | 95              | 50       | 4,500                                                                                                                                                 | 410             | 130      |
| 5.5           | 3,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 330             | 160      | 3,500                       | 240             | 80       | 2,900                         | 220             | 110      | 1,700                                                                                                                                                                                                                                                                | 95              | 50       | 4,100                                                                                                                                                 | 410             | 130      |
| 6             | 3,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 340             | 170      | 3,200                       | 260             | 85       | 2,700                         | 240             | 120      | 1,600                                                                                                                                                                                                                                                                | 100             | 50       | 3,700                                                                                                                                                 | 410             | 130      |
| 7             | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 330             | 170      | 2,700                       | 250             | 80       | 2,300                         | 230             | 120      | 1,400                                                                                                                                                                                                                                                                | 100             | 50       | 3,200                                                                                                                                                 | 380             | 130      |
| 8             | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 320             | 160      | 2,400                       | 240             | 75       | 2,000                         | 220             | 110      | 1,200                                                                                                                                                                                                                                                                | 100             | 50       | 2,800                                                                                                                                                 | 360             | 120      |
| 9             | 2,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 310             | 150      | 2,100                       | 230             | 75       | 1,800                         | 220             | 110      | 1,100                                                                                                                                                                                                                                                                | 100             | 50       | 2,500                                                                                                                                                 | 350             | 120      |
| 10            | 2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 300             | 150      | 1,900                       | 230             | 75       | 1,600                         | 210             | 100      | 1,000                                                                                                                                                                                                                                                                | 100             | 50       | 2,200                                                                                                                                                 | 330             | 110      |
| 12            | 1,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 270             | 140      | 1,600                       | 220             | 70       | 1,300                         | 200             | 100      | 800                                                                                                                                                                                                                                                                  | 100             | 50       | 1,900                                                                                                                                                 | 320             | 110      |
| Depth of Cut  | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 0.3\sim 0.9=0.05D</math><br/><math>\phi 1\sim 2.9=0.07D</math><br/><math>\phi 3\sim 12=0.15D</math></div> <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 0.1\sim 0.4=0.05D</math><br/><math>\phi 0.5\sim 1.4=0.15D</math><br/><math>\phi 1.5\sim 3.9=0.5D</math><br/><math>\phi 4\sim 12=0.75D</math></div> |                 |          |                             |                 |          |                               |                 |          | <div>Side Milling</div> <div></div> <div><math>0.02D</math></div>                                                                                                               |                 |          | <div>Side Milling</div> <div></div> <div><math>0.2D</math></div> |                 |          |
|               | <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 0.1\sim 0.4=0.05D</math><br/><math>\phi 0.5\sim 12=0.15D</math></div>                                                                                                                                                                                                                                                                                                                                                     |                 |          |                             |                 |          |                               |                 |          | <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 0.1\sim 0.4=0.1D</math><br/><math>\phi 0.5\sim 1.4=0.4D</math><br/><math>\phi 1.5\sim 12=0.75D</math></div> |                 |          |                                                                                                                                                       |                 |          |
| Notes         | ※1 Use cutting fluid.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Recommend to use oil mist coolant for machining hardened steels.<br>※4 Adjust both spindle speed and feed at the same rate.<br>※5 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                                                                                                                                                                                                                         |                 |          |                             |                 |          |                               |                 |          |                                                                                                                                                                                                                                                                      |                 |          |                                                                                                                                                       |                 |          |

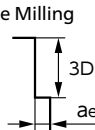
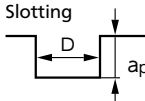
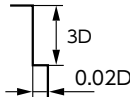
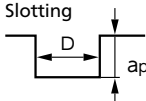
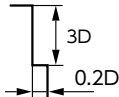
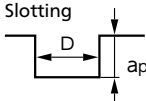
## Recommended Milling Conditions

Technical drawing of a drill bit. The drawing shows a side view of the drill bit with a cutting edge. The diameter is labeled  $D$ , the total length is labeled  $L$ , and the length of the cutting edge is labeled  $l$ .

- Unit : mm

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00035-00340 | 3.4      | 10.2              | 12°                  | 6              | 45                 |
| 08-00035-00350 | 3.5      | 10.5              | 12°                  | 6              | 45                 |
| 08-00035-00360 | 3.6      | 10.8              | 12°                  | 6              | 45                 |
| 08-00035-00370 | 3.7      | 11.1              | 12°                  | 6              | 45                 |
| 08-00035-00380 | 3.8      | 11.4              | 12°                  | 6              | 45                 |
| 08-00035-00390 | 3.9      | 11.7              | 12°                  | 6              | 45                 |
| 08-00035-00400 | 4        | 12                | 12°                  | 6              | 50                 |
| 08-00035-00410 | 4.1      | 12.3              | 12°                  | 6              | 50                 |
| 08-00035-00420 | 4.2      | 12.6              | 12°                  | 6              | 50                 |
| 08-00035-00430 | 4.3      | 12.9              | 12°                  | 6              | 50                 |
| 08-00035-00440 | 4.4      | 13.2              | 12°                  | 6              | 50                 |
| 08-00035-00450 | 4.5      | 13.5              | 12°                  | 6              | 50                 |
| 08-00035-00460 | 4.6      | 13.8              | 12°                  | 6              | 55                 |
| 08-00035-00470 | 4.7      | 14.1              | 12°                  | 6              | 55                 |
| 08-00035-00480 | 4.8      | 14.4              | 12°                  | 6              | 55                 |
| 08-00035-00490 | 4.9      | 14.7              | 12°                  | 6              | 55                 |
| 08-00035-00500 | 5        | 15                | 12°                  | 6              | 55                 |
| 08-00035-00510 | 5.1      | 15.3              | 12°                  | 6              | 55                 |
| 08-00035-00520 | 5.2      | 15.6              | 12°                  | 6              | 55                 |
| 08-00035-00530 | 5.3      | 15.9              | 12°                  | 6              | 55                 |
| 08-00035-00540 | 5.4      | 16.2              | 12°                  | 6              | 55                 |
| 08-00035-00550 | 5.5      | 16.5              | 12°                  | 6              | 60                 |
| 08-00035-00560 | 5.6      | 16.8              | 12°                  | 6              | 60                 |
| 08-00035-00570 | 5.7      | 17.1              | 12°                  | 6              | 60                 |
| 08-00035-00580 | 5.8      | 17.4              | 12°                  | 6              | 60                 |
| 08-00035-00590 | 5.9      | 17.7              | 12°                  | 6              | 60                 |
| 08-00035-00600 | 6        | 18                | —                    | 6              | 60                 |
| 08-00035-00700 | 7        | 21                | 12°                  | 8              | 65                 |
| 08-00035-00800 | 8        | 24                | —                    | 8              | 65                 |
| 08-00035-00900 | 9        | 27                | 12°                  | 10             | 75                 |
| 08-00035-01000 | 10       | 30                | —                    | 10             | 75                 |
| 08-00035-01200 | 12       | 36                | —                    | 12             | 80                 |

H-011

| Work Material                                                                                                                                                                                                                                                                                                                                         | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |          | Alloy Steels<br>SCM・SKD・SUS |              |          | Prehardened Steels<br>HPM・NAK |              |          | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                                                                                                                                                                                                                             |              |          | Copper                                                                                                                                                                                                                                                                                                                                                                                                  |        |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------|--------------|----------|-------------------------------|--------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|
| Cutting Speed                                                                                                                                                                                                                                                                                                                                         | 45～75m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |          | 45～65m/min                  |              |          | 35～55m/min                    |              |          | 15～35m/min                                                                                                                                                                                                                                                                                                                                                    |              |          | 55～75m/min                                                                                                                                                                                                                                                                                                                                                                                              |        |     |
| Dia.                                                                                                                                                                                                                                                                                                                                                  | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Feed         |          | Spindle Speed               | Feed         |          | Spindle Speed                 | Feed         |          | Spindle Speed                                                                                                                                                                                                                                                                                                                                                 | Feed         |          | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                           | Feed   |     |
|                                                                                                                                                                                                                                                                                                                                                       | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | mm/min       |          | min <sup>-1</sup>           | mm/min       |          | min <sup>-1</sup>             | mm/min       |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                             | mm/min       |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                       | mm/min |     |
|                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Side Milling | Slotting |                             | Side Milling | Slotting |                               | Side Milling | Slotting |                                                                                                                                                                                                                                                                                                                                                               | Side Milling | Slotting |                                                                                                                                                                                                                                                                                                                                                                                                         |        |     |
| 0.1                                                                                                                                                                                                                                                                                                                                                   | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | —            | 25       | 50,000                      | —            | 15       | 50,000                        | —            | 20       | 50,000                                                                                                                                                                                                                                                                                                                                                        | —            | 15       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                  | 60     | 25  |
| 0.2                                                                                                                                                                                                                                                                                                                                                   | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | —            | 40       | 50,000                      | —            | 25       | 50,000                        | —            | 30       | 39,800                                                                                                                                                                                                                                                                                                                                                        | —            | 20       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                  | 90     | 40  |
| 0.3                                                                                                                                                                                                                                                                                                                                                   | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 100          | 50       | 50,000                      | 90           | 35       | 47,700                        | 80           | 40       | 26,500                                                                                                                                                                                                                                                                                                                                                        | —            | 20       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                  | 150    | 60  |
| 0.4                                                                                                                                                                                                                                                                                                                                                   | 47,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 140          | 70       | 43,800                      | 120          | 50       | 35,800                        | 100          | 50       | 19,900                                                                                                                                                                                                                                                                                                                                                        | —            | 20       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                  | 200    | 80  |
| 0.5                                                                                                                                                                                                                                                                                                                                                   | 38,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 150          | 75       | 35,000                      | 120          | 50       | 28,600                        | 100          | 50       | 15,900                                                                                                                                                                                                                                                                                                                                                        | 50           | 25       | 41,400                                                                                                                                                                                                                                                                                                                                                                                                  | 210    | 85  |
| 1                                                                                                                                                                                                                                                                                                                                                     | 19,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 190          | 95       | 17,500                      | 140          | 50       | 14,300                        | 110          | 60       | 8,000                                                                                                                                                                                                                                                                                                                                                         | 65           | 30       | 20,700                                                                                                                                                                                                                                                                                                                                                                                                  | 250    | 90  |
| 1.5                                                                                                                                                                                                                                                                                                                                                   | 12,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 190          | 95       | 11,700                      | 140          | 50       | 9,500                         | 110          | 60       | 5,300                                                                                                                                                                                                                                                                                                                                                         | 65           | 30       | 13,800                                                                                                                                                                                                                                                                                                                                                                                                  | 280    | 100 |
| 2                                                                                                                                                                                                                                                                                                                                                     | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 190          | 95       | 8,800                       | 160          | 55       | 7,200                         | 140          | 70       | 4,000                                                                                                                                                                                                                                                                                                                                                         | 65           | 30       | 10,300                                                                                                                                                                                                                                                                                                                                                                                                  | 310    | 110 |
| 2.5                                                                                                                                                                                                                                                                                                                                                   | 7,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 230          | 110      | 7,000                       | 170          | 60       | 5,700                         | 140          | 70       | 3,200                                                                                                                                                                                                                                                                                                                                                         | 70           | 35       | 8,300                                                                                                                                                                                                                                                                                                                                                                                                   | 330    | 120 |
| 3                                                                                                                                                                                                                                                                                                                                                     | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 260          | 130      | 5,800                       | 170          | 60       | 4,800                         | 150          | 80       | 2,700                                                                                                                                                                                                                                                                                                                                                         | 70           | 35       | 6,900                                                                                                                                                                                                                                                                                                                                                                                                   | 350    | 120 |
| 3.5                                                                                                                                                                                                                                                                                                                                                   | 5,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 270          | 135      | 5,000                       | 180          | 60       | 4,100                         | 150          | 80       | 2,300                                                                                                                                                                                                                                                                                                                                                         | 75           | 35       | 5,900                                                                                                                                                                                                                                                                                                                                                                                                   | 350    | 120 |
| 4                                                                                                                                                                                                                                                                                                                                                     | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 280          | 140      | 4,400                       | 180          | 60       | 3,600                         | 150          | 80       | 2,000                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 5,200                                                                                                                                                                                                                                                                                                                                                                                                   | 360    | 120 |
| 4.5                                                                                                                                                                                                                                                                                                                                                   | 4,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 290          | 145      | 3,900                       | 200          | 65       | 3,200                         | 170          | 90       | 1,800                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 4,600                                                                                                                                                                                                                                                                                                                                                                                                   | 360    | 120 |
| 5                                                                                                                                                                                                                                                                                                                                                     | 3,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300          | 150      | 3,500                       | 210          | 70       | 2,900                         | 190          | 95       | 1,600                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 4,100                                                                                                                                                                                                                                                                                                                                                                                                   | 370    | 120 |
| 5.5                                                                                                                                                                                                                                                                                                                                                   | 3,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 310          | 155      | 3,200                       | 220          | 70       | 2,600                         | 200          | 100      | 1,400                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 3,800                                                                                                                                                                                                                                                                                                                                                                                                   | 370    | 120 |
| 6                                                                                                                                                                                                                                                                                                                                                     | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 320          | 160      | 2,900                       | 230          | 75       | 2,400                         | 210          | 110      | 1,300                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 3,400                                                                                                                                                                                                                                                                                                                                                                                                   | 370    | 120 |
| 7                                                                                                                                                                                                                                                                                                                                                     | 2,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300          | 150      | 2,500                       | 220          | 70       | 2,000                         | 200          | 100      | 1,100                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 3,000                                                                                                                                                                                                                                                                                                                                                                                                   | 360    | 120 |
| 8                                                                                                                                                                                                                                                                                                                                                     | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 280          | 140      | 2,200                       | 220          | 70       | 1,800                         | 200          | 100      | 1,000                                                                                                                                                                                                                                                                                                                                                         | 80           | 40       | 2,600                                                                                                                                                                                                                                                                                                                                                                                                   | 340    | 110 |
| 9                                                                                                                                                                                                                                                                                                                                                     | 2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 270          | 135      | 1,900                       | 210          | 65       | 1,600                         | 190          | 95       | 900                                                                                                                                                                                                                                                                                                                                                           | 80           | 40       | 2,300                                                                                                                                                                                                                                                                                                                                                                                                   | 330    | 100 |
| 10                                                                                                                                                                                                                                                                                                                                                    | 1,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 260          | 130      | 1,800                       | 210          | 65       | 1,400                         | 180          | 90       | 800                                                                                                                                                                                                                                                                                                                                                           | 80           | 40       | 2,100                                                                                                                                                                                                                                                                                                                                                                                                   | 320    | 100 |
| 12                                                                                                                                                                                                                                                                                                                                                    | 1,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 260          | 130      | 1,500                       | 210          | 65       | 1,200                         | 170          | 85       | 700                                                                                                                                                                                                                                                                                                                                                           | 80           | 40       | 1,700                                                                                                                                                                                                                                                                                                                                                                                                   | 290    | 95  |
| Depth of Cut<br><br>(D: Dia.)                                                                                                                                                                                                                                                                                                                         | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 0.3 \sim 0.9 = 0.04D</math><br/><math>\phi 1 \sim 2.9 = 0.05D</math><br/><math>\phi 3 \sim 12 = 0.1D</math></div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.4 = 0.05D</math><br/><math>\phi 0.5 \sim 1.4 = 0.08D</math><br/><math>\phi 1.5 \sim 3.9 = 0.25D</math><br/><math>\phi 4 \sim 12 = 0.4D</math></div> |              |          |                             |              |          |                               |              |          | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.4 = 0.05D</math><br/><math>\phi 0.5 \sim 12 = 0.1D</math></div> |              |          | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.4 = 0.05D</math><br/><math>\phi 0.5 \sim 1.4 = 0.3D</math><br/><math>\phi 1.5 \sim 12 = 0.5D</math></div> |        |     |
|                                                                                                                                                                                                                                                                                                                                                       | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |          |                             |              |          |                               |              |          |                                                                                                                                                                                                                                                                                                                                                               |              |          |                                                                                                                                                                                                                                                                                                                                                                                                         |        |     |
| <div>※1 Use cutting fluid.</div> <div>※2 Use cutting fluid with smoke retardant.</div> <div>※3 Recommend to use oil mist coolant for machining hardened steels.</div> <div>※4 Adjust both spindle speed and feed at the same rate.</div> <div>※5 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.</div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |              |          |                             |              |          |                               |              |          |                                                                                                                                                                                                                                                                                                                                                               |              |          |                                                                                                                                                                                                                                                                                                                                                                                                         |        |     |

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Square

MX240

Size  $\phi$  0.3 ~  $\phi$  12

MG

2

40°

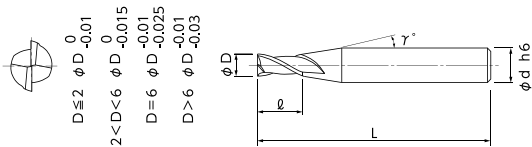
Side

Face

MUGEN COATING 2-Flute LEAD40 End Mill

Recommended Milling Conditions

For various work materials. L/D=4. For side milling only.



$D \leq 2$

$2 < D < 6$

$D = 6$

$D > 6$

$\phi D \begin{smallmatrix} 0 \\ -0.01 \end{smallmatrix}$

$\phi D \begin{smallmatrix} 0 \\ -0.015 \end{smallmatrix}$

$\phi D \begin{smallmatrix} -0.01 \\ -0.025 \end{smallmatrix}$

$\phi D \begin{smallmatrix} -0.01 \\ -0.03 \end{smallmatrix}$

L/D=4 and helix 40° is suitable for deep machining with minimum deflection of cutting up-right surface.

| Code No.       | Dia.<br>(D) | Length<br>of Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 08-00040-00030 | 0.3         | 1.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00040 | 0.4         | 1.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00050 | 0.5         | 2                       | 12°                                 | 4                    | 45                       |
| 08-00040-00060 | 0.6         | 2.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00070 | 0.7         | 2.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00080 | 0.8         | 3.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00090 | 0.9         | 3.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00100 | 1           | 4                       | 12°                                 | 4                    | 45                       |
| 08-00040-00110 | 1.1         | 4.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00120 | 1.2         | 4.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00130 | 1.3         | 5.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00140 | 1.4         | 5.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00150 | 1.5         | 6                       | 12°                                 | 4                    | 45                       |
| 08-00040-00160 | 1.6         | 6.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00170 | 1.7         | 6.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00180 | 1.8         | 7.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00190 | 1.9         | 7.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00200 | 2           | 8                       | 12°                                 | 4                    | 45                       |
| 08-00040-00210 | 2.1         | 8.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00220 | 2.2         | 8.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00230 | 2.3         | 9.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00240 | 2.4         | 9.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00250 | 2.5         | 10                      | 12°                                 | 4                    | 45                       |
| 08-00040-00260 | 2.6         | 10.4                    | 12°                                 | 4                    | 50                       |
| 08-00040-00270 | 2.7         | 10.8                    | 12°                                 | 4                    | 50                       |
| 08-00040-00280 | 2.8         | 11.2                    | 12°                                 | 4                    | 50                       |
| 08-00040-00290 | 2.9         | 11.6                    | 12°                                 | 4                    | 50                       |
| 08-00040-00300 | 3           | 12                      | 12°                                 | 6                    | 50                       |
| 08-00040-00310 | 3.1         | 12.4                    | 12°                                 | 6                    | 50                       |
| 08-00040-00320 | 3.2         | 12.8                    | 12°                                 | 6                    | 50                       |
| 08-00040-00330 | 3.3         | 13.2                    | 12°                                 | 6                    | 50                       |
| 08-00040-00340 | 3.4         | 13.6                    | 12°                                 | 6                    | 50                       |

| Code No.       | Dia.<br>(D) | Length<br>of Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 08-00040-00350 | 3.5         | 14                      | 12°                                 | 6                    | 50                       |
| 08-00040-00360 | 3.6         | 14.4                    | 12°                                 | 6                    | 50                       |
| 08-00040-00370 | 3.7         | 14.8                    | 12°                                 | 6                    | 50                       |
| 08-00040-00380 | 3.8         | 15.2                    | 12°                                 | 6                    | 50                       |
| 08-00040-00390 | 3.9         | 15.6                    | 12°                                 | 6                    | 50                       |
| 08-00040-00400 | 4           | 16                      | 12°                                 | 6                    | 55                       |
| 08-00040-00410 | 4.1         | 16.4                    | 12°                                 | 6                    | 55                       |
| 08-00040-00420 | 4.2         | 16.8                    | 12°                                 | 6                    | 55                       |
| 08-00040-00430 | 4.3         | 17.2                    | 12°                                 | 6                    | 55                       |
| 08-00040-00440 | 4.4         | 17.6                    | 12°                                 | 6                    | 55                       |
| 08-00040-00450 | 4.5         | 18                      | 12°                                 | 6                    | 55                       |
| 08-00040-00460 | 4.6         | 18.4                    | 12°                                 | 6                    | 55                       |
| 08-00040-00470 | 4.7         | 18.8                    | 12°                                 | 6                    | 55                       |
| 08-00040-00480 | 4.8         | 19.2                    | 12°                                 | 6                    | 55                       |
| 08-00040-00490 | 4.9         | 19.6                    | 12°                                 | 6                    | 55                       |
| 08-00040-00500 | 5           | 20                      | 12°                                 | 6                    | 60                       |
| 08-00040-00510 | 5.1         | 20.4                    | 12°                                 | 6                    | 60                       |
| 08-00040-00520 | 5.2         | 20.8                    | 12°                                 | 6                    | 60                       |
| 08-00040-00530 | 5.3         | 21.2                    | 12°                                 | 6                    | 60                       |
| 08-00040-00540 | 5.4         | 21.6                    | 12°                                 | 6                    | 60                       |
| 08-00040-00550 | 5.5         | 22                      | 12°                                 | 6                    | 65                       |
| 08-00040-00560 | 5.6         | 22.4                    | 12°                                 | 6                    | 65                       |
| 08-00040-00570 | 5.7         | 22.8                    | 12°                                 | 6                    | 65                       |
| 08-00040-00580 | 5.8         | 23.2                    | 12°                                 | 6                    | 65                       |
| 08-00040-00590 | 5.9         | 23.6                    | 12°                                 | 6                    | 65                       |
| 08-00040-00600 | 6           | 24                      | —                                   | 6                    | 65                       |
| 08-00040-00700 | 7           | 28                      | 12°                                 | 8                    | 90                       |
| 08-00040-00800 | 8           | 32                      | —                                   | 8                    | 90                       |
| 08-00040-00900 | 9           | 36                      | 12°                                 | 10                   | 100                      |
| 08-00040-01000 | 10          | 40                      | —                                   | 10                   | 100                      |
| 08-00040-01200 | 12          | 48                      | —                                   | 12                   | 105                      |

Unit : mm

How to Order

When you order, indicate MX240 (D).    ※(  $\gamma$  ) is reference value.

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Square

MX240

Size  $\phi$  0.3 ~  $\phi$  12

MG

2

40°

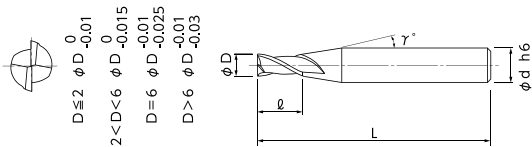
Side

Face

MUGEN COATING 2-Flute LEAD40 End Mill

Recommended Milling Conditions

For various work materials. L/D=4. For side milling only.



$D \leq 2$

$2 < D < 6$

$D = 6$

$D > 6$

$\phi D \begin{smallmatrix} 0 \\ -0.01 \end{smallmatrix}$

$\phi D \begin{smallmatrix} 0 \\ -0.015 \end{smallmatrix}$

$\phi D \begin{smallmatrix} -0.01 \\ -0.025 \end{smallmatrix}$

$\phi D \begin{smallmatrix} -0.01 \\ -0.03 \end{smallmatrix}$

L/D=4 and helix 40° is suitable for deep machining with minimum deflection of cutting up-right surface.

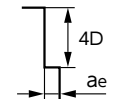
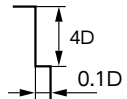
| Code No.       | Dia.<br>(D) | Length<br>of Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 08-00040-00030 | 0.3         | 1.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00040 | 0.4         | 1.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00050 | 0.5         | 2                       | 12°                                 | 4                    | 45                       |
| 08-00040-00060 | 0.6         | 2.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00070 | 0.7         | 2.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00080 | 0.8         | 3.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00090 | 0.9         | 3.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00100 | 1           | 4                       | 12°                                 | 4                    | 45                       |
| 08-00040-00110 | 1.1         | 4.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00120 | 1.2         | 4.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00130 | 1.3         | 5.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00140 | 1.4         | 5.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00150 | 1.5         | 6                       | 12°                                 | 4                    | 45                       |
| 08-00040-00160 | 1.6         | 6.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00170 | 1.7         | 6.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00180 | 1.8         | 7.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00190 | 1.9         | 7.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00200 | 2           | 8                       | 12°                                 | 4                    | 45                       |
| 08-00040-00210 | 2.1         | 8.4                     | 12°                                 | 4                    | 45                       |
| 08-00040-00220 | 2.2         | 8.8                     | 12°                                 | 4                    | 45                       |
| 08-00040-00230 | 2.3         | 9.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00240 | 2.4         | 9.6                     | 12°                                 | 4                    | 45                       |
| 08-00040-00250 | 2.5         | 10                      | 12°                                 | 4                    | 45                       |
| 08-00040-00260 | 2.6         | 10.4                    | 12°                                 | 4                    | 50                       |
| 08-00040-00270 | 2.7         | 10.8                    | 12°                                 | 4                    | 50                       |
| 08-00040-00280 | 2.8         | 11.2                    | 12°                                 | 4                    | 50                       |
| 08-00040-00290 | 2.9         | 11.6                    | 12°                                 | 4                    | 50                       |
| 08-00040-00300 | 3           | 12                      | 12°                                 | 6                    | 50                       |
| 08-00040-00310 | 3.1         | 12.4                    | 12°                                 | 6                    | 50                       |
| 08-00040-00320 | 3.2         | 12.8                    | 12°                                 | 6                    | 50                       |
| 08-00040-00330 | 3.3         | 13.2                    | 12°                                 | 6                    | 50                       |
| 08-00040-00340 | 3.4         | 13.6                    | 12°                                 | 6                    | 50                       |

| Code No.       | Dia.<br>(D) | Length<br>of Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 08-00040-00350 | 3.5         | 14                      | 12°                                 | 6                    | 50                       |
| 08-00040-00360 | 3.6         | 14.4                    | 12°                                 | 6                    | 50                       |
| 08-00040-00370 | 3.7         | 14.8                    | 12°                                 | 6                    | 50                       |
| 08-00040-00380 | 3.8         | 15.2                    | 12°                                 | 6                    | 50                       |
| 08-00040-00390 | 3.9         | 15.6                    | 12°                                 | 6                    | 50                       |
| 08-00040-00400 | 4           | 16                      | 12°                                 | 6                    | 55                       |
| 08-00040-00410 | 4.1         | 16.4                    | 12°                                 | 6                    | 55                       |
| 08-00040-00420 | 4.2         | 16.8                    | 12°                                 | 6                    | 55                       |
| 08-00040-00430 | 4.3         | 17.2                    | 12°                                 | 6                    | 55                       |
| 08-00040-00440 | 4.4         | 17.6                    | 12°                                 | 6                    | 55                       |
| 08-00040-00450 | 4.5         | 18                      | 12°                                 | 6                    | 55                       |
| 08-00040-00460 | 4.6         | 18.4                    | 12°                                 | 6                    | 55                       |
| 08-00040-00470 | 4.7         | 18.8                    | 12°                                 | 6                    | 55                       |
| 08-00040-00480 | 4.8         | 19.2                    | 12°                                 | 6                    | 55                       |
| 08-00040-00490 | 4.9         | 19.6                    | 12°                                 | 6                    | 55                       |
| 08-00040-00500 | 5           | 20                      | 12°                                 | 6                    | 60                       |
| 08-00040-00510 | 5.1         | 20.4                    | 12°                                 | 6                    | 60                       |
| 08-00040-00520 | 5.2         | 20.8                    | 12°                                 | 6                    | 60                       |
| 08-00040-00530 | 5.3         | 21.2                    | 12°                                 | 6                    | 60                       |
| 08-00040-00540 | 5.4         | 21.6                    | 12°                                 | 6                    | 60                       |
| 08-00040-00550 | 5.5         | 22                      | 12°                                 | 6                    | 65                       |
| 08-00040-00560 | 5.6         | 22.4                    | 12°                                 | 6                    | 65                       |
| 08-00040-00570 | 5.7         | 22.8                    | 12°                                 | 6                    | 65                       |
| 08-00040-00580 | 5.8         | 23.2                    | 12°                                 | 6                    | 65                       |
| 08-00040-00590 | 5.9         | 23.6                    | 12°                                 | 6                    | 65                       |
| 08-00040-00600 | 6           | 24                      | —                                   | 6                    | 65                       |
| 08-00040-00700 | 7           | 28                      | 12°                                 | 8                    | 90                       |
| 08-00040-00800 | 8           | 32                      | —                                   | 8                    | 90                       |
| 08-00040-00900 | 9           | 36                      | 12°                                 | 10                   | 100                      |
| 08-00040-01000 | 10          | 40                      | —                                   | 10                   | 100                      |
| 08-00040-01200 | 12          | 48                      | —                                   | 12                   | 105                      |

Unit : mm

How to Order

When you order, indicate MX240 (D).    ※(  $\gamma$  ) is reference value.

| Work Material                  | Carbon Steels<br>S50C                                                                                                                                                                                                                                                           |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Copper                                                                                                                                  |        |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------|--------|
| Cutting Speed                  | 20~30m/min                                                                                                                                                                                                                                                                      |        | 15~25m/min                  |        | 15~20m/min                    |        | 20~40m/min                                                                                                                              |        |
| Dia.                           | Spindle<br>Speed                                                                                                                                                                                                                                                                | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                                                                                                                        | Feed   |
|                                | min <sup>-1</sup>                                                                                                                                                                                                                                                               | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                                                                       | mm/min |
| 0.3                            | 26,500                                                                                                                                                                                                                                                                          | 50     | 21,200                      | 40     | 18,600                        | 30     | 31,800                                                                                                                                  | 100    |
| 0.4                            | 19,900                                                                                                                                                                                                                                                                          | 60     | 15,900                      | 45     | 13,900                        | 40     | 23,900                                                                                                                                  | 100    |
| 0.5                            | 15,900                                                                                                                                                                                                                                                                          | 65     | 12,700                      | 45     | 11,100                        | 40     | 19,100                                                                                                                                  | 100    |
| 1                              | 8,000                                                                                                                                                                                                                                                                           | 80     | 6,400                       | 50     | 5,600                         | 45     | 9,500                                                                                                                                   | 110    |
| 1.5                            | 5,300                                                                                                                                                                                                                                                                           | 80     | 4,200                       | 50     | 3,700                         | 45     | 6,400                                                                                                                                   | 130    |
| 2                              | 4,000                                                                                                                                                                                                                                                                           | 80     | 3,200                       | 60     | 2,800                         | 50     | 4,800                                                                                                                                   | 140    |
| 2.5                            | 3,200                                                                                                                                                                                                                                                                           | 100    | 2,500                       | 60     | 2,200                         | 55     | 3,800                                                                                                                                   | 150    |
| 3                              | 2,700                                                                                                                                                                                                                                                                           | 110    | 2,100                       | 60     | 1,900                         | 60     | 3,200                                                                                                                                   | 160    |
| 3.5                            | 2,300                                                                                                                                                                                                                                                                           | 120    | 1,800                       | 60     | 1,600                         | 60     | 2,700                                                                                                                                   | 170    |
| 4                              | 2,000                                                                                                                                                                                                                                                                           | 120    | 1,600                       | 65     | 1,400                         | 60     | 2,400                                                                                                                                   | 170    |
| 4.5                            | 1,800                                                                                                                                                                                                                                                                           | 130    | 1,400                       | 70     | 1,200                         | 65     | 2,100                                                                                                                                   | 170    |
| 5                              | 1,600                                                                                                                                                                                                                                                                           | 130    | 1,300                       | 80     | 1,100                         | 70     | 1,900                                                                                                                                   | 170    |
| 5.5                            | 1,400                                                                                                                                                                                                                                                                           | 130    | 1,200                       | 90     | 1,000                         | 80     | 1,700                                                                                                                                   | 180    |
| 6                              | 1,300                                                                                                                                                                                                                                                                           | 130    | 1,100                       | 90     | 900                           | 80     | 1,600                                                                                                                                   | 180    |
| 7                              | 1,100                                                                                                                                                                                                                                                                           | 120    | 900                         | 90     | 800                           | 80     | 1,400                                                                                                                                   | 170    |
| 8                              | 1,000                                                                                                                                                                                                                                                                           | 120    | 800                         | 80     | 700                           | 75     | 1,200                                                                                                                                   | 160    |
| 9                              | 900                                                                                                                                                                                                                                                                             | 110    | 700                         | 80     | 650                           | 75     | 1,100                                                                                                                                   | 155    |
| 10                             | 800                                                                                                                                                                                                                                                                             | 110    | 600                         | 70     | 600                           | 75     | 1,000                                                                                                                                   | 150    |
| 12                             | 700                                                                                                                                                                                                                                                                             | 110    | 500                         | 70     | 500                           | 75     | 800                                                                                                                                     | 140    |
| Depth of Cut<br><br>(D : Dia.) | <div>Side Milling</div> <div><div><math>a_e</math><br/><math>\phi 0.3 \sim 0.9 = 0.03D</math><br/><math>\phi 1 \sim 2.9 = 0.04D</math><br/><math>\phi 3 \sim 12 = 0.08D</math></div></div> |        |                             |        |                               |        | <div>Side Milling</div> <div><div>0.1D</div></div> |        |
| Notes                          | ※1 Use cutting fluid.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                             |        |                             |        |                               |        |                                                                                                                                         |        |

How to Order

When you order, indicate MX240 (D).    ※(  $\gamma$  ) is reference value.

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Square

MX240

Size  $\phi$  0.3 ~  $\phi$  12

MG

2

40°

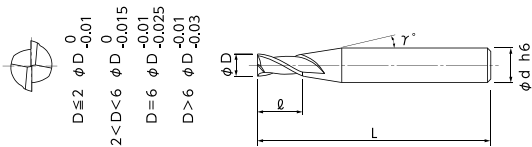
Side

Face

MUGEN COATING 2-Flute LEAD40 End Mill

Recommended Milling Conditions

For various work materials. L/D=4. For side milling only.



$D \leq 2$

$2 < D < 6$

$D = 6$

$D > 6$

$\phi D \begin{smallmatrix} 0 \\ -0.01 \end{smallmatrix}$

$\phi D \begin{smallmatrix} 0 \\ -0.015 \end{smallmatrix}$

$\phi D \begin{smallmatrix} -0.01 \\ -0.025 \end{smallmatrix}$

$\phi D \begin{smallmatrix} -0.01 \\ -0.03 \end{smallmatrix}$

L/D=4 and helix 40° is suitable for deep machining with minimum deflection of cutting up-right surface.

| Code No.       | Dia.<br>(D) | Length<br>of Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 08-00040-00030 | 0.3         | 1.2                     | 12°                                 | 4                    | 45                       |
| 08-00040-00040 | 0.4         | 1.6                     | 12°                                 | 4                    | 45                       |
|                |             |                         |                                     |                      |                          |



# MX425

Size  $\phi 1 \sim \phi 12$



# MX425

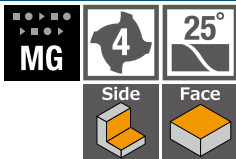
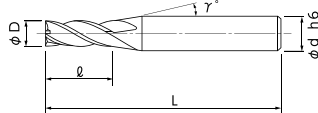
## MUGEN COATING 4-Flute LEAD25 End Mill

## Recommended Milling Conditions

For various work materials. L/D=1.  
Suitable for side milling with 4-flute



|             |        |     |        |
|-------------|--------|-----|--------|
| $D \geq 3$  | $\phi$ | $D$ | 0      |
|             |        |     | -0.01  |
| $3 < D < 6$ | $\phi$ | $D$ | 0      |
|             |        |     | -0.015 |
| $D = 6$     | $\phi$ | $D$ | -0.01  |
|             |        |     | -0.025 |
| $D > 6$     | $\phi$ | $D$ | -0.01  |
|             |        |     | -0.03  |



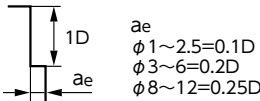
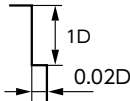
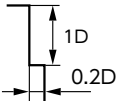
- L/D=1 and helix 25° type, increased the rigidity to suppress chattering and minimized milling deflection.

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00075-00100 | 1        | 1                 | 12°                  | 4              | 45                 |
| 08-00075-00150 | 1.5      | 1.5               | 12°                  | 4              | 45                 |
| 08-00075-00200 | 2        | 2                 | 12°                  | 4              | 45                 |
| 08-00075-00250 | 2.5      | 2.5               | 12°                  | 4              | 45                 |
| 08-00075-00300 | 3        | 3                 | 12°                  | 6              | 45                 |
| 08-00075-00350 | 3.5      | 3.5               | 12°                  | 6              | 45                 |
| 08-00075-00400 | 4        | 4                 | 12°                  | 6              | 45                 |
| 08-00075-00450 | 4.5      | 4.5               | 12°                  | 6              | 50                 |
| 08-00075-00500 | 5        | 5                 | 12°                  | 6              | 50                 |
| 08-00075-00550 | 5.5      | 5.5               | 12°                  | 6              | 50                 |
| 08-00075-00600 | 6        | 6                 | —                    | 6              | 50                 |
| 08-00075-00800 | 8        | 8                 | —                    | 8              | 65                 |
| 08-00075-01000 | 10       | 10                | —                    | 10             | 75                 |
| 08-00075-01200 | 12       | 12                | —                    | 12             | 80                 |

## How to Order

When you order, indicate MX425 (D). ※(γ) is reference value.

| Work Material                  | Carbon Steels<br>S50C                                                                                                                                                                                                                                                             |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC)                                                                     |        | Copper                                                                                                |        |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------|--------|
| Cutting Speed                  | 50～80m/min                                                                                                                                                                                                                                                                        |        | 50～70m/min                  |        | 40～60m/min                    |        | 20～40m/min                                                                                            |        | 60～80m/min                                                                                            |        |
| Dia.                           | Side Milling                                                                                                                                                                                                                                                                      |        | Side Milling                |        | Side Milling                  |        | Side Milling                                                                                          |        | Side Milling                                                                                          |        |
|                                | Spindle<br>Speed                                                                                                                                                                                                                                                                  | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                                                                                      | Feed   | Spindle<br>Speed                                                                                      | Feed   |
|                                | min <sup>-1</sup>                                                                                                                                                                                                                                                                 | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                                     | mm/min | min <sup>-1</sup>                                                                                     | mm/min |
| 1                              | 20,700                                                                                                                                                                                                                                                                            | 320    | 19,100                      | 230    | 15,900                        | 200    | 9,500                                                                                                 | 120    | 22,300                                                                                                | 410    |
| 1.5                            | 13,800                                                                                                                                                                                                                                                                            | 320    | 12,700                      | 230    | 10,600                        | 200    | 6,400                                                                                                 | 120    | 14,900                                                                                                | 450    |
| 2                              | 10,300                                                                                                                                                                                                                                                                            | 320    | 9,500                       | 260    | 8,000                         | 230    | 4,800                                                                                                 | 120    | 11,100                                                                                                | 500    |
| 2.5                            | 8,300                                                                                                                                                                                                                                                                             | 380    | 7,600                       | 270    | 6,400                         | 240    | 3,800                                                                                                 | 120    | 8,900                                                                                                 | 540    |
| 3                              | 6,900                                                                                                                                                                                                                                                                             | 420    | 6,400                       | 290    | 5,300                         | 260    | 3,200                                                                                                 | 120    | 7,400                                                                                                 | 560    |
| 3.5                            | 5,900                                                                                                                                                                                                                                                                             | 450    | 5,500                       | 290    | 4,500                         | 260    | 2,700                                                                                                 | 130    | 6,400                                                                                                 | 570    |
| 4                              | 5,200                                                                                                                                                                                                                                                                             | 530    | 4,800                       | 320    | 4,000                         | 290    | 2,400                                                                                                 | 160    | 5,600                                                                                                 | 660    |
| 4.5                            | 4,600                                                                                                                                                                                                                                                                             | 540    | 4,200                       | 360    | 3,500                         | 320    | 2,100                                                                                                 | 160    | 5,000                                                                                                 | 680    |
| 5                              | 4,100                                                                                                                                                                                                                                                                             | 560    | 3,800                       | 390    | 3,200                         | 360    | 1,900                                                                                                 | 160    | 4,500                                                                                                 | 700    |
| 5.5                            | 3,800                                                                                                                                                                                                                                                                             | 560    | 3,500                       | 410    | 2,900                         | 370    | 1,700                                                                                                 | 160    | 4,100                                                                                                 | 700    |
| 6                              | 3,400                                                                                                                                                                                                                                                                             | 580    | 3,200                       | 440    | 2,700                         | 410    | 1,600                                                                                                 | 170    | 3,700                                                                                                 | 700    |
| 8                              | 2,600                                                                                                                                                                                                                                                                             | 540    | 2,400                       | 410    | 2,000                         | 370    | 1,200                                                                                                 | 170    | 2,800                                                                                                 | 610    |
| 10                             | 2,100                                                                                                                                                                                                                                                                             | 510    | 1,900                       | 390    | 1,600                         | 360    | 1,000                                                                                                 | 170    | 2,200                                                                                                 | 560    |
| 12                             | 1,700                                                                                                                                                                                                                                                                             | 460    | 1,600                       | 370    | 1,300                         | 340    | 800                                                                                                   | 170    | 1,900                                                                                                 | 540    |
| Depth of Cut<br><br>(D : Dia.) | Side Milling<br>                                                                                                                                                                             |        |                             |        |                               |        | Side Milling<br> |        | Side Milling<br> |        |
| Notes                          | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |        |                             |        |                               |        |                                                                                                       |        |                                                                                                       |        |



# MX430

Size  $\phi 1 \sim \phi 12$

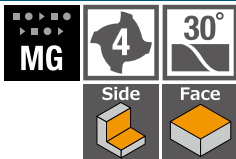
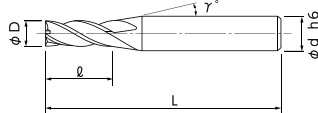
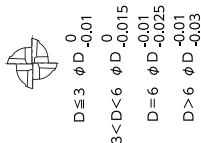


# MX430

## MUGEN COATING 4-Flute LEAD30 End Mill

## Recommended Milling Conditions

For various work materials. L/D=2.  
Suitable for side milling with 4-flute

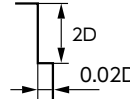
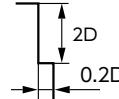


● L/D=2 and helix 30° standard type, applicable to any milling process.

| Unit : mm      |             |                      |                         |                   |                       |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(τ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 08-00080-00100 | 1           | 2                    | 12°                     | 4                 | 45                    |
| 08-00080-00150 | 1.5         | 3                    | 12°                     | 4                 | 45                    |
| 08-00080-00200 | 2           | 4                    | 12°                     | 4                 | 45                    |
| 08-00080-00250 | 2.5         | 5                    | 12°                     | 4                 | 45                    |
| 08-00080-00300 | 3           | 6                    | 12°                     | 6                 | 45                    |
| 08-00080-00350 | 3.5         | 7                    | 12°                     | 6                 | 45                    |
| 08-00080-00400 | 4           | 8                    | 12°                     | 6                 | 45                    |
| 08-00080-00450 | 4.5         | 9                    | 12°                     | 6                 | 50                    |
| 08-00080-00500 | 5           | 10                   | 12°                     | 6                 | 50                    |
| 08-00080-00550 | 5.5         | 11                   | 12°                     | 6                 | 50                    |
| 08-00080-00600 | 6           | 12                   | —                       | 6                 | 50                    |
| 08-00080-00800 | 8           | 16                   | —                       | 8                 | 65                    |
| 08-00080-01000 | 10          | 20                   | —                       | 10                | 75                    |
| 08-00080-01200 | 12          | 24                   | —                       | 12                | 80                    |

## How to Order

When you order, indicate MX430 (D). ※(γ) is reference value.

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                             |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                      |        | Copper                                                                                                                                                |        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Cutting Speed                 | 50～80m/min                                                                                                                                                                                                                                                                        |        | 50～70m/min                  |        | 40～60m/min                    |        | 20～40m/min                                                                                                                                             |        | 60～80m/min                                                                                                                                            |        |
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                      |        | Side Milling                |        | Side Milling                  |        | Side Milling                                                                                                                                           |        | Side Milling                                                                                                                                          |        |
|                               | Spindle<br>Speed                                                                                                                                                                                                                                                                  | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                                                                                                                                       | Feed   | Spindle<br>Speed                                                                                                                                      | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                 | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                                                                                      | mm/min | min <sup>-1</sup>                                                                                                                                     | mm/min |
| 1                             | 20,700                                                                                                                                                                                                                                                                            | 320    | 19,100                      | 230    | 15,900                        | 200    | 9,500                                                                                                                                                  | 120    | 22,300                                                                                                                                                | 410    |
| 1.5                           | 13,800                                                                                                                                                                                                                                                                            | 320    | 12,700                      | 230    | 10,600                        | 200    | 6,400                                                                                                                                                  | 120    | 14,900                                                                                                                                                | 450    |
| 2                             | 10,300                                                                                                                                                                                                                                                                            | 320    | 9,500                       | 260    | 8,000                         | 230    | 4,800                                                                                                                                                  | 120    | 11,100                                                                                                                                                | 500    |
| 2.5                           | 8,300                                                                                                                                                                                                                                                                             | 380    | 7,600                       | 270    | 6,400                         | 240    | 3,800                                                                                                                                                  | 120    | 8,900                                                                                                                                                 | 540    |
| 3                             | 6,900                                                                                                                                                                                                                                                                             | 420    | 6,400                       | 290    | 5,300                         | 260    | 3,200                                                                                                                                                  | 120    | 7,400                                                                                                                                                 | 560    |
| 3.5                           | 5,900                                                                                                                                                                                                                                                                             | 450    | 5,500                       | 290    | 4,500                         | 260    | 2,700                                                                                                                                                  | 130    | 6,400                                                                                                                                                 | 570    |
| 4                             | 5,200                                                                                                                                                                                                                                                                             | 530    | 4,800                       | 320    | 4,000                         | 290    | 2,400                                                                                                                                                  | 160    | 5,600                                                                                                                                                 | 660    |
| 4.5                           | 4,600                                                                                                                                                                                                                                                                             | 540    | 4,200                       | 360    | 3,500                         | 320    | 2,100                                                                                                                                                  | 160    | 5,000                                                                                                                                                 | 680    |
| 5                             | 4,100                                                                                                                                                                                                                                                                             | 560    | 3,800                       | 390    | 3,200                         | 360    | 1,900                                                                                                                                                  | 160    | 4,500                                                                                                                                                 | 700    |
| 5.5                           | 3,800                                                                                                                                                                                                                                                                             | 560    | 3,500                       | 410    | 2,900                         | 370    | 1,700                                                                                                                                                  | 160    | 4,100                                                                                                                                                 | 700    |
| 6                             | 3,400                                                                                                                                                                                                                                                                             | 580    | 3,200                       | 440    | 2,700                         | 410    | 1,600                                                                                                                                                  | 170    | 3,700                                                                                                                                                 | 700    |
| 8                             | 2,600                                                                                                                                                                                                                                                                             | 540    | 2,400                       | 410    | 2,000                         | 370    | 1,200                                                                                                                                                  | 170    | 2,800                                                                                                                                                 | 610    |
| 10                            | 2,100                                                                                                                                                                                                                                                                             | 510    | 1,900                       | 390    | 1,600                         | 360    | 1,000                                                                                                                                                  | 170    | 2,200                                                                                                                                                 | 560    |
| 12                            | 1,700                                                                                                                                                                                                                                                                             | 460    | 1,600                       | 370    | 1,300                         | 340    | 800                                                                                                                                                    | 170    | 1,900                                                                                                                                                 | 540    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 1 \sim 2.5 = 0.07D</math><br/><math>\phi 3 \sim 6 = 0.15D</math><br/><math>\phi 8 \sim 12 = 0.2D</math></div>       |        |                             |        |                               |        | <div>Side Milling</div> <div></div> <div><math>0.02D</math></div> |        | <div>Side Milling</div> <div></div> <div><math>0.2D</math></div> |        |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |        |                             |        |                               |        |                                                                                                                                                        |        |                                                                                                                                                       |        |

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

Coating

MX435

Size  $\phi 1 \sim \phi 12$

MUGEN COATING 4-Flute LEAD35 End Mill

MG

4

35°

Side

Face

$D \approx 3$

$\phi D$

$D$

$-0.01$

$0$

$\phi D$

$D$

$-0.015$

$3 < D < 6$

$\phi D$

$D$

$-0.01$

$D = 6$

$\phi D$

$D$

$-0.025$

$D > 6$

$\phi D$

$D$

$-0.01$

$D > 6$

$\phi D$

$D$

$-0.03$

$\phi D$

$L$

$L$

$\phi d$

$h_6$

$\gamma^\circ$

L/D=3 and helix 35° for appropriate length of cut to avoid the inconveniences in size selection.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| 08-00085-00100 | 1           | 3                    | 12°                     | 4                 | 45                    |
| 08-00085-00150 | 1.5         | 4.5                  | 12°                     | 4                 | 45                    |
| 08-00085-00200 | 2           | 6                    | 12°                     | 4                 | 45                    |
| 08-00085-00250 | 2.5         | 7.5                  | 12°                     | 4                 | 45                    |
| 08-00085-00300 | 3           | 9                    | 12°                     | 6                 | 45                    |
| 08-00085-00350 | 3.5         | 10.5                 | 12°                     | 6                 | 45                    |
| 08-00085-00400 | 4           | 12                   | 12°                     | 6                 | 50                    |
| 08-00085-00450 | 4.5         | 13.5                 | 12°                     | 6                 | 50                    |
| 08-00085-00500 | 5           | 15                   | 12°                     | 6                 | 55                    |
| 08-00085-00550 | 5.5         | 16.5                 | 12°                     | 6                 | 60                    |
| 08-00085-00600 | 6           | 18                   | —                       | 6                 | 60                    |
| 08-00085-00800 | 8           | 24                   | —                       | 8                 | 65                    |
| 08-00085-01000 | 10          | 30                   | —                       | 10                | 75                    |
| 08-00085-01200 | 12          | 36                   | —                       | 12                | 80                    |

How to Order

When you order, indicate MX435 (D).    ※( γ ) is reference value.

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

Coating

MX435

Size  $\phi 1 \sim \phi 12$

MUGEN COATING 4-Flute LEAD35 End Mill

MG

4

35°

Side

Face

$D \approx 3$

$\phi D$

$D$

$-0.01$

$0$

$\phi D$

$D$

$-0.015$

$3 < D < 6$

$\phi D$

$D$

$-0.01$

$D = 6$

$\phi D$

$D$

$-0.025$

$D > 6$

$\phi D$

$D$

$-0.01$

$D > 6$

$\phi D$

$D$

$-0.03$

$\phi D$

$L$

$L$

$\phi d$

$h_6$

$\gamma^\circ$

L/D=3 and helix 35° for appropriate length of cut to avoid the inconveniences in size selection.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| 08-00085-00100 | 1           | 3                    | 12°                     | 4                 | 45                    |
| 08-00085-00150 | 1.5         | 4.5                  | 12°                     | 4                 | 45                    |
| 08-00085-00200 | 2           | 6                    | 12°                     | 4                 | 45                    |
| 08-00085-00250 | 2.5         | 7.5                  | 12°                     | 4                 | 45                    |
| 08-00085-00300 | 3           | 9                    | 12°                     | 6                 | 45                    |
| 08-00085-00350 | 3.5         | 10.5                 | 12°                     | 6                 | 45                    |
| 08-00085-00400 | 4           | 12                   | 12°                     | 6                 | 50                    |
| 08-00085-00450 | 4.5         | 13.5                 | 12°                     | 6                 | 50                    |
| 08-00085-00500 | 5           | 15                   | 12°                     | 6                 | 55                    |
| 08-00085-00550 | 5.5         | 16.5                 | 12°                     | 6                 | 60                    |
| 08-00085-00600 | 6           | 18                   | —                       | 6                 | 60                    |
| 08-00085-00800 | 8           | 24                   | —                       | 8                 | 65                    |
| 08-00085-01000 | 10          | 30                   | —                       | 10                | 75                    |
| 08-00085-01200 | 12          | 36                   | —                       | 12                | 80                    |

How to Order

When you order, indicate MX435 (D).    ※( γ ) is reference value.

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

Coating

MX435

Size  $\phi 1 \sim \phi 12$

MUGEN COATING 4-Flute LEAD35 End Mill

MG

4

35°

Side

Face

$D \approx 3$

$\phi D$

$D$

$-0.01$

$0$

$\phi D$

$D$

$-0.015$

$3 < D < 6$

$\phi D$

$D$

$-0.01$

$D = 6$

$\phi D$

$D$

$-0.025$

$D > 6$

$\phi D$

$D$

$-0.01$

$D > 6$

$\phi D$

$D$

$-0.03$

$\phi D$

$L$

$L$

$\phi d$

$h_6$

$\gamma^\circ$

L/D=3 and helix 35° for appropriate length of cut to avoid the inconveniences in size selection.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| 08-00085-00100 | 1           | 3                    | 12°                     | 4                 | 45                    |
| 08-00085-00150 | 1.5         | 4.5                  | 12°                     | 4                 | 45                    |
| 08-00085-00200 | 2           | 6                    | 12°                     | 4                 | 45                    |
| 08-00085-00250 | 2.5         | 7.5                  | 12°                     | 4                 | 45                    |
| 08-00085-00300 | 3           | 9                    | 12°                     | 6                 | 45                    |
| 08-00085-00350 | 3.5         | 10.5                 | 12°                     | 6                 | 45                    |
| 08-00085-00400 | 4           | 12                   | 12°                     | 6                 | 50                    |
| 08-00085-00450 | 4.5         | 13.5                 | 12°                     | 6                 | 50                    |
| 08-00085-00500 | 5           | 15                   | 12°                     | 6                 | 55                    |
| 08-00085-00550 | 5.5         | 16.5                 | 12°                     | 6                 | 60                    |
| 08-00085-00600 | 6           | 18                   | —                       | 6                 | 60                    |
| 08-00085-00800 | 8           | 24                   | —                       | 8                 | 65                    |
| 08-00085-01000 | 10          | 30                   | —                       | 10                | 75                    |
| 08-00085-01200 | 12          | 36                   | —                       | 12                | 80                    |

How to Order

When you order, indicate MX435 (D).    ※( γ ) is reference value.

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                  |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC)                                                                                                             |        | Copper                                                                                                                                      |        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Cutting Speed                 | 45～75m/min                                                                                                                                                                                                                                                                                             |        | 45～65m/min                  |        | 35～55m/min                    |        | 15～35m/min                                                                                                                                    |        | 55～75m/min                                                                                                                                  |        |
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                                           |        | Side Milling                |        | Side Milling                  |        | Side Milling                                                                                                                                  |        | Side Milling                                                                                                                                |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                                                          | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed                                                                                                                                 | Feed   | Spindle Speed                                                                                                                               | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                      | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                                                                             | mm/min | min <sup>-1</sup>                                                                                                                           | mm/min |
| 1                             | 19,100                                                                                                                                                                                                                                                                                                 | 290    | 17,500                      | 210    | 14,300                        | 170    | 8,000                                                                                                                                         | 100    | 20,700                                                                                                                                      | 380    |
| 1.5                           | 12,700                                                                                                                                                                                                                                                                                                 | 290    | 11,700                      | 210    | 9,500                         | 170    | 5,300                                                                                                                                         | 100    | 13,800                                                                                                                                      | 420    |
| 2                             | 9,500                                                                                                                                                                                                                                                                                                  | 290    | 8,800                       | 240    | 7,200                         | 210    | 4,000                                                                                                                                         | 100    | 10,300                                                                                                                                      | 470    |
| 2.5                           | 7,600                                                                                                                                                                                                                                                                                                  | 350    | 7,000                       | 260    | 5,700                         | 210    | 3,200                                                                                                                                         | 110    | 8,300                                                                                                                                       | 500    |
| 3                             | 6,400                                                                                                                                                                                                                                                                                                  | 390    | 5,800                       | 260    | 4,800                         | 230    | 2,700                                                                                                                                         | 110    | 6,900                                                                                                                                       | 530    |
| 3.5                           | 5,500                                                                                                                                                                                                                                                                                                  | 410    | 5,000                       | 270    | 4,100                         | 230    | 2,300                                                                                                                                         | 120    | 5,900                                                                                                                                       | 530    |
| 4                             | 4,800                                                                                                                                                                                                                                                                                                  | 480    | 4,400                       | 310    | 3,600                         | 260    | 2,000                                                                                                                                         | 140    | 5,200                                                                                                                                       | 610    |
| 4.5                           | 4,200                                                                                                                                                                                                                                                                                                  | 490    | 3,900                       | 340    | 3,200                         | 290    | 1,800                                                                                                                                         | 140    | 4,600                                                                                                                                       | 610    |
| 5                             | 3,800                                                                                                                                                                                                                                                                                                  | 510    | 3,500                       | 360    | 2,900                         | 320    | 1,600                                                                                                                                         | 140    | 4,100                                                                                                                                       | 630    |
| 5.5                           | 3,500                                                                                                                                                                                                                                                                                                  | 530    | 3,200                       | 370    | 2,600                         | 340    | 1,400                                                                                                                                         | 140    | 3,800                                                                                                                                       | 630    |
| 6                             | 3,200                                                                                                                                                                                                                                                                                                  | 540    | 2,900                       | 390    | 2,400                         | 360    | 1,300                                                                                                                                         | 140    | 3,400                                                                                                                                       | 630    |
| 8                             | 2,400                                                                                                                                                                                                                                                                                                  | 480    | 2,200                       | 370    | 1,800                         | 340    | 1,000                                                                                                                                         | 140    | 2,600                                                                                                                                       | 580    |
| 10                            | 1,900                                                                                                                                                                                                                                                                                                  | 440    | 1,800                       | 360    | 1,400                         | 310    | 800                                                                                                                                           | 140    | 2,100                                                                                                                                       | 540    |
| 12                            | 1,600                                                                                                                                                                                                                                                                                                  | 440    | 1,500                       | 360    | 1,200                         | 290    | 700                                                                                                                                           | 140    | 1,700                                                                                                                                       | 490    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div><div><div><div><div><math>3D</math></div><div><math>a_e</math></div></div><div><math>a_e</math></div></div><div><math>a_e</math><br/><math>\phi 1 \sim 2.5 = 0.05D</math><br/><math>\phi 3 \sim 6 = 0.1D</math><br/><math>\phi 8 \sim 12 = 0.15D</math></div></div></div> |        |                             |        |                               |        | <div>Side Milling</div> <div><div><div><div><math>3D</math></div><div><math>0.02D</math></div></div><div><math>0.02D</math></div></div></div> |        | <div>Side Milling</div> <div><div><div><div><math>3D</math></div><div><math>0.2D</math></div></div><div><math>0.2D</math></div></div></div> |        |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                      |        |                             |        |                               |        |                                                                                                                                               |        |                                                                                                                                             |        |

H-020

H-021



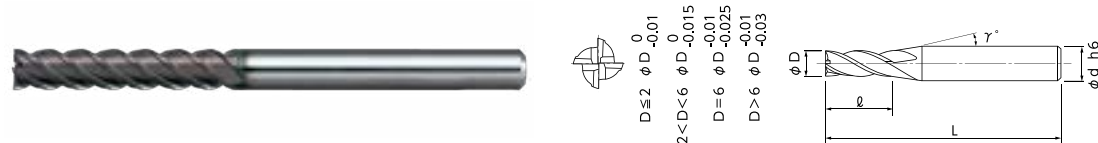
# MX445

Size  $\phi$  1 ~  $\phi$  12



## MUGEN COATING 4-Flute LEAD45 End Mill

For various work materials. L/D=5.  
Suitable for side milling with 4-flute



- L/D=5 and helix 45° to minimize the milling deflection even though the long cutting length design.

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00095-00100 | 1        | 5                 | 12°                  | 4              | 45                 |
| 08-00095-00150 | 1.5      | 7.5               | 12°                  | 4              | 45                 |
| 08-00095-00200 | 2        | 10                | 12°                  | 4              | 50                 |
| 08-00095-00250 | 2.5      | 12.5              | 12°                  | 4              | 50                 |
| 08-00095-00300 | 3        | 15                | 12°                  | 6              | 55                 |
| 08-00095-00350 | 3.5      | 17.5              | 12°                  | 6              | 60                 |
| 08-00095-00400 | 4        | 20                | 12°                  | 6              | 60                 |
| 08-00095-00450 | 4.5      | 22.5              | 12°                  | 6              | 65                 |
| 08-00095-00500 | 5        | 25                | 12°                  | 6              | 65                 |
| 08-00095-00550 | 5.5      | 27.5              | 12°                  | 6              | 75                 |
| 08-00095-00600 | 6        | 30                | —                    | 6              | 75                 |
| 08-00095-00800 | 8        | 40                | —                    | 8              | 90                 |
| 08-00095-01000 | 10       | 50                | —                    | 10             | 100                |
| 08-00095-01200 | 12       | 60                | —                    | 12             | 105                |

### How to Order

When you order, indicate MX445 (D). ※(γ) is reference value.

## Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                      |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Copper                                              |        |  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-----------------------------------------------------|--------|--|
| Cutting Speed                 | 15～25m/min                                                                                                                                                                                                 |        | 10～20m/min                  |        | 10～15m/min                    |        | 15～35m/min                                          |        |  |
| Dia.                          | Side Milling                                                                                                                                                                                               |        | Side Milling                |        | Side Milling                  |        | Side Milling                                        |        |  |
|                               | Spindle<br>Speed                                                                                                                                                                                           | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                                    | Feed   |  |
|                               | min <sup>-1</sup>                                                                                                                                                                                          | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                   | mm/min |  |
| 1                             | 6,400                                                                                                                                                                                                      | 100    | 4,800                       | 60     | 4,000                         | 55     | 8,000                                               | 150    |  |
| 1.5                           | 4,200                                                                                                                                                                                                      | 100    | 3,200                       | 60     | 2,700                         | 55     | 5,300                                               | 170    |  |
| 2                             | 3,200                                                                                                                                                                                                      | 100    | 2,400                       | 70     | 2,000                         | 60     | 4,000                                               | 190    |  |
| 2.5                           | 2,500                                                                                                                                                                                                      | 120    | 1,900                       | 70     | 1,600                         | 60     | 3,200                                               | 200    |  |
| 3                             | 2,100                                                                                                                                                                                                      | 130    | 1,600                       | 75     | 1,300                         | 70     | 2,700                                               | 210    |  |
| 3.5                           | 1,800                                                                                                                                                                                                      | 140    | 1,400                       | 75     | 1,100                         | 70     | 2,300                                               | 210    |  |
| 4                             | 1,600                                                                                                                                                                                                      | 160    | 1,200                       | 90     | 1,000                         | 80     | 2,000                                               | 240    |  |
| 4.5                           | 1,400                                                                                                                                                                                                      | 170    | 1,100                       | 90     | 900                           | 85     | 1,800                                               | 240    |  |
| 5                             | 1,300                                                                                                                                                                                                      | 170    | 1,000                       | 100    | 800                           | 90     | 1,600                                               | 240    |  |
| 5.5                           | 1,200                                                                                                                                                                                                      | 170    | 900                         | 100    | 700                           | 95     | 1,400                                               | 240    |  |
| 6                             | 1,100                                                                                                                                                                                                      | 190    | 800                         | 110    | 700                           | 100    | 1,300                                               | 240    |  |
| 8                             | 800                                                                                                                                                                                                        | 160    | 600                         | 100    | 500                           | 90     | 1,000                                               | 220    |  |
| 10                            | 600                                                                                                                                                                                                        | 150    | 500                         | 100    | 400                           | 85     | 800                                                 | 200    |  |
| 12                            | 500                                                                                                                                                                                                        | 140    | 400                         | 90     | 300                           | 80     | 700                                                 | 200    |  |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div><div><math>a_e</math><br/><math>\phi</math> 1～2.5=0.03D<br/><math>\phi</math> 3～6=0.06D<br/><math>\phi</math> 8～12=0.08D</div></div>                                          |        |                             |        |                               |        | <div>Side Milling</div> <div><div>0.06D</div></div> |        |  |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |        |                             |        |                               |        |                                                     |        |  |

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

Hardened Steel H

MSE230SS

Size  $\phi$  0.1 ~  $\phi$  6

MUGEN COATING 2-Flute Super Short End Mill

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

Hardened Steel H

MG

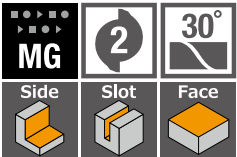
Side

2

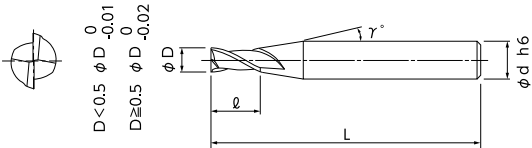
Slot

30°

Face







● ■

: Semi-standard item, please inquire for price and delivery.

| Code No.         | Dia.<br>(D) | Length<br>of Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|------------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| ■ 08-00103-00010 | 0.1         | 0.1                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00015 | 0.15        | 0.15                    | 9°                          | 4                    | 45                       |
| ■ 08-00103-00020 | 0.2         | 0.2                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00030 | 0.3         | 0.3                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00040 | 0.4         | 0.4                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00050 | 0.5         | 0.5                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00060 | 0.6         | 0.6                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00070 | 0.7         | 0.7                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00080 | 0.8         | 0.8                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00090 | 0.9         | 0.9                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00100 | 1           | 1                       | 9°                          | 4                    | 45                       |
| ■ 08-00103-00110 | 1.1         | 1.1                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00120 | 1.2         | 1.2                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00130 | 1.3         | 1.3                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00140 | 1.4         | 1.4                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00150 | 1.5         | 1.5                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00160 | 1.6         | 1.6                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00170 | 1.7         | 1.7                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00180 | 1.8         | 1.8                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00190 | 1.9         | 1.9                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00200 | 2           | 2                       | 9°                          | 4                    | 45                       |
| ■ 08-00103-00210 | 2.1         | 2.1                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00220 | 2.2         | 2.2                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00230 | 2.3         | 2.3                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00240 | 2.4         | 2.4                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00250 | 2.5         | 2.5                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00260 | 2.6         | 2.6                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00270 | 2.7         | 2.7                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00280 | 2.8         | 2.8                     | 9°                          | 4                    | 45                       |
| ■ 08-00103-00290 | 2.9         | 2.9                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00300 | 3           | 3                       | 9°                          | 6                    | 50                       |

| Code No.         | Dia.<br>(D) | Length<br>of Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|------------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| ■ 08-00103-00310 | 3.1         | 3.1                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00320 | 3.2         | 3.2                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00330 | 3.3         | 3.3                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00340 | 3.4         | 3.4                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00350 | 3.5         | 3.5                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00360 | 3.6         | 3.6                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00370 | 3.7         | 3.7                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00380 | 3.8         | 3.8                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00390 | 3.9         | 3.9                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00400 | 4           | 4                       | 9°                          | 6                    | 50                       |
| ■ 08-00103-00410 | 4.1         | 4.1                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00420 | 4.2         | 4.2                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00430 | 4.3         | 4.3                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00440 | 4.4         | 4.4                     | 9°                          | 6                    | 50                       |
| ■ 08-00103-00450 | 4.5         | 4.5                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00460 | 4.6         | 4.6                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00470 | 4.7         | 4.7                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00480 | 4.8         | 4.8                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00490 | 4.9         | 4.9                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00500 | 5           | 5                       | 9°                          | 6                    | 55                       |
| ■ 08-00103-00510 | 5.1         | 5.1                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00520 | 5.2         | 5.2                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00530 | 5.3         | 5.3                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00540 | 5.4         | 5.4                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00550 | 5.5         | 5.5                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00560 | 5.6         | 5.6                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00570 | 5.7         | 5.7                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00580 | 5.8         | 5.8                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00590 | 5.9         | 5.9                     | 9°                          | 6                    | 55                       |
| ■ 08-00103-00600 | 6           | 6                       | —                           | 6                    | 55                       |

How to Order

When you order, indicate MSE230SS (D).    ※(γ) is reference value.

Recommended Milling Conditions

| Work Material | Carbon Steels<br>S50C              |              |          | Alloy Steels<br>SCM・SKD・SUS |              |          | Prehardened Steels<br>HPM・NAK |              |          |
|---------------|------------------------------------|--------------|----------|-----------------------------|--------------|----------|-------------------------------|--------------|----------|
| Cutting Speed | 50~80m/min                         |              |          | 50~70m/min                  |              |          | 40~60m/min                    |              |          |
| Dia.          | Spindle Speed<br>min <sup>-1</sup> | mm/min       |          | min <sup>-1</sup>           | mm/min       |          | min <sup>-1</sup>             | mm/min       |          |
|               |                                    | Side Milling | Slotting |                             | Side Milling | Slotting |                               | Side Milling | Slotting |
| 0.1           | 50,000                             | —            | 25       | 50,000                      | —            | 15       | 50,000                        | —            | 20       |
| 0.15          | 50,000                             | —            | 30       | 50,000                      | —            | 20       | 50,000                        | —            | 20       |
| 0.2           | 50,000                             | —            | 40       | 50,000                      | —            | 25       | 50,000                        | —            | 30       |
| 0.3           | 50,000                             | 100          | 50       | 50,000                      | 90           | 35       | 50,000                        | 85           | 40       |
| 0.4           | 50,000                             | 150          | 75       | 47,700                      | 130          | 50       | 39,800                        | 110          | 55       |
| 0.5           | 41,400                             | 170          | 85       | 38,200                      | 130          | 50       | 31,800                        | 110          | 55       |
| 0.6           | 34,500                             | 180          | 90       | 33,300                      | 130          | 50       | 26,500                        | 120          | 55       |
| 0.7           | 29,600                             | 200          | 100      | 28,600                      | 130          | 55       | 22,700                        | 120          | 55       |
| 0.8           | 25,900                             | 210          | 100      | 23,900                      | 150          | 55       | 19,900                        | 130          | 65       |
| 0.9           | 23,000                             | 210          | 100      | 21,200                      | 150          | 55       | 17,700                        | 130          | 65       |
| 1             | 20,700                             | 210          | 100      | 19,100                      | 150          | 55       | 16,000                        | 130          | 65       |
| 1.1           | 18,800                             | 210          | 100      | 17,400                      | 150          | 55       | 14,500                        | 130          | 65       |
| 1.2           | 17,300                             | 210          | 100      | 15,900                      | 150          | 55       | 13,300                        | 130          | 65       |
| 1.3           | 16,000                             | 210          | 100      | 14,700                      | 150          | 55       | 12,200                        | 130          | 65       |
| 1.4           | 14,800                             | 210          | 100      | 13,600                      | 150          | 55       | 11,400                        | 130          | 65       |
| 1.5           | 13,800                             | 210          | 100      | 12,700                      | 150          | 55       | 10,600                        | 130          | 65       |
| 1.6           | 13,000                             | 210          | 100      | 11,900                      | 150          | 55       | 10,000                        | 140          | 65       |
| 1.7           | 12,200                             | 210          | 100      | 11,200                      | 150          | 55       | 9,400                         | 140          | 65       |
| 1.8           | 11,500                             | 210          | 100      | 10,600                      | 160          | 60       | 8,800                         | 140          | 75       |
| 1.9           | 10,900                             | 210          | 100      | 10,100                      | 160          | 60       | 8,400                         | 150          | 75       |
| 2             | 10,400                             | 210          | 100      | 9,600                       | 170          | 60       | 8,000                         | 150          | 75       |
| 2.1           | 9,900                              | 220          | 100      | 9,100                       | 170          | 60       | 7,600                         | 150          | 75       |
| 2.2           | 9,400                              | 220          | 100      | 8,700                       | 170          | 60       | 7,200                         | 150          | 75       |
| 2.3           | 9,000                              | 230          | 120      | 8,300                       | 170          | 65       | 6,900                         | 150          | 80       |
| 2.4           | 8,600                              | 240          | 120      | 8,000                       | 180          | 65       | 6,600                         | 160          | 80       |
| 2.5           | 8,300                              | 250          | 120      | 7,600                       | 180          | 65       | 6,400                         | 160          | 80       |
| 2.6           | 8,000                              | 250          | 120      | 7,300                       | 180          | 65       | 6,100                         | 160          | 80       |
| 2.7           | 7,700                              | 260          | 120      | 7,100                       | 180          | 65       | 5,900                         | 160          | 80       |
| 2.8           | 7,400                              | 260          | 140      | 6,800                       | 180          | 70       | 5,700                         | 170          | 85       |
| 2.9           | 7,100                              | 270          | 140      | 6,600                       | 190          | 70       | 5,500                         | 170          | 85       |
| 3             | 6,900                              | 280          | 140      | 6,400                       | 190          | 70       | 5,300                         | 170          | 85       |
| 3.1           | 6,700                              | 280          | 140      | 6,200                       | 190          | 70       | 5,100                         | 170          | 85       |
| 3.2           | 6,500                              | 280          | 140      | 6,000                       | 190          | 70       | 5,000                         | 170          | 85       |
| 3.3           | 6,300                              | 290          | 150      | 5,800                       | 190          | 70       | 4,800                         | 170          | 85       |
| 3.4           | 6,100                              | 290          | 150      | 5,600                       | 190          | 70       | 4,700                         | 170          | 85       |
| 3.5           | 5,900                              | 300          | 150      | 5,500                       | 190          | 70       | 4,500                         | 170          | 85       |
| 3.6           | 5,800                              | 300          | 150      | 5,300                       | 190          | 70       | 4,400                         | 170          | 85       |
| 3.7           | 5,600                              | 300          | 150      | 5,200                       | 190          | 70       | 4,300                         | 170          | 85       |
| 3.8           | 5,400                              | 300          | 160      | 5,000                       | 190          | 70       | 4,200                         | 170          | 85       |
| 3.9           | 5,300                              | 310          | 160      | 4,900                       | 190          | 70       | 4,100                         | 170          | 85       |
| 4             | 5,200                              | 310          | 160      | 4,800                       | 190          | 70       | 4,000                         | 170          | 85       |
| 4.1           | 5,000                              | 310          | 160      | 4,700                       | 200          | 70       | 3,900                         | 180          | 85       |
| 4.2           | 4,900                              | 310          | 160      | 4,500                       | 200          | 70       | 3,800                         | 180          | 85       |
| 4.3           | 4,800                              | 310          | 160      | 4,400                       | 200          | 70       | 3,700                         | 180          | 85       |
| 4.4           | 4,700                              | 310          | 160      | 4,300                       | 210          | 70       | 3,600                         | 190          | 85       |
| 4.5           | 4,600                              | 320          | 160      | 4,200                       | 210          | 70       | 3,500                         | 190          | 85       |
| 4.6           | 4,500                              | 320          | 160      | 4,200                       | 210          | 70       | 3,500                         | 190          | 85       |
| 4.7           | 4,400                              | 320          | 160      | 4,100                       | 220          | 75       | 3,400                         | 200          | 85       |
| 4.8           | 4,300                              | 320          | 160      | 4,000                       | 220          | 75       | 3,300                         | 200          | 110      |
| 4.9           | 4,200                              | 320          | 160      | 3,900                       | 230          | 75       | 3,200                         | 200          | 110      |

H-026

H-027



Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Coating Square

MSE230SS

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                      |                |          | Alloy Steels<br>SCM・SKD・SUS        |                |          | Prehardened Steels<br>HPM・NAK      |                |          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|------------------------------------|----------------|----------|------------------------------------|----------------|----------|
| Cutting Speed                 | 50~80m/min                                                                                                                                                                                                 |                |          | 50~70m/min                         |                |          | 40~60m/min                         |                |          |
| Dia.                          | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                                                         | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          |
|                               |                                                                                                                                                                                                            | Side Milling   | Slotting |                                    | Side Milling   | Slotting |                                    | Side Milling   | Slotting |
|                               |                                                                                                                                                                                                            |                |          |                                    |                |          |                                    |                |          |
| 5                             | 4,100                                                                                                                                                                                                      | 330            | 160      | 3,800                              | 230            | 75       | 3,200                              | 210            | 110      |
| 5.1                           | 4,100                                                                                                                                                                                                      | 330            | 160      | 3,700                              | 230            | 75       | 3,100                              | 210            | 110      |
| 5.2                           | 4,000                                                                                                                                                                                                      | 330            | 160      | 3,700                              | 230            | 75       | 3,100                              | 210            | 110      |
| 5.3                           | 3,900                                                                                                                                                                                                      | 330            | 160      | 3,600                              | 240            | 75       | 3,000                              | 220            | 110      |
| 5.4                           | 3,800                                                                                                                                                                                                      | 330            | 160      | 3,500                              | 240            | 75       | 2,900                              | 220            | 110      |
| 5.5                           | 3,800                                                                                                                                                                                                      | 330            | 160      | 3,500                              | 240            | 75       | 2,900                              | 220            | 110      |
| 5.6                           | 3,700                                                                                                                                                                                                      | 330            | 160      | 3,400                              | 240            | 75       | 2,800                              | 230            | 110      |
| 5.7                           | 3,600                                                                                                                                                                                                      | 330            | 160      | 3,400                              | 250            | 85       | 2,800                              | 230            | 110      |
| 5.8                           | 3,600                                                                                                                                                                                                      | 330            | 170      | 3,300                              | 250            | 85       | 2,700                              | 230            | 120      |
| 5.9                           | 3,500                                                                                                                                                                                                      | 340            | 170      | 3,200                              | 250            | 85       | 2,700                              | 240            | 120      |
| 6                             | 3,400                                                                                                                                                                                                      | 340            | 170      | 3,200                              | 260            | 85       | 2,700                              | 240            | 120      |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                      |                |          |                                    |                |          |                                    |                |          |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |                |          |                                    |                |          |                                    |                |          |

| Work Material | Hardend Steels<br>SKD61 (～52HRC)   |                |          | Aluminium Alloy                    |                |          | Copper                             |                |          |
|---------------|------------------------------------|----------------|----------|------------------------------------|----------------|----------|------------------------------------|----------------|----------|
| Cutting Speed | 20～40m/min                         |                |          | 100～200m/min                       |                |          | 60～80m/min                         |                |          |
| Dia.          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          |
|               |                                    | Side Milling   | Slotting |                                    | Side Milling   | Slotting |                                    | Side Milling   | Slotting |
|               |                                    |                |          |                                    |                |          |                                    |                |          |
| 0.1           | 50,000                             | —              | 15       | 50,000                             | 60             | 25       | 50,000                             | 60             | 25       |
| 0.15          | 50,000                             | —              | 15       | 50,000                             | 70             | 25       | 50,000                             | 70             | 25       |
| 0.2           | 47,700                             | —              | 20       | 50,000                             | 90             | 35       | 50,000                             | 90             | 35       |
| 0.3           | 31,800                             | —              | 20       | 50,000                             | 150            | 60       | 50,000                             | 150            | 60       |
| 0.4           | 23,900                             | 50             | 25       | 50,000                             | 200            | 80       | 50,000                             | 200            | 80       |
| 0.5           | 19,100                             | 60             | 30       | 50,000                             | 250            | 100      | 44,600                             | 220            | 90       |
| 0.6           | 15,900                             | 60             | 30       | 50,000                             | 300            | 100      | 37,100                             | 230            | 90       |
| 0.7           | 13,600                             | 60             | 30       | 50,000                             | 350            | 180      | 31,800                             | 240            | 90       |
| 0.8           | 11,900                             | 70             | 35       | 50,000                             | 450            | 180      | 27,900                             | 250            | 95       |
| 0.9           | 10,600                             | 70             | 35       | 50,000                             | 500            | 180      | 24,800                             | 260            | 95       |
| 1             | 9,500                              | 75             | 40       | 47,700                             | 570            | 200      | 22,300                             | 270            | 95       |
| 1.1           | 8,700                              | 75             | 40       | 43,400                             | 570            | 200      | 20,300                             | 270            | 95       |
| 1.2           | 8,000                              | 75             | 40       | 39,800                             | 600            | 200      | 18,600                             | 280            | 95       |
| 1.3           | 7,300                              | 75             | 40       | 36,700                             | 620            | 200      | 17,100                             | 280            | 95       |
| 1.4           | 6,800                              | 75             | 40       | 34,100                             | 630            | 220      | 15,900                             | 290            | 100      |
| 1.5           | 6,400                              | 75             | 40       | 31,800                             | 640            | 220      | 14,900                             | 300            | 100      |
| 1.6           | 6,000                              | 75             | 40       | 29,800                             | 660            | 220      | 13,900                             | 300            | 100      |
| 1.7           | 5,600                              | 75             | 40       | 28,100                             | 680            | 220      | 13,100                             | 310            | 100      |
| 1.8           | 5,300                              | 75             | 40       | 26,500                             | 700            | 250      | 12,400                             | 310            | 120      |
| 1.9           | 5,000                              | 75             | 40       | 25,100                             | 700            | 250      | 11,700                             | 320            | 120      |

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Coating Square

MSE230SS

Recommended Milling Conditions

| Work Material                 | Hardend Steels<br>SKD61 (～52HRC)                                                                                                                                                                                                                                                  |                |          | Aluminium Alloy                    |                |          | Copper                             |                |          |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|------------------------------------|----------------|----------|------------------------------------|----------------|----------|
| Cutting Speed                 | 20～40m/min                                                                                                                                                                                                                                                                        |                |          | 100～200m/min                       |                |          | 60～80m/min                         |                |          |
| Dia.                          | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                                                                                                                                | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          |
|                               |                                                                                                                                                                                                                                                                                   | Side Milling   | Slotting |                                    | Side Milling   | Slotting |                                    | Side Milling   | Slotting |
|                               |                                                                                                                                                                                                                                                                                   |                |          |                                    |                |          |                                    |                |          |
| 2                             | 4,800                                                                                                                                                                                                                                                                             | 75             | 40       | 23,900                             | 720            | 250      | 11,100                             | 330            | 120      |
| 2.1                           | 4,500                                                                                                                                                                                                                                                                             | 75             | 40       | 22,700                             | 720            | 250      | 10,600                             | 330            | 120      |
| 2.2                           | 4,300                                                                                                                                                                                                                                                                             | 75             | 40       | 21,700                             | 740            | 250      | 10,100                             | 340            | 120      |
| 2.3                           | 4,200                                                                                                                                                                                                                                                                             | 75             | 40       | 20,800                             | 740            | 250      | 9,700                              | 350            | 120      |
| 2.4                           | 4,000                                                                                                                                                                                                                                                                             | 75             | 40       | 19,900                             | 760            | 270      | 9,300                              | 350            | 120      |
| 2.5                           | 3,800                                                                                                                                                                                                                                                                             | 75             | 40       | 19,100                             | 760            | 270      | 8,900                              | 360            | 120      |
| 2.6                           | 3,700                                                                                                                                                                                                                                                                             | 80             | 40       | 18,400                             | 760            | 270      | 8,600                              | 360            | 120      |
| 2.7                           | 3,500                                                                                                                                                                                                                                                                             | 80             | 40       | 17,700                             | 780            | 270      | 8,300                              | 360            | 120      |
| 2.8                           | 3,400                                                                                                                                                                                                                                                                             | 80             | 40       | 17,100                             | 780            | 270      | 8,000                              | 370            | 130      |
| 2.9                           | 3,300                                                                                                                                                                                                                                                                             | 80             | 40       | 16,500                             | 800            | 270      | 7,700                              | 370            | 130      |
| 3                             | 3,200                                                                                                                                                                                                                                                                             | 80             | 40       | 15,900                             | 800            | 270      | 7,400                              | 370            | 130      |
| 3.1                           | 3,100                                                                                                                                                                                                                                                                             | 80             | 40       | 15,400                             | 800            | 270      | 7,200                              | 370            | 130      |
| 3.2                           | 3,000                                                                                                                                                                                                                                                                             | 85             | 40       | 14,900                             | 820            | 270      | 7,000                              | 380            | 130      |
| 3.3                           | 2,900                                                                                                                                                                                                                                                                             | 85             | 45       | 14,500                             | 820            | 270      | 6,800                              | 380            | 130      |
| 3.4                           | 2,800                                                                                                                                                                                                                                                                             | 85             | 45       | 14,000                             | 820            | 270      | 6,600                              | 380            | 130      |
| 3.5                           | 2,700                                                                                                                                                                                                                                                                             | 85             | 45       | 13,600                             | 820            | 270      | 6,400                              | 380            | 130      |
| 3.6                           | 2,700                                                                                                                                                                                                                                                                             | 90             | 45       | 13,300                             | 820            | 270      | 6,200                              | 390            | 130      |
| 3.7                           | 2,600                                                                                                                                                                                                                                                                             | 90             | 45       | 12,900                             | 830            | 270      | 6,000                              | 390            | 130      |
| 3.8                           | 2,500                                                                                                                                                                                                                                                                             | 90             | 50       | 12,600                             | 830            | 270      | 5,900                              | 390            | 130      |
| 3.9                           | 2,400                                                                                                                                                                                                                                                                             | 90             | 50       | 12,200                             | 830            | 270      | 5,700                              | 390            | 130      |
| 4                             | 2,400                                                                                                                                                                                                                                                                             | 95             | 50       | 11,900                             | 830            | 270      | 5,600                              | 390            | 130      |
| 4.1                           | 2,300                                                                                                                                                                                                                                                                             | 95             | 50       | 11,600                             | 830            | 270      | 5,400                              | 400            | 130      |
| 4.2                           | 2,300                                                                                                                                                                                                                                                                             | 95             | 50       | 11,400                             | 840            | 270      | 5,300                              | 400            | 130      |
| 4.3                           | 2,200                                                                                                                                                                                                                                                                             | 95             | 50       | 11,100                             | 840            | 270      | 5,200                              | 400            | 130      |
| 4.4                           | 2,200                                                                                                                                                                                                                                                                             | 95             | 50       | 10,900                             | 840            | 270      | 5,100                              | 400            | 130      |
| 4.5                           | 2,100                                                                                                                                                                                                                                                                             | 95             | 50       | 10,600                             | 840            | 270      | 5,000                              | 400            | 130      |
| 4.6                           | 2,100                                                                                                                                                                                                                                                                             | 95             | 50       | 10,400                             | 850            | 270      | 4,800                              | 400            | 130      |
| 4.7                           | 2,000                                                                                                                                                                                                                                                                             | 95             | 50       | 10,200                             | 850            | 270      | 4,700                              | 410            | 130      |
| 4.8                           | 2,000                                                                                                                                                                                                                                                                             | 95             | 50       | 9,900                              | 850            | 280      | 4,600                              | 410            | 130      |
| 4.9                           | 1,900                                                                                                                                                                                                                                                                             | 95             | 50       | 9,700                              | 850            | 280      | 4,500                              | 410            | 130      |
| 5                             | 1,900                                                                                                                                                                                                                                                                             | 95             | 50       | 9,500                              | 860            | 280      | 4,500                              | 410            | 130      |
| 5.1                           | 1,900                                                                                                                                                                                                                                                                             | 95             | 50       | 9,400                              | 860            | 280      | 4,400                              | 410            | 130      |
| 5.2                           | 1,800                                                                                                                                                                                                                                                                             | 95             | 50       | 9,200                              | 860            | 280      | 4,300                              | 410            | 130      |
| 5.3                           | 1,800                                                                                                                                                                                                                                                                             | 95             | 50       | 9,000                              | 860            | 280      | 4,200                              | 410            | 130      |
| 5.4                           | 1,800                                                                                                                                                                                                                                                                             | 95             | 50       | 8,800                              | 860            | 280      | 4,100                              | 410            | 130      |
| 5.5                           | 1,700                                                                                                                                                                                                                                                                             | 95             | 50       | 8,700                              | 870            | 280      | 4,100                              | 410            | 130      |
| 5.6                           | 1,700                                                                                                                                                                                                                                                                             | 95             | 50       | 8,500                              | 870            | 280      | 4,000                              | 410            | 130      |
| 5.7                           | 1,700                                                                                                                                                                                                                                                                             | 95             | 50       | 8,400                              | 870            | 280      | 3,900                              | 410            | 130      |
| 5.8                           | 1,600                                                                                                                                                                                                                                                                             | 95             | 50       | 8,200                              | 870            | 290      | 3,800                              | 410            | 130      |
| 5.9                           | 1,600                                                                                                                                                                                                                                                                             | 95             | 50       | 8,100                              | 880            | 290      | 3,800                              | 410            | 130      |
| 6                             | 1,600                                                                                                                                                                                                                                                                             | 100            | 50       | 8,000                              | 880            | 290      | 3,700                              | 410            | 130      |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                             |                |          |                                    |                |          |                                    |                |          |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |                |          |                                    |                |          |                                    |                |          |

H-028

H-029

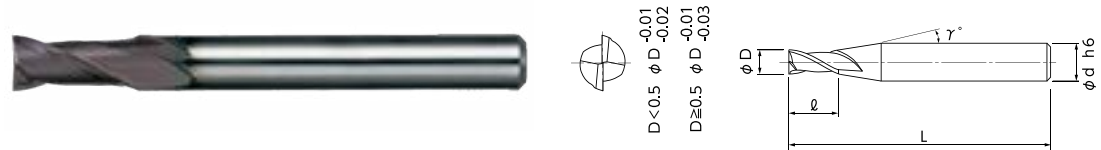
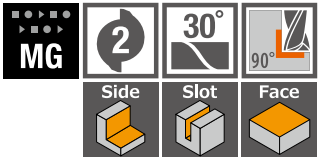
# MSES230P

Size  $\phi$  0.1 ~  $\phi$  12



## MUGEN COATING 2-Flute Sharp Edge Short End Mill

Sharp edge type with 2-flute and helix angle 30°



- It is very suitable for high speed cutting due to the length of cut is short and rigid.
- Sharp edge profile guarantees high shearing ability.

Unit : mm

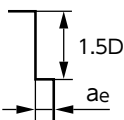
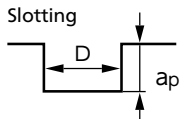
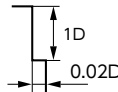
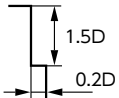
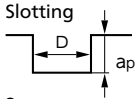
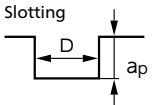
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00102-00010 | 0.1         | 0.15                 | 9°                               | 4                 | 45                    |
| 08-00102-00015 | 0.15        | 0.2                  | 9°                               | 4                 | 45                    |
| 08-00102-00020 | 0.2         | 0.3                  | 9°                               | 4                 | 45                    |
| 08-00102-00025 | 0.25        | 0.3                  | 9°                               | 4                 | 45                    |
| 08-00102-00030 | 0.3         | 0.4                  | 9°                               | 4                 | 45                    |
| 08-00102-00035 | 0.35        | 0.4                  | 9°                               | 4                 | 45                    |
| 08-00102-00040 | 0.4         | 0.6                  | 9°                               | 4                 | 45                    |
| 08-00102-00045 | 0.45        | 0.6                  | 9°                               | 4                 | 45                    |
| 08-00102-00050 | 0.5         | 0.7                  | 9°                               | 4                 | 45                    |
| 08-00102-00060 | 0.6         | 1                    | 9°                               | 4                 | 45                    |
| 08-00102-00070 | 0.7         | 1.2                  | 9°                               | 4                 | 45                    |
| 08-00102-00080 | 0.8         | 1.5                  | 9°                               | 4                 | 45                    |
| 08-00102-00100 | 1           | 2                    | 9°                               | 4                 | 45                    |
| 08-00102-00120 | 1.2         | 2.5                  | 9°                               | 4                 | 45                    |
| 08-00102-00150 | 1.5         | 3                    | 9°                               | 4                 | 45                    |
| 08-00102-00160 | 1.6         | 3                    | 9°                               | 4                 | 45                    |
| 08-00102-00180 | 1.8         | 3.5                  | 9°                               | 4                 | 45                    |
| 08-00102-00200 | 2           | 4                    | 9°                               | 4                 | 45                    |
| 08-00102-00250 | 2.5         | 5                    | 9°                               | 4                 | 45                    |
| 08-00102-00300 | 3           | 6                    | 9°                               | 4                 | 50                    |
| 08-00102-00400 | 4           | 8                    | —                                | 4                 | 50                    |
| 08-00102-00500 | 5           | 10                   | 9°                               | 6                 | 55                    |
| 08-00102-00600 | 6           | 12                   | —                                | 6                 | 55                    |
| 08-00102-00800 | 8           | 16                   | —                                | 8                 | 65                    |
| 08-00102-01000 | 10          | 20                   | —                                | 10                | 75                    |
| 08-00102-01200 | 12          | 24                   | —                                | 12                | 80                    |

### How to Order

When you order, indicate MSES230P (D). ※( $\gamma$ ) is reference value.

# MSES230P

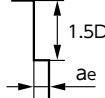
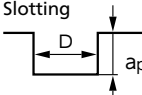
## Recommended Milling Conditions

| Work Material | Carbon Steels S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |          | Alloy Steels SCM・SKD・SUS |              |          | Prehardened Steels HPM・NAK |              |          | Hardened Steels SKD61 (～52HRC)                                                                                                                                  |                                                                                                                                                                                                                           |          | Aluminium Alloy                                                                                                                                                  |                                                                                                                                                                                                                                                                      |          | Copper            |              |          |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|--------------------------|--------------|----------|----------------------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------|--------------|----------|
| Cutting Speed | 50～80m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |          | 50～70m/min               |              |          | 40～60m/min                 |              |          | 20～40m/min                                                                                                                                                      |                                                                                                                                                                                                                           |          | 100～200m/min                                                                                                                                                     |                                                                                                                                                                                                                                                                      |          | 60～80m/min        |              |          |
| Dia.          | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Feed         |          | Spindle Speed            | Feed         |          | Spindle Speed              | Feed         |          | Spindle Speed                                                                                                                                                   | Feed                                                                                                                                                                                                                      |          | Spindle Speed                                                                                                                                                    | Feed                                                                                                                                                                                                                                                                 |          | Spindle Speed     | Feed         |          |
|               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | mm/min       |          | min <sup>-1</sup>        | mm/min       |          | min <sup>-1</sup>          | mm/min       |          | min <sup>-1</sup>                                                                                                                                               | mm/min                                                                                                                                                                                                                    |          | min <sup>-1</sup>                                                                                                                                                | mm/min                                                                                                                                                                                                                                                               |          | min <sup>-1</sup> | mm/min       |          |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Side Milling | Slotting |                          | Side Milling | Slotting |                            | Side Milling | Slotting |                                                                                                                                                                 | Side Milling                                                                                                                                                                                                              | Slotting |                                                                                                                                                                  | Side Milling                                                                                                                                                                                                                                                         | Slotting |                   | Side Milling | Slotting |
| 0.1           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | —            | 25       | 50,000                   | —            | 15       | 50,000                     | —            | 20       | 50,000                                                                                                                                                          | —                                                                                                                                                                                                                         | 15       | 50,000                                                                                                                                                           | 60                                                                                                                                                                                                                                                                   | 25       | 50,000            | 60           | 25       |
| 0.2           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | —            | 40       | 50,000                   | —            | 25       | 50,000                     | —            | 30       | 47,700                                                                                                                                                          | —                                                                                                                                                                                                                         | 20       | 50,000                                                                                                                                                           | 90                                                                                                                                                                                                                                                                   | 35       | 50,000            | 90           | 35       |
| 0.3           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 100          | 50       | 50,000                   | 90           | 35       | 50,000                     | 85           | 40       | 31,800                                                                                                                                                          | —                                                                                                                                                                                                                         | 20       | 50,000                                                                                                                                                           | 150                                                                                                                                                                                                                                                                  | 60       | 50,000            | 150          | 60       |
| 0.4           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 150          | 75       | 47,700                   | 130          | 50       | 39,800                     | 110          | 55       | 23,900                                                                                                                                                          | 50                                                                                                                                                                                                                        | 25       | 50,000                                                                                                                                                           | 200                                                                                                                                                                                                                                                                  | 80       | 50,000            | 200          | 80       |
| 0.5           | 41,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 170          | 85       | 38,200                   | 130          | 50       | 31,800                     | 110          | 55       | 19,100                                                                                                                                                          | 60                                                                                                                                                                                                                        | 30       | 50,000                                                                                                                                                           | 250                                                                                                                                                                                                                                                                  | 100      | 44,600            | 220          | 90       |
| 0.8           | 25,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 210          | 100      | 23,900                   | 150          | 55       | 19,900                     | 130          | 65       | 11,900                                                                                                                                                          | 70                                                                                                                                                                                                                        | 35       | 50,000                                                                                                                                                           | 450                                                                                                                                                                                                                                                                  | 180      | 27,900            | 250          | 95       |
| 1             | 20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 210          | 100      | 19,100                   | 150          | 55       | 15,900                     | 130          | 65       | 9,500                                                                                                                                                           | 75                                                                                                                                                                                                                        | 40       | 47,700                                                                                                                                                           | 570                                                                                                                                                                                                                                                                  | 200      | 22,300            | 270          | 95       |
| 1.5           | 13,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 210          | 100      | 12,700                   | 150          | 55       | 10,600                     | 130          | 65       | 6,400                                                                                                                                                           | 75                                                                                                                                                                                                                        | 40       | 31,800                                                                                                                                                           | 640                                                                                                                                                                                                                                                                  | 220      | 14,900            | 300          | 100      |
| 2             | 10,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 210          | 100      | 9,500                    | 170          | 60       | 8,000                      | 150          | 75       | 4,800                                                                                                                                                           | 75                                                                                                                                                                                                                        | 40       | 23,900                                                                                                                                                           | 720                                                                                                                                                                                                                                                                  | 250      | 11,100            | 330          | 120      |
| 2.5           | 8,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 250          | 120      | 7,600                    | 180          | 65       | 6,400                      | 160          | 80       | 3,800                                                                                                                                                           | 75                                                                                                                                                                                                                        | 40       | 19,100                                                                                                                                                           | 760                                                                                                                                                                                                                                                                  | 270      | 8,900             | 360          | 120      |
| 3             | 6,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 280          | 140      | 6,400                    | 190          | 70       | 5,300                      | 170          | 85       | 3,200                                                                                                                                                           | 80                                                                                                                                                                                                                        | 40       | 15,900                                                                                                                                                           | 800                                                                                                                                                                                                                                                                  | 270      | 7,400             | 370          | 130      |
| 4             | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 310          | 160      | 4,800                    | 190          | 70       | 4,000                      | 170          | 85       | 2,400                                                                                                                                                           | 95                                                                                                                                                                                                                        | 50       | 11,900                                                                                                                                                           | 830                                                                                                                                                                                                                                                                  | 270      | 5,600             | 390          | 130      |
| 5             | 4,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 330          | 160      | 3,800                    | 230          | 75       | 3,200                      | 210          | 110      | 1,900                                                                                                                                                           | 95                                                                                                                                                                                                                        | 50       | 9,500                                                                                                                                                            | 860                                                                                                                                                                                                                                                                  | 280      | 4,500             | 410          | 130      |
| 6             | 3,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 340          | 170      | 3,200                    | 260          | 85       | 2,700                      | 240          | 120      | 1,600                                                                                                                                                           | 100                                                                                                                                                                                                                       | 50       | 8,000                                                                                                                                                            | 880                                                                                                                                                                                                                                                                  | 290      | 3,700             | 410          | 130      |
| 8             | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 310          | 160      | 2,400                    | 240          | 80       | 2,000                      | 220          | 110      | 1,200                                                                                                                                                           | 100                                                                                                                                                                                                                       | 50       | 6,000                                                                                                                                                            | 780                                                                                                                                                                                                                                                                  | 260      | 2,800             | 360          | 120      |
| 10            | 2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 290          | 150      | 1,900                    | 230          | 75       | 1,600                      | 210          | 100      | 1,000                                                                                                                                                           | 100                                                                                                                                                                                                                       | 50       | 4,800                                                                                                                                                            | 720                                                                                                                                                                                                                                                                  | 240      | 2,200             | 330          | 110      |
| 12            | 1,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 270          | 140      | 1,600                    | 220          | 75       | 1,300                      | 200          | 100      | 800                                                                                                                                                             | 100                                                                                                                                                                                                                       | 50       | 4,000                                                                                                                                                            | 680                                                                                                                                                                                                                                                                  | 220      | 1,900             | 320          | 110      |
| Depth of Cut  | <div>Side Milling</div>  <div><math>ae</math><br/><math>\phi 0.3 \sim 0.95 = 0.05D</math><br/><math>\phi 1 \sim 2.55 = 0.07D</math><br/><math>\phi 2.6 \sim 6 = 0.1D</math><br/><math>\phi 6.5 \sim 12 = 0.15D</math></div> <div>Slotting</div>  <div><math>ap</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 1.45 = 0.1D</math><br/><math>\phi 1.5 \sim 3.9 = 0.35D</math><br/><math>\phi 4 \sim 12 = 0.5D</math></div> |              |          |                          |              |          |                            |              |          | <div>Side Milling</div>  <div><math>1D</math><br/><math>0.02D</math></div> |                                                                                                                                                                                                                           |          | <div>Side Milling</div>  <div><math>1.5D</math><br/><math>0.2D</math></div> |                                                                                                                                                                                                                                                                      |          |                   |              |          |
|               | (D: Dia.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |              |          |                          |              |          |                            |              |          |                                                                                                                                                                 | <div>Slotting</div>  <div><math>ap</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 12 = 0.1D</math></div> |          |                                                                                                                                                                  | <div>Slotting</div>  <div><math>ap</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 1.45 = 0.3D</math><br/><math>\phi 1.5 \sim 12 = 0.5D</math></div> |          |                   |              |          |
| Notes         | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                                                                                                                                                                                                                                                                                              |              |          |                          |              |          |                            |              |          |                                                                                                                                                                 |                                                                                                                                                                                                                           |          |                                                                                                                                                                  |                                                                                                                                                                                                                                                                      |          |                   |              |          |



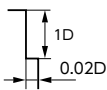
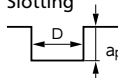
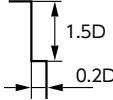
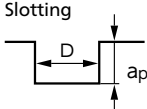
MSE230

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |          | Alloy Steels<br>SCM・SKD・SUS |              |          | Prehardened Steels<br>HPM・NAK |              |          |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------|--------------|----------|-------------------------------|--------------|----------|
| Cutting Speed                 | 50～80m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |          | 50～70m/min                  |              |          | 40～60m/min                    |              |          |
| Dia.                          | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Feed         |          | Spindle Speed               | Feed         |          | Spindle Speed                 | Feed         |          |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mm/min       |          |                             | mm/min       |          |                               | mm/min       |          |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Side Milling | Slotting | min <sup>-1</sup>           | Side Milling | Slotting | min <sup>-1</sup>             | Side Milling | Slotting |
| 0.1                           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | —            | 25       | 50,000                      | —            | 15       | 50,000                        | —            | 20       |
| 0.2                           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | —            | 40       | 50,000                      | —            | 25       | 50,000                        | —            | 30       |
| 0.3                           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100          | 50       | 50,000                      | 90           | 35       | 50,000                        | 85           | 40       |
| 0.4                           | 50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 150          | 75       | 47,700                      | 130          | 50       | 39,800                        | 110          | 55       |
| 0.5                           | 41,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 170          | 85       | 38,200                      | 130          | 50       | 31,800                        | 110          | 55       |
| 0.8                           | 25,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 210          | 100      | 23,900                      | 150          | 55       | 19,900                        | 130          | 65       |
| 1                             | 20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 210          | 100      | 19,100                      | 150          | 55       | 15,900                        | 130          | 65       |
| 1.5                           | 13,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 210          | 100      | 12,700                      | 150          | 55       | 10,600                        | 130          | 65       |
| 2                             | 10,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 210          | 100      | 9,500                       | 170          | 60       | 8,000                         | 150          | 75       |
| 2.5                           | 8,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 250          | 120      | 7,600                       | 180          | 65       | 6,400                         | 160          | 80       |
| 3                             | 6,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 280          | 140      | 6,400                       | 190          | 70       | 5,300                         | 170          | 85       |
| 3.5                           | 5,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300          | 150      | 5,500                       | 190          | 70       | 4,500                         | 170          | 85       |
| 4                             | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 310          | 160      | 4,800                       | 190          | 70       | 4,000                         | 170          | 85       |
| 5                             | 4,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 330          | 160      | 3,800                       | 230          | 75       | 3,200                         | 210          | 110      |
| 6                             | 3,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 340          | 170      | 3,200                       | 260          | 85       | 2,700                         | 240          | 120      |
| 7                             | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 330          | 170      | 2,700                       | 240          | 80       | 2,300                         | 230          | 120      |
| 8                             | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 310          | 160      | 2,400                       | 240          | 80       | 2,000                         | 220          | 110      |
| 9                             | 2,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300          | 150      | 2,100                       | 230          | 80       | 1,800                         | 220          | 110      |
| 10                            | 2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 290          | 150      | 1,900                       | 230          | 75       | 1,600                         | 210          | 100      |
| 11                            | 1,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 290          | 140      | 1,700                       | 220          | 75       | 1,400                         | 200          | 100      |
| 12                            | 1,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 270          | 140      | 1,600                       | 220          | 75       | 1,300                         | 200          | 100      |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div></div><div><math>a_e</math><br/><math>\phi 0.3 \sim 0.95 = 0.05D</math><br/><math>\phi 1 \sim 2.55 = 0.07D</math><br/><math>\phi 2.6 \sim 6 = 0.1D</math><br/><math>\phi 6.5 \sim 12 = 0.15D</math></div></div> <div><div>Slotting</div><div></div><div><math>a_p</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 1.45 = 0.1D</math><br/><math>\phi 1.5 \sim 3.9 = 0.35D</math><br/><math>\phi 4 \sim 12 = 0.5D</math></div></div> |              |          |                             |              |          |                               |              |          |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |          |                             |              |          |                               |              |          |

MSE230

Recommended Milling Conditions

| Work Material                 | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                                                                                                                                                                                                                              |                    |          | Aluminium Alloy                                                                                                                                                                                                                                                                                                                                                                                           |                    |          | Copper                                 |                    |          |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|----------------------------------------|--------------------|----------|
| Cutting Speed                 | 20～40m/min                                                                                                                                                                                                                                                                                                                                                     |                    |          | 100～200m/min                                                                                                                                                                                                                                                                                                                                                                                              |                    |          | 60～80m/min                             |                    |          |
| Dia.                          | Spindle Speed<br><br>min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                         | Feed<br><br>mm/min |          | Spindle Speed<br><br>min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                    | Feed<br><br>mm/min |          | Spindle Speed<br><br>min <sup>-1</sup> | Feed<br><br>mm/min |          |
|                               |                                                                                                                                                                                                                                                                                                                                                                | Side Milling       | Slotting |                                                                                                                                                                                                                                                                                                                                                                                                           | Side Milling       | Slotting |                                        | Side Milling       | Slotting |
|                               |                                                                                                                                                                                                                                                                                                                                                                |                    |          |                                                                                                                                                                                                                                                                                                                                                                                                           |                    |          |                                        |                    |          |
| 0.1                           | 50,000                                                                                                                                                                                                                                                                                                                                                         | —                  | 15       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                    | 60                 | 25       | 50,000                                 | 60                 | 25       |
| 0.2                           | 47,700                                                                                                                                                                                                                                                                                                                                                         | —                  | 20       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                    | 90                 | 35       | 50,000                                 | 90                 | 35       |
| 0.3                           | 31,800                                                                                                                                                                                                                                                                                                                                                         | —                  | 20       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                    | 150                | 60       | 50,000                                 | 150                | 60       |
| 0.4                           | 23,900                                                                                                                                                                                                                                                                                                                                                         | 50                 | 25       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                    | 200                | 80       | 50,000                                 | 200                | 80       |
| 0.5                           | 19,100                                                                                                                                                                                                                                                                                                                                                         | 60                 | 30       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                    | 250                | 100      | 44,600                                 | 220                | 90       |
| 0.8                           | 11,900                                                                                                                                                                                                                                                                                                                                                         | 70                 | 35       | 50,000                                                                                                                                                                                                                                                                                                                                                                                                    | 450                | 180      | 27,900                                 | 250                | 95       |
| 1                             | 9,500                                                                                                                                                                                                                                                                                                                                                          | 75                 | 40       | 47,700                                                                                                                                                                                                                                                                                                                                                                                                    | 570                | 200      | 22,300                                 | 270                | 95       |
| 1.5                           | 6,400                                                                                                                                                                                                                                                                                                                                                          | 75                 | 40       | 31,800                                                                                                                                                                                                                                                                                                                                                                                                    | 640                | 220      | 14,900                                 | 300                | 100      |
| 2                             | 4,800                                                                                                                                                                                                                                                                                                                                                          | 75                 | 40       | 23,900                                                                                                                                                                                                                                                                                                                                                                                                    | 720                | 250      | 11,100                                 | 330                | 120      |
| 2.5                           | 3,800                                                                                                                                                                                                                                                                                                                                                          | 75                 | 40       | 19,100                                                                                                                                                                                                                                                                                                                                                                                                    | 760                | 270      | 8,900                                  | 360                | 120      |
| 3                             | 3,200                                                                                                                                                                                                                                                                                                                                                          | 80                 | 40       | 15,900                                                                                                                                                                                                                                                                                                                                                                                                    | 800                | 270      | 7,400                                  | 370                | 130      |
| 3.5                           | 2,700                                                                                                                                                                                                                                                                                                                                                          | 85                 | 45       | 13,600                                                                                                                                                                                                                                                                                                                                                                                                    | 820                | 270      | 6,400                                  | 380                | 130      |
| 4                             | 2,400                                                                                                                                                                                                                                                                                                                                                          | 95                 | 50       | 11,900                                                                                                                                                                                                                                                                                                                                                                                                    | 830                | 270      | 5,600                                  | 390                | 130      |
| 5                             | 1,900                                                                                                                                                                                                                                                                                                                                                          | 95                 | 50       | 9,500                                                                                                                                                                                                                                                                                                                                                                                                     | 860                | 280      | 4,500                                  | 410                | 130      |
| 6                             | 1,600                                                                                                                                                                                                                                                                                                                                                          | 100                | 50       | 8,000                                                                                                                                                                                                                                                                                                                                                                                                     | 880                | 290      | 3,700                                  | 410                | 130      |
| 7                             | 1,400                                                                                                                                                                                                                                                                                                                                                          | 100                | 50       | 6,800                                                                                                                                                                                                                                                                                                                                                                                                     | 820                | 270      | 3,200                                  | 380                | 130      |
| 8                             | 1,200                                                                                                                                                                                                                                                                                                                                                          | 100                | 50       | 6,000                                                                                                                                                                                                                                                                                                                                                                                                     | 780                | 260      | 2,800                                  | 360                | 120      |
| 9                             | 1,100                                                                                                                                                                                                                                                                                                                                                          | 100                | 50       | 5,300                                                                                                                                                                                                                                                                                                                                                                                                     | 740                | 240      | 2,500                                  | 350                | 120      |
| 10                            | 1,000                                                                                                                                                                                                                                                                                                                                                          | 100                | 50       | 4,800                                                                                                                                                                                                                                                                                                                                                                                                     | 720                | 240      | 2,200                                  | 330                | 110      |
| 11                            | 900                                                                                                                                                                                                                                                                                                                                                            | 100                | 50       | 4,300                                                                                                                                                                                                                                                                                                                                                                                                     | 690                | 230      | 2,000                                  | 320                | 110      |
| 12                            | 800                                                                                                                                                                                                                                                                                                                                                            | 100                | 50       | 4,000                                                                                                                                                                                                                                                                                                                                                                                                     | 680                | 220      | 1,900                                  | 320                | 110      |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 12 = 0.1D</math></div> |                    |          | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 1.45 = 0.3D</math><br/><math>\phi 1.5 \sim 12 = 0.5D</math></div> |                    |          |                                        |                    |          |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                              |                    |          |                                                                                                                                                                                                                                                                                                                                                                                                           |                    |          |                                        |                    |          |





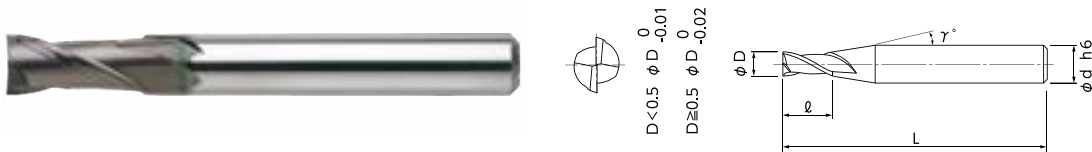
**Regular Line**  
**MUGEN COATING**  
 Full Cutting Length Type

- P** Carbon Steel ☒
- P** Alloy Steel ☒
- P** Prehardened Steel ☒
- M** Stainless Steel ☐
- N** Aluminium Alloy ☐
- N** Copper ☐
- N** Resin ☐

## Recommended Milling Conditions

MG

Side Slot Face



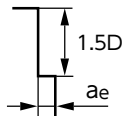
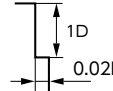
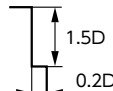
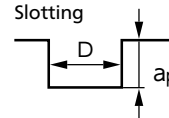
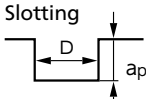
● Printed actual measurement of diameter in micron.



※Micron units dimensions cannot be specified.

| Unit : mm      |             |                      |                         |                   |                       |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 08-00105-00010 | 0.1         | 0.15                 | 9°                      | 4                 | 45                    |
| 08-00105-00020 | 0.2         | 0.4                  | 9°                      | 4                 | 45                    |
| 08-00105-00030 | 0.3         | 0.6                  | 9°                      | 4                 | 45                    |
| 08-00105-00040 | 0.4         | 0.8                  | 9°                      | 4                 | 45                    |
| 08-00105-00050 | 0.5         | 1.25                 | 9°                      | 4                 | 45                    |
| 08-00105-00080 | 0.8         | 2                    | 9°                      | 4                 | 45                    |
| 08-00105-00100 | 1           | 2.5                  | 9°                      | 4                 | 45                    |
| 08-00105-00150 | 1.5         | 4                    | 9°                      | 4                 | 45                    |
| 08-00105-00200 | 2           | 5                    | 9°                      | 4                 | 45                    |
| 08-00105-00250 | 2.5         | 7                    | 9°                      | 4                 | 45                    |
| 08-00105-00300 | 3           | 8                    | 9°                      | 6                 | 50                    |
| 08-00105-00400 | 4           | 10                   | 9°                      | 6                 | 50                    |
| 08-00105-00500 | 5           | 13                   | 9°                      | 6                 | 55                    |
| 08-00105-00600 | 6           | 15                   | —                       | 6                 | 55                    |

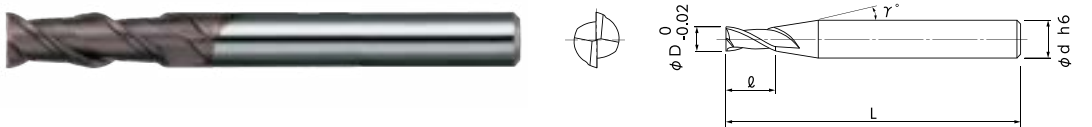
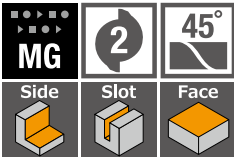
**How to Order** When you order, indicate MSE230M (D). ※(γ) is reference value.

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                   |          | Alloy Steels<br>SCM・SKD・SUS |              |          | Prehardened Steels<br>HPM・NAK |              |          | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                                          |              |          | Aluminium Alloy                                                                                                                                                             |              |          | Copper                                                                                                                                                                                                                                                                                                                    |              |          |                                                                                                                                                                                                                                       |  |  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------|--------------|----------|-------------------------------|--------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Cutting Speed                 | 50～80m/min                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                   |          | 50～70m/min                  |              |          | 40～60m/min                    |              |          | 20～40m/min                                                                                                                                                                 |              |          | 100～200m/min                                                                                                                                                                |              |          | 60～80m/min                                                                                                                                                                                                                                                                                                                |              |          |                                                                                                                                                                                                                                       |  |  |
| Dia.                          | Spindle Speed                                                                                                                                                                                                                                                                                                                | Feed                                                                                                                                                                                                                                                                              |          | Spindle Speed               | Feed         |          | Spindle Speed                 | Feed         |          | Spindle Speed                                                                                                                                                              | Feed         |          | Spindle Speed                                                                                                                                                               | Feed         |          | Spindle Speed                                                                                                                                                                                                                                                                                                             | Feed         |          |                                                                                                                                                                                                                                       |  |  |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                            | mm/min                                                                                                                                                                                                                                                                            |          | min <sup>-1</sup>           | mm/min       |          | min <sup>-1</sup>             | mm/min       |          | min <sup>-1</sup>                                                                                                                                                          | mm/min       |          | min <sup>-1</sup>                                                                                                                                                           | mm/min       |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                         | mm/min       |          |                                                                                                                                                                                                                                       |  |  |
|                               |                                                                                                                                                                                                                                                                                                                              | Side Milling                                                                                                                                                                                                                                                                      | Slotting |                             | Side Milling | Slotting |                               | Side Milling | Slotting |                                                                                                                                                                            | Side Milling | Slotting |                                                                                                                                                                             | Side Milling | Slotting |                                                                                                                                                                                                                                                                                                                           | Side Milling | Slotting |                                                                                                                                                                                                                                       |  |  |
| 0.1                           | 50,000                                                                                                                                                                                                                                                                                                                       | —                                                                                                                                                                                                                                                                                 | 25       | 50,000                      | —            | 15       | 50,000                        | —            | 20       | 50,000                                                                                                                                                                     | —            | 15       | 50,000                                                                                                                                                                      | 60           | 25       | 50,000                                                                                                                                                                                                                                                                                                                    | 60           | 25       |                                                                                                                                                                                                                                       |  |  |
| 0.2                           | 50,000                                                                                                                                                                                                                                                                                                                       | —                                                                                                                                                                                                                                                                                 | 40       | 50,000                      | —            | 25       | 50,000                        | —            | 30       | 47,700                                                                                                                                                                     | —            | 20       | 50,000                                                                                                                                                                      | 90           | 35       | 50,000                                                                                                                                                                                                                                                                                                                    | 90           | 35       |                                                                                                                                                                                                                                       |  |  |
| 0.3                           | 50,000                                                                                                                                                                                                                                                                                                                       | 100                                                                                                                                                                                                                                                                               | 50       | 50,000                      | 90           | 35       | 50,000                        | 85           | 40       | 31,800                                                                                                                                                                     | —            | 20       | 50,000                                                                                                                                                                      | 150          | 60       | 50,000                                                                                                                                                                                                                                                                                                                    | 150          | 60       |                                                                                                                                                                                                                                       |  |  |
| 0.4                           | 50,000                                                                                                                                                                                                                                                                                                                       | 150                                                                                                                                                                                                                                                                               | 75       | 47,700                      | 130          | 50       | 39,800                        | 110          | 55       | 23,900                                                                                                                                                                     | 50           | 25       | 50,000                                                                                                                                                                      | 200          | 80       | 50,000                                                                                                                                                                                                                                                                                                                    | 200          | 80       |                                                                                                                                                                                                                                       |  |  |
| 0.5                           | 41,400                                                                                                                                                                                                                                                                                                                       | 170                                                                                                                                                                                                                                                                               | 85       | 38,200                      | 130          | 50       | 31,800                        | 110          | 55       | 19,100                                                                                                                                                                     | 60           | 30       | 50,000                                                                                                                                                                      | 250          | 100      | 44,600                                                                                                                                                                                                                                                                                                                    | 220          | 90       |                                                                                                                                                                                                                                       |  |  |
| 0.8                           | 25,900                                                                                                                                                                                                                                                                                                                       | 210                                                                                                                                                                                                                                                                               | 100      | 23,900                      | 150          | 55       | 19,900                        | 130          | 65       | 11,900                                                                                                                                                                     | 70           | 35       | 50,000                                                                                                                                                                      | 450          | 180      | 27,900                                                                                                                                                                                                                                                                                                                    | 250          | 95       |                                                                                                                                                                                                                                       |  |  |
| 1                             | 20,700                                                                                                                                                                                                                                                                                                                       | 210                                                                                                                                                                                                                                                                               | 100      | 19,100                      | 150          | 55       | 15,900                        | 130          | 65       | 9,500                                                                                                                                                                      | 75           | 40       | 47,700                                                                                                                                                                      | 570          | 200      | 22,300                                                                                                                                                                                                                                                                                                                    | 270          | 95       |                                                                                                                                                                                                                                       |  |  |
| 1.5                           | 13,800                                                                                                                                                                                                                                                                                                                       | 210                                                                                                                                                                                                                                                                               | 100      | 12,700                      | 150          | 55       | 10,600                        | 130          | 65       | 6,400                                                                                                                                                                      | 75           | 40       | 31,800                                                                                                                                                                      | 640          | 220      | 14,900                                                                                                                                                                                                                                                                                                                    | 300          | 100      |                                                                                                                                                                                                                                       |  |  |
| 2                             | 10,300                                                                                                                                                                                                                                                                                                                       | 210                                                                                                                                                                                                                                                                               | 100      | 9,500                       | 170          | 60       | 8,000                         | 150          | 75       | 4,800                                                                                                                                                                      | 75           | 40       | 23,900                                                                                                                                                                      | 720          | 250      | 11,100                                                                                                                                                                                                                                                                                                                    | 330          | 120      |                                                                                                                                                                                                                                       |  |  |
| 2.5                           | 8,300                                                                                                                                                                                                                                                                                                                        | 250                                                                                                                                                                                                                                                                               | 120      | 7,600                       | 180          | 65       | 6,400                         | 160          | 80       | 3,800                                                                                                                                                                      | 75           | 40       | 19,100                                                                                                                                                                      | 760          | 270      | 8,900                                                                                                                                                                                                                                                                                                                     | 360          | 120      |                                                                                                                                                                                                                                       |  |  |
| 3                             | 6,900                                                                                                                                                                                                                                                                                                                        | 280                                                                                                                                                                                                                                                                               | 140      | 6,400                       | 190          | 70       | 5,300                         | 170          | 85       | 3,200                                                                                                                                                                      | 80           | 40       | 15,900                                                                                                                                                                      | 800          | 270      | 7,400                                                                                                                                                                                                                                                                                                                     | 370          | 130      |                                                                                                                                                                                                                                       |  |  |
| 4                             | 5,200                                                                                                                                                                                                                                                                                                                        | 310                                                                                                                                                                                                                                                                               | 160      | 4,800                       | 190          | 70       | 4,000                         | 170          | 85       | 2,400                                                                                                                                                                      | 95           | 50       | 11,900                                                                                                                                                                      | 830          | 270      | 5,600                                                                                                                                                                                                                                                                                                                     | 390          | 130      |                                                                                                                                                                                                                                       |  |  |
| 5                             | 4,100                                                                                                                                                                                                                                                                                                                        | 330                                                                                                                                                                                                                                                                               | 160      | 3,800                       | 230          | 75       | 3,200                         | 210          | 110      | 1,900                                                                                                                                                                      | 95           | 50       | 9,500                                                                                                                                                                       | 860          | 280      | 4,500                                                                                                                                                                                                                                                                                                                     | 410          | 130      |                                                                                                                                                                                                                                       |  |  |
| 6                             | 3,400                                                                                                                                                                                                                                                                                                                        | 340                                                                                                                                                                                                                                                                               | 170      | 3,200                       | 260          | 85       | 2,700                         | 240          | 120      | 1,600                                                                                                                                                                      | 100          | 50       | 8,000                                                                                                                                                                       | 880          | 290      | 3,700                                                                                                                                                                                                                                                                                                                     | 410          | 130      |                                                                                                                                                                                                                                       |  |  |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 0.3 \sim 0.95 = 0.05D</math><br/><math>\phi 1 \sim 2.55 = 0.07D</math><br/><math>\phi 2.6 \sim 6 = 0.1D</math><br/><math>\phi 6.5 \sim 12 = 0.15D</math></div> |                                                                                                                                                                                                                                                                                   |          |                             |              |          |                               |              |          | <div>Side Milling</div> <div></div> <div><math>1D</math><br/><math>0.02D</math></div> |              |          | <div>Side Milling</div> <div></div> <div><math>1.5D</math><br/><math>0.2D</math></div> |              |          | <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 1.45 = 0.1D</math><br/><math>\phi 1.5 \sim 3.9 = 0.35D</math><br/><math>\phi 4 \sim 12 = 0.5D</math></div> |              |          | <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 0.1 \sim 0.45 = 0.05D</math><br/><math>\phi 0.5 \sim 12 = 0.1D</math></div> |  |  |
|                               | Notes                                                                                                                                                                                                                                                                                                                        | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |          |                             |              |          |                               |              |          |                                                                                                                                                                            |              |          |                                                                                                                                                                             |              |          |                                                                                                                                                                                                                                                                                                                           |              |          |                                                                                                                                                                                                                                       |  |  |



## Recommended Milling Conditions

2-flute with high helix angle 45°. Applicable to tough work materials



- Our original MUGEN COATING has been put on 2-flute end mill.
- Compared with 30° helix angle, it can be reduced cutting load.

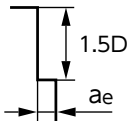
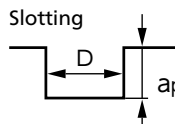
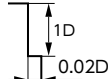
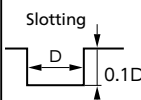
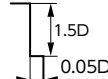
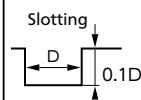
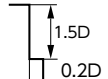
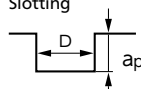
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00120-00200 | 2           | 5                    | 9°                               | 4                 | 45                    |
| 08-00120-00250 | 2.5         | 7                    | 9°                               | 4                 | 45                    |
| 08-00120-00300 | 3           | 8                    | 9°                               | 6                 | 50                    |
| 08-00120-00400 | 4           | 10                   | 9°                               | 6                 | 50                    |
| 08-00120-00500 | 5           | 13                   | 9°                               | 6                 | 55                    |
| 08-00120-00600 | 6           | 15                   | —                                | 6                 | 55                    |
| 08-00120-00800 | 8           | 20                   | —                                | 8                 | 65                    |
| 08-00120-01000 | 10          | 25                   | —                                | 10                | 75                    |
| 08-00120-01200 | 12          | 30                   | —                                | 12                | 80                    |

Unit : mm

## How to Order

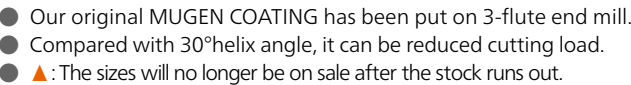
When you order, indicate MSE245 (D). ※ (γ) is reference value.

$\otimes(\gamma)$  is reference value.

| Side Milling                  | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |          |                   |              |          | Alloy Steels<br>SCM・SKD・SUS |              |          |                                                                                                                                                                                                                                            |              |          | Prehardened Steels<br>HPM・NAK |              |          |                   |              |          | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                                                                                                          |              |          |                   |              |          | Heat Resistance Alloy |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          | Aluminium Alloy |  |  |        |  |  | Copper      |  |  |  |  |  |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-------------------|--------------|----------|-----------------------------|--------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-------------------------------|--------------|----------|-------------------|--------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-------------------|--------------|----------|-----------------------|--------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------|--|--|--------|--|--|-------------|--|--|--|--|--|
| Cutting Speed                 | 60～100m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |              |          |                   |              |          | 50～70m/min                  |              |          |                                                                                                                                                                                                                                            |              |          | 40～60m/min                    |              |          |                   |              |          | 20～40m/min                                                                                                                                                                                                                                 |              |          |                   |              |          | 15～25m/min            |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          | 100～200m/min    |  |  |        |  |  | 80～150m/min |  |  |  |  |  |
| Dia.                          | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |          | Feed              |              |          | Spindle Speed               |              |          | Feed                                                                                                                                                                                                                                       |              |          | Spindle Speed                 |              |          | Feed              |              |          | Spindle Speed                                                                                                                                                                                                                              |              |          | Feed              |              |          | Spindle Speed         |              |          | Feed                                                                                                                                                                                                                                                                                                                                               |              |          | Spindle Speed   |  |  | Feed   |  |  |             |  |  |  |  |  |
|                               | mm/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |          | mm/min            |              |          | mm/min                      |              |          | mm/min                                                                                                                                                                                                                                     |              |          | mm/min                        |              |          | mm/min            |              |          | mm/min                                                                                                                                                                                                                                     |              |          | mm/min            |              |          | mm/min                |              |          | mm/min                                                                                                                                                                                                                                                                                                                                             |              |          | mm/min          |  |  | mm/min |  |  |             |  |  |  |  |  |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Side Milling | Slotting | min <sup>-1</sup> | Side Milling | Slotting | min <sup>-1</sup>           | Side Milling | Slotting | min <sup>-1</sup>                                                                                                                                                                                                                          | Side Milling | Slotting | min <sup>-1</sup>             | Side Milling | Slotting | min <sup>-1</sup> | Side Milling | Slotting | min <sup>-1</sup>                                                                                                                                                                                                                          | Side Milling | Slotting | min <sup>-1</sup> | Side Milling | Slotting | min <sup>-1</sup>     | Side Milling | Slotting | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                  | Side Milling | Slotting |                 |  |  |        |  |  |             |  |  |  |  |  |
| 2                             | 12,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 330          | 160      | 9,600             | 250          | 80       | 8,000                       | 130          | 65       | 4,800                                                                                                                                                                                                                                      | 100          | 50       | 3,200                         | 60           | 30       | 31,800            | 1,300        | 450      | 24,000                                                                                                                                                                                                                                     | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 2.5                           | 10,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 400          | 200      | 7,600             | 250          | 80       | 6,400                       | 130          | 65       | 3,800                                                                                                                                                                                                                                      | 100          | 50       | 2,500                         | 60           | 30       | 25,400            | 1,300        | 450      | 19,000                                                                                                                                                                                                                                     | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 3                             | 8,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 440          | 220      | 6,400             | 300          | 100      | 5,300                       | 170          | 85       | 3,200                                                                                                                                                                                                                                      | 130          | 65       | 2,100                         | 70           | 35       | 21,200            | 1,300        | 450      | 16,000                                                                                                                                                                                                                                     | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 4                             | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500          | 250      | 4,800             | 300          | 100      | 4,000                       | 170          | 85       | 2,400                                                                                                                                                                                                                                      | 130          | 65       | 1,600                         | 70           | 35       | 16,000            | 1,300        | 450      | 12,000                                                                                                                                                                                                                                     | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 5                             | 5,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 530          | 260      | 3,800             | 360          | 120      | 3,200                       | 220          | 110      | 1,900                                                                                                                                                                                                                                      | 150          | 75       | 1,300                         | 80           | 40       | 12,700            | 1,300        | 450      | 9,600                                                                                                                                                                                                                                      | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 6                             | 4,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 550          | 270      | 3,200             | 360          | 120      | 2,700                       | 220          | 110      | 1,600                                                                                                                                                                                                                                      | 150          | 75       | 1,100                         | 80           | 40       | 10,600            | 1,300        | 450      | 8,000                                                                                                                                                                                                                                      | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 8                             | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500          | 250      | 2,400             | 360          | 120      | 2,000                       | 220          | 110      | 1,200                                                                                                                                                                                                                                      | 150          | 75       | 800                           | 80           | 40       | 8,000             | 1,100        | 380      | 6,000                                                                                                                                                                                                                                      | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 10                            | 2,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 460          | 230      | 1,900             | 360          | 120      | 1,600                       | 220          | 110      | 1,000                                                                                                                                                                                                                                      | 150          | 75       | 600                           | 80           | 40       | 6,300             | 1,000        | 350      | 4,800                                                                                                                                                                                                                                      | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| 12                            | 2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 440          | 220      | 1,600             | 360          | 120      | 1,300                       | 220          | 110      | 800                                                                                                                                                                                                                                        | 150          | 75       | 500                           | 80           | 40       | 5,300             | 1,000        | 350      | 4,000                                                                                                                                                                                                                                      | 1,200        | 400      |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>ae</math><br/><math>\phi 2 \sim 2.5 = 0.1D</math><br/><math>\phi 3 \sim 6 = 0.15D</math><br/><math>\phi 8 \sim 12 = 0.2D</math></div> <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 2 \sim 3 = 0.35D</math><br/><math>\phi 4 \sim 12 = 0.5D</math></div> |              |          |                   |              |          |                             |              |          | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> |              |          |                               |              |          |                   |              |          | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> |              |          |                   |              |          |                       |              |          | <div>Side Milling</div> <div></div> <div>Slotting</div> <div></div> <div><math>ap</math><br/><math>\phi 2 \sim 3 = 0.3D</math><br/><math>\phi 4 \sim 12 = 0.5D</math></div> |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |          |                   |              |          |                             |              |          |                                                                                                                                                                                                                                            |              |          |                               |              |          |                   |              |          |                                                                                                                                                                                                                                            |              |          |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |
| Notes                         | <div>※1 Use cutting fluid with smoke retardant.</div> <div>※2 Recommend to use oil mist coolant for machining hardened steels.</div> <div>※3 Adjust both spindle speed and feed at the same rate.</div> <div>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.</div>                                                                                                                                                                                  |              |          |                   |              |          |                             |              |          |                                                                                                                                                                                                                                            |              |          |                               |              |          |                   |              |          |                                                                                                                                                                                                                                            |              |          |                   |              |          |                       |              |          |                                                                                                                                                                                                                                                                                                                                                    |              |          |                 |  |  |        |  |  |             |  |  |  |  |  |

## MSE345

## Recommended Milling Conditions

Unit : mm

▲ Discontinued Products

- ※1 Use cutting fluid with smoke retardant.
- ※2 Recommend to use oil mist coolant for machining hardened steels.
- ※3 Adjust both spindle speed and feed at the same rate.
- ※4 Use rigid and precise machine and chuck holder.
- ※5 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.

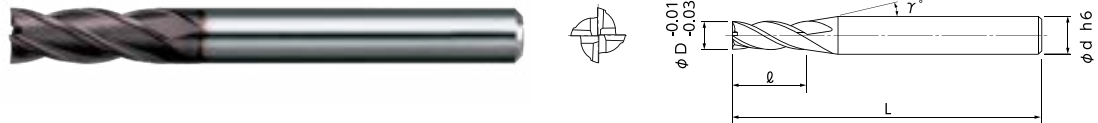
# MSE430P

Size  $\phi$  1 ~  $\phi$  12



## MUGEN COATING 4-Flute Sharp Edge End Mill

4-flute sharp edge type with helix angle 30°



- It can be cut from nonferrous to steels due to the sharp edges.
- Minimize tool deflection for accurate finishing.

Unit : mm

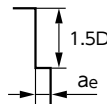
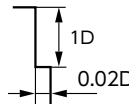
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00112-00100 | 1           | 2.5                  | 9°                               | 4                 | 45                    |
| 08-00112-00150 | 1.5         | 4                    | 9°                               | 4                 | 45                    |
| 08-00112-00200 | 2           | 5                    | 9°                               | 4                 | 45                    |
| 08-00112-00250 | 2.5         | 7                    | 9°                               | 4                 | 45                    |
| 08-00112-00300 | 3           | 8                    | 9°                               | 4                 | 50                    |
| 08-00112-00400 | 4           | 10                   | —                                | 4                 | 50                    |
| 08-00112-00500 | 5           | 13                   | 9°                               | 6                 | 55                    |
| 08-00112-00600 | 6           | 15                   | —                                | 6                 | 55                    |
| 08-00112-00800 | 8           | 20                   | —                                | 8                 | 65                    |
| 08-00112-01000 | 10          | 25                   | —                                | 10                | 75                    |
| 08-00112-01200 | 12          | 30                   | —                                | 12                | 80                    |

### How to Order

When you order, indicate MSE430P (D). ※( $\gamma$ ) is reference value.

# MSE430P

## Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                            |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC)                                                                                                                                        |        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Cutting Speed                 | 60～100m/min                                                                                                                                                                                                                                                                                                      |        | 50～70m/min                  |        | 35～60m/min                    |        | 20～40m/min                                                                                                                                                               |        |
| Dia.                          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                 | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                                                                                                                                                         | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                                                                                                        | mm/min |
| 1                             | 20,700                                                                                                                                                                                                                                                                                                           | 330    | 19,100                      | 210    | 14,300                        | 150    | 9,600                                                                                                                                                                    | 160    |
| 2                             | 10,300                                                                                                                                                                                                                                                                                                           | 330    | 9,600                       | 270    | 7,200                         | 160    | 4,800                                                                                                                                                                    | 180    |
| 3                             | 6,900                                                                                                                                                                                                                                                                                                            | 440    | 6,400                       | 320    | 4,800                         | 180    | 3,200                                                                                                                                                                    | 210    |
| 4                             | 5,200                                                                                                                                                                                                                                                                                                            | 500    | 4,800                       | 380    | 3,600                         | 180    | 2,400                                                                                                                                                                    | 230    |
| 5                             | 4,100                                                                                                                                                                                                                                                                                                            | 520    | 3,800                       | 380    | 2,900                         | 200    | 1,900                                                                                                                                                                    | 250    |
| 6                             | 3,400                                                                                                                                                                                                                                                                                                            | 540    | 3,200                       | 380    | 2,400                         | 200    | 1,600                                                                                                                                                                    | 250    |
| 8                             | 2,700                                                                                                                                                                                                                                                                                                            | 520    | 2,400                       | 380    | 1,800                         | 200    | 1,200                                                                                                                                                                    | 250    |
| 10                            | 2,100                                                                                                                                                                                                                                                                                                            | 470    | 1,900                       | 380    | 1,400                         | 200    | 1,000                                                                                                                                                                    | 250    |
| 12                            | 1,700                                                                                                                                                                                                                                                                                                            | 440    | 1,600                       | 380    | 1,200                         | 200    | 800                                                                                                                                                                      | 250    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 1\sim 2=0.05D</math><br/><math>\phi 3\sim 6=0.1D</math><br/><math>\phi 8\sim 12=0.15D</math></div>                                                   |        |                             |        |                               |        | <div>Side Milling</div> <div></div> <div><math>1D</math><br/><math>0.02D</math></div> |        |
|                               | <div>Notes</div> <div>※1 Use cutting fluid with smoke retardant.<br/>※2 Recommend to use oil mist coolant for machining hardened steels.<br/>※3 Adjust both spindle speed and feed at the same rate.<br/>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.</div> |        |                             |        |                               |        |                                                                                                                                                                          |        |

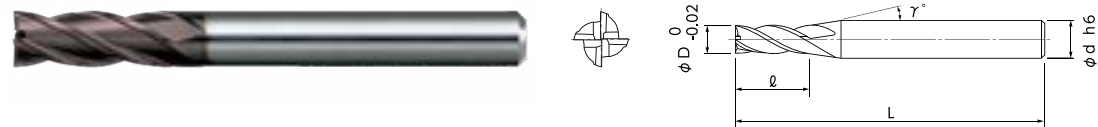
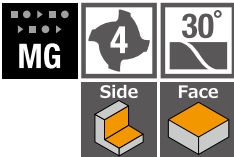
# MSE430

Size  $\phi$  1 ~  $\phi$  20



## MUGEN COATING 4-Flute End Mill

4-flute standard type with helix angle 30°  
For multi-purpose, from roughing to finishing



- Our original MUGEN COATING has been put on 4-flute end mill.
- It can be cut from non-hardened materials to hardened materials.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Unit : mm

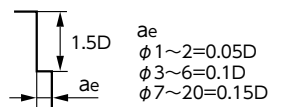
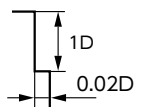
| Code No.         | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|------------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00110-00100   | 1           | 2.5                  | 9°                               | 4                 | 45                    |
| 08-00110-00150   | 1.5         | 4                    | 9°                               | 4                 | 45                    |
| 08-00110-00200   | 2           | 5                    | 9°                               | 4                 | 45                    |
| 08-00110-00250   | 2.5         | 7                    | 9°                               | 4                 | 45                    |
| 08-00110-00300   | 3           | 8                    | 9°                               | 6                 | 50                    |
| 08-00110-00350   | 3.5         | 9                    | 9°                               | 6                 | 50                    |
| 08-00110-00400   | 4           | 10                   | 9°                               | 6                 | 50                    |
| 08-00110-00450   | 4.5         | 12                   | 9°                               | 6                 | 55                    |
| 08-00110-00500   | 5           | 13                   | 9°                               | 6                 | 55                    |
| 08-00110-00550   | 5.5         | 14                   | 9°                               | 6                 | 55                    |
| 08-00110-00600   | 6           | 15                   | —                                | 6                 | 55                    |
| 08-00110-00650   | 6.5         | 17                   | 9°                               | 8                 | 60                    |
| 08-00110-00700   | 7           | 18                   | 9°                               | 8                 | 65                    |
| 08-00110-00750   | 7.5         | 19                   | 9°                               | 8                 | 65                    |
| 08-00110-00800   | 8           | 20                   | —                                | 8                 | 65                    |
| 08-00110-00850   | 8.5         | 22                   | 9°                               | 10                | 70                    |
| 08-00110-00900   | 9           | 23                   | 9°                               | 10                | 70                    |
| 08-00110-00950   | 9.5         | 24                   | 9°                               | 10                | 75                    |
| 08-00110-01000   | 10          | 25                   | —                                | 10                | 75                    |
| 08-00110-01200   | 12          | 30                   | —                                | 12                | 80                    |
| ▲ 08-00110-01400 | 14          | 35                   | —                                | 12                | 100                   |
| ▲ 08-00110-01500 | 15          | 40                   | 9°                               | 16                | 110                   |
| ▲ 08-00110-01600 | 16          | 40                   | —                                | 16                | 110                   |
| ▲ 08-00110-01800 | 18          | 45                   | —                                | 16                | 120                   |
| ▲ 08-00110-02000 | 20          | 50                   | —                                | 20                | 135                   |

### How to Order

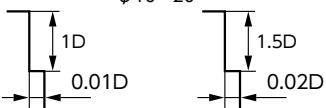
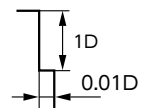
When you order, indicate MSE430 (D). ※ (  $\gamma$  ) is reference value.

▲ Discontinued Products

## Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                               |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC)                                                   |        |
|-------------------------------|-------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-------------------------------------------------------------------------------------|--------|
| Cutting Speed                 | 60～100m/min                                                                         |        | 50～70m/min                  |        | 35～60m/min                    |        | 20～40m/min                                                                          |        |
| Dia.                          | Spindle Speed                                                                       | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed                                                                       | Feed   |
|                               | min <sup>-1</sup>                                                                   | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                   | mm/min |
| 1                             | 20,700                                                                              | 330    | 19,100                      | 210    | 14,300                        | 150    | 9,600                                                                               | 160    |
| 2                             | 10,300                                                                              | 330    | 9,600                       | 270    | 7,200                         | 160    | 4,800                                                                               | 180    |
| 3                             | 6,900                                                                               | 440    | 6,400                       | 320    | 4,800                         | 180    | 3,200                                                                               | 210    |
| 4                             | 5,200                                                                               | 500    | 4,800                       | 380    | 3,600                         | 180    | 2,400                                                                               | 230    |
| 5                             | 4,100                                                                               | 520    | 3,800                       | 380    | 2,900                         | 200    | 1,900                                                                               | 250    |
| 6                             | 3,400                                                                               | 540    | 3,200                       | 380    | 2,400                         | 200    | 1,600                                                                               | 250    |
| 7                             | 3,000                                                                               | 530    | 2,700                       | 380    | 2,000                         | 200    | 1,400                                                                               | 250    |
| 8                             | 2,700                                                                               | 520    | 2,400                       | 380    | 1,800                         | 200    | 1,200                                                                               | 250    |
| 9                             | 2,300                                                                               | 480    | 2,100                       | 380    | 1,600                         | 200    | 1,100                                                                               | 250    |
| 10                            | 2,100                                                                               | 470    | 1,900                       | 380    | 1,400                         | 200    | 1,000                                                                               | 250    |
| 12                            | 1,700                                                                               | 440    | 1,600                       | 380    | 1,200                         | 200    | 800                                                                                 | 250    |
| 14                            | 1,500                                                                               | 430    | 1,400                       | 360    | 1,000                         | 190    | 700                                                                                 | 230    |
| 15                            | 1,400                                                                               | 430    | 1,300                       | 350    | 1,000                         | 180    | 600                                                                                 | 210    |
| 16                            | 1,300                                                                               | 420    | 1,200                       | 330    | 900                           | 160    | 600                                                                                 | 200    |
| 18                            | 1,150                                                                               | 400    | 1,100                       | 330    | 800                           | 160    | 500                                                                                 | 200    |
| 20                            | 1,050                                                                               | 400    | 1,000                       | 330    | 700                           | 160    | 500                                                                                 | 200    |
| Depth of Cut<br><br>(D: Dia.) | Side Milling                                                                        |        |                             |        |                               |        | Side Milling                                                                        |        |
|                               |  |        |                             |        |                               |        |  |        |

## Recommended High Speed Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                             |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC)                                                     |        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|---------------------------------------------------------------------------------------|--------|
| Cutting Speed                 | 250m/min                                                                                                                                                                                                                                                                          |        | 200m/min                    |        | 160m/min                      |        | 80m/min                                                                               |        |
| Dia.                          | Spindle Speed                                                                                                                                                                                                                                                                     | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed                                                                         | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                 | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                     | mm/min |
| 6                             | 13,300                                                                                                                                                                                                                                                                            | 2,600  | 10,600                      | 2,000  | 8,500                         | 1,600  | 4,200                                                                                 | 500    |
| 8                             | 10,000                                                                                                                                                                                                                                                                            | 2,600  | 8,000                       | 2,000  | 6,400                         | 1,600  | 3,200                                                                                 | 500    |
| 10                            | 8,000                                                                                                                                                                                                                                                                             | 2,600  | 6,400                       | 2,000  | 5,100                         | 1,600  | 2,500                                                                                 | 500    |
| 12                            | 6,600                                                                                                                                                                                                                                                                             | 2,600  | 5,300                       | 2,000  | 4,200                         | 1,600  | 2,100                                                                                 | 500    |
| 16                            | 5,000                                                                                                                                                                                                                                                                             | 2,000  | 4,000                       | 1,500  | 3,200                         | 1,200  | 1,600                                                                                 | 380    |
| 20                            | 4,000                                                                                                                                                                                                                                                                             | 2,000  | 3,200                       | 1,500  | 2,500                         | 1,200  | 1,300                                                                                 | 380    |
| Depth of Cut<br><br>(D: Dia.) | Side Milling<br>φ6～9.5                      φ10～20                                                                                                                                                                                                                                |        |                             |        |                               |        | Side Milling                                                                          |        |
|                               |                                                                                                                                                                                              |        |                             |        |                               |        |  |        |
| Notes                         | ※1 Use cutting fluid with smoke retardant.<br>※2 Recommend to use oil mist coolant for machining hardened steels.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |        |                             |        |                               |        |                                                                                       |        |



Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Titanium Alloy  
Heat Resistant Alloy

~ 55  
HRC

Hardened Steel

Coating  
Square

MSE445

Size  $\phi 2 \sim \phi 20$

MUGEN COATING 4-Flute End Mill

4-flute with high helix angle 45°  
Suitable for side milling of tough work materials

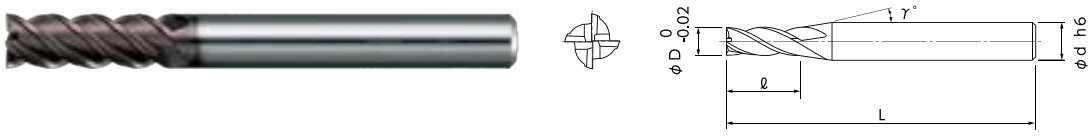
MG

4

45°

Side

Face



● Our original MUGEN COATING has been put on 4-flute end mill.

● Compared with 30° helix angle, it can be reduced cutting load.

● ▲ : The sizes will no longer be on sale after the stock runs out.

| Code No.         | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|------------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| 08-00140-00200   | 2           | 5                    | 9°                      | 4                 | 45                    |
| 08-00140-00250   | 2.5         | 7                    | 9°                      | 4                 | 45                    |
| 08-00140-00300   | 3           | 8                    | 9°                      | 6                 | 50                    |
| 08-00140-00400   | 4           | 10                   | 9°                      | 6                 | 50                    |
| 08-00140-00500   | 5           | 13                   | 9°                      | 6                 | 55                    |
| 08-00140-00600   | 6           | 15                   | —                       | 6                 | 55                    |
| 08-00140-00800   | 8           | 20                   | —                       | 8                 | 65                    |
| 08-00140-01000   | 10          | 25                   | —                       | 10                | 75                    |
| 08-00140-01200   | 12          | 30                   | —                       | 12                | 80                    |
| ▲ 08-00140-01600 | 16          | 40                   | —                       | 16                | 110                   |
| ▲ 08-00140-02000 | 20          | 50                   | —                       | 20                | 135                   |

How to Order

When you order, indicate MSE445 (D).      ※ (γ) is reference value.

▲ Discontinued Products

MSE445

Regular Line  
MUGEN COATING  
Full Cutting Length Type

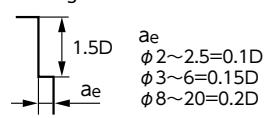
Recommended Milling Conditions

| Work Material | Carbon Steels<br>S50C |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC) |        | Heat Resistance Alloy |        |
|---------------|-----------------------|--------|-----------------------------|--------|-------------------------------|--------|-----------------------------------|--------|-----------------------|--------|
| Cutting Speed | 60～100m/min           |        | 50～70m/min                  |        | 40～60m/min                    |        | 20～40m/min                        |        | 15～25m/min            |        |
| Dia.          | Spindle Speed         | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed                     | Feed   | Spindle Speed         | Feed   |
|               | min <sup>-1</sup>     | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                 | mm/min | min <sup>-1</sup>     | mm/min |
| 2             | 12,700                | 560    | 9,600                       | 325    | 8,000                         | 220    | 4,800                             | 210    | 3,200                 | 100    |
| 2.5           | 10,200                | 670    | 7,600                       | 325    | 6,400                         | 220    | 3,800                             | 210    | 2,500                 | 100    |
| 3             | 8,500                 | 750    | 6,400                       | 390    | 5,300                         | 240    | 3,200                             | 260    | 2,100                 | 130    |
| 4             | 6,400                 | 840    | 4,800                       | 390    | 4,000                         | 240    | 2,400                             | 260    | 1,600                 | 130    |
| 5             | 5,100                 | 900    | 3,800                       | 470    | 3,200                         | 260    | 1,900                             | 300    | 1,300                 | 150    |
| 6             | 4,200                 | 920    | 3,200                       | 470    | 2,700                         | 260    | 1,600                             | 300    | 1,100                 | 150    |
| 8             | 3,200                 | 840    | 2,400                       | 470    | 2,000                         | 260    | 1,200                             | 300    | 800                   | 150    |
| 10            | 2,500                 | 770    | 1,900                       | 470    | 1,600                         | 260    | 1,000                             | 300    | 600                   | 150    |
| 12            | 2,100                 | 740    | 1,600                       | 470    | 1,300                         | 260    | 800                               | 300    | 500                   | 150    |
| 16            | 1,600                 | 700    | 1,200                       | 390    | 1,000                         | 220    | 600                               | 260    | 400                   | 130    |
| 20            | 1,300                 | 690    | 1,000                       | 390    | 800                           | 220    | 500                               | 260    | 300                   | 130    |

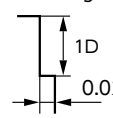
Depth of Cut

(D: Dia.)

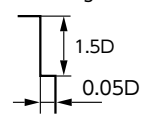
Side Milling



Side Milling



Side Milling



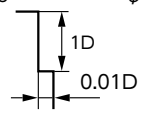
Recommended High Speed Milling Conditions

| Work Material | Carbon Steels<br>S50C |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61 (～52HRC) |        |
|---------------|-----------------------|--------|-----------------------------|--------|-------------------------------|--------|-----------------------------------|--------|
| Cutting Speed | 250m/min              |        | 200m/min                    |        | 160m/min                      |        | 80m/min                           |        |
| Dia.          | Spindle Speed         | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed                     | Feed   |
|               | min <sup>-1</sup>     | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                 | mm/min |
| 6             | 13,300                | 2,900  | 10,600                      | 2,250  | 8,500                         | 1,800  | 4,250                             | 600    |
| 8             | 10,000                | 2,900  | 8,000                       | 2,250  | 6,400                         | 1,800  | 3,200                             | 600    |
| 10            | 8,000                 | 2,900  | 6,400                       | 2,250  | 5,100                         | 1,800  | 2,550                             | 600    |
| 12            | 6,600                 | 2,900  | 5,300                       | 2,250  | 4,200                         | 1,800  | 2,100                             | 600    |
| 16            | 5,000                 | 2,300  | 4,000                       | 1,700  | 3,200                         | 1,350  | 1,600                             | 450    |
| 20            | 4,000                 | 2,300  | 3,200                       | 1,700  | 2,500                         | 1,350  | 1,300                             | 450    |

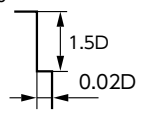
Depth of Cut

(D: Dia.)

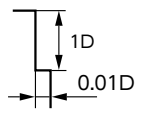
Side Milling



Side Milling



Side Milling



Notes

※1 Use cutting fluid with smoke retardant.  
※2 Recommend to use oil mist coolant for machining hardened steels.  
※3 Adjust both spindle speed and feed at the same rate.  
※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.

H-048

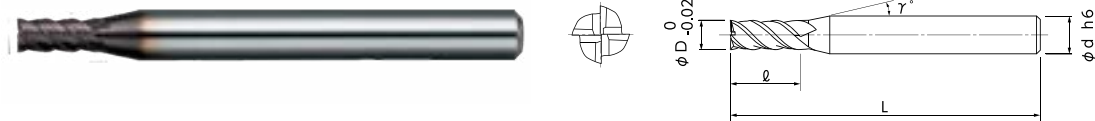
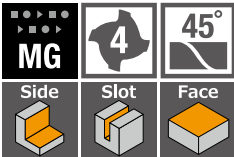
H-049



MUGEN COATING 4-Flute End Mill For Hardened Steel

Recommended Milling Conditions

4-flute with high helix angle. For finishing of prehardened steels and hardened steels (~55HRC)



- Machineable to high hardened steels (48~55HRC).
- Realized high precision finishing without the deflection.

Unit : mm

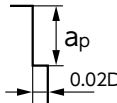
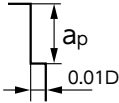
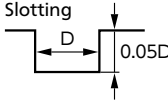
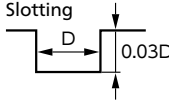
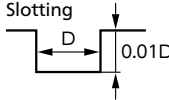
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00400-00100 | 1           | 1.5                  | 12°                              | 6                 | 60                    |
| 08-00400-00150 | 1.5         | 2.5                  | 12°                              | 6                 | 60                    |
| 08-00400-00200 | 2           | 4                    | 12°                              | 6                 | 60                    |
| 08-00400-00300 | 3           | 6                    | 12°                              | 6                 | 60                    |
| 08-00400-00400 | 4           | 8                    | 12°                              | 6                 | 60                    |

How to Order

When you order, indicate MHD445 (D). ※( $\gamma$ ) is reference value.

Recommended High Speed Milling Conditions

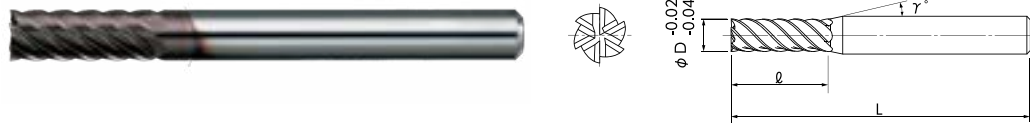
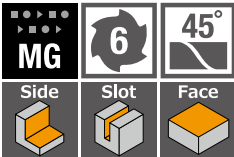
| Work Material             | Hardened Steels<br>SKD61<br>(45~50HRC)                                      |        |                   |        | Hardened Steels<br>SKD61・STAVAX・HPM-38<br>(50~55HRC) |        |                   |        | Hardened Steels<br>SKD11<br>(55HRC)                                         |        |                   |        |
|---------------------------|-----------------------------------------------------------------------------|--------|-------------------|--------|------------------------------------------------------|--------|-------------------|--------|-----------------------------------------------------------------------------|--------|-------------------|--------|
| Dia.                      | Side Milling                                                                |        | Slotting          |        | Side Milling                                         |        | Slotting          |        | Side Milling                                                                |        | Slotting          |        |
|                           | Spindle Speed                                                               | Feed   | Spindle Speed     | Feed   | Spindle Speed                                        | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                               | Feed   | Spindle Speed     | Feed   |
|                           | min <sup>-1</sup>                                                           | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                           | mm/min | min <sup>-1</sup> | mm/min |
| 1                         | 6,400                                                                       | 280    | 3,200             | 140    | 5,400                                                | 240    | 2,700             | 120    | 4,800                                                                       | 200    | 2,400             | 100    |
| 1.5                       | 4,200                                                                       | 300    | 2,100             | 150    | 3,600                                                | 230    | 1,800             | 120    | 3,200                                                                       | 180    | 1,600             | 90     |
| 2                         | 3,200                                                                       | 320    | 1,600             | 160    | 2,700                                                | 230    | 1,400             | 120    | 2,400                                                                       | 180    | 1,200             | 90     |
| 3                         | 3,700                                                                       | 520    | 1,900             | 260    | 3,200                                                | 380    | 1,600             | 140    | 2,600                                                                       | 260    | 1,300             | 130    |
| 4                         | 2,800                                                                       | 450    | 1,400             | 230    | 2,400                                                | 360    | 1,200             | 180    | 2,000                                                                       | 260    | 1,000             | 130    |
| Depth of Cut<br>(D: Dia.) | Side Milling<br><br>$a_p$<br>$\phi 1 \sim 2 = 1D$<br>$\phi 3 \sim 4 = 1.5D$ |        |                   |        |                                                      |        |                   |        | Side Milling<br><br>$a_p$<br>$\phi 1 \sim 2 = 1D$<br>$\phi 3 \sim 4 = 1.5D$ |        |                   |        |
|                           | Slotting<br><br>D<br>0.05D                                                  |        |                   |        | Slotting<br><br>D<br>0.03D                           |        |                   |        | Slotting<br><br>D<br>0.01D                                                  |        |                   |        |

| Work Material                 | Hardened Steels<br>SKD61<br>(45~50HRC)                                                                                                                                                                                                                      |        |                   |        | Hardened Steels<br>SKD61・STAVAX・HPM-38<br>(50~55HRC)                                                                                                       |        |                   |        | Hardened Steels<br>SKD11<br>(55HRC)                                                                                                                                                                                 |        |                   |        |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Dia.                          | Side Milling                                                                                                                                                                                                                                                |        | Slotting          |        | Side Milling                                                                                                                                               |        | Slotting          |        | Side Milling                                                                                                                                                                                                        |        | Slotting          |        |
|                               | Spindle Speed                                                                                                                                                                                                                                               | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                                                              | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                                                                                                                       | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                           | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                                                          | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                                                                                                                   | mm/min | min <sup>-1</sup> | mm/min |
| 1                             | 20,000                                                                                                                                                                                                                                                      | 950    | 10,000            | 480    | 17,500                                                                                                                                                     | 770    | 8,800             | 390    | 12,700                                                                                                                                                                                                              | 510    | 6,400             | 260    |
| 1.5                           | 13,800                                                                                                                                                                                                                                                      | 1,000  | 6,900             | 500    | 11,700                                                                                                                                                     | 750    | 5,900             | 380    | 8,500                                                                                                                                                                                                               | 480    | 4,300             | 240    |
| 2                             | 10,400                                                                                                                                                                                                                                                      | 1,000  | 5,200             | 500    | 8,700                                                                                                                                                      | 730    | 4,400             | 370    | 6,400                                                                                                                                                                                                               | 460    | 3,200             | 230    |
| 3                             | 10,600                                                                                                                                                                                                                                                      | 1,500  | 5,300             | 750    | 9,500                                                                                                                                                      | 1,100  | 4,800             | 550    | 7,400                                                                                                                                                                                                               | 740    | 3,700             | 370    |
| 4                             | 8,000                                                                                                                                                                                                                                                       | 1,300  | 4,000             | 650    | 7,200                                                                                                                                                      | 1,100  | 3,600             | 550    | 5,600                                                                                                                                                                                                               | 740    | 2,800             | 370    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div>  <div><math>a_p</math><br/><math>\phi 1 \sim 2 = 1D</math><br/><math>\phi 3 \sim 4 = 1.5D</math></div>                                         |        |                   |        |                                                                                                                                                            |        |                   |        | <div>Side Milling</div>  <div><math>a_p</math><br/><math>\phi 1 \sim 2 = 1D</math><br/><math>\phi 3 \sim 4 = 1.5D</math></div> |        |                   |        |
|                               | <div>Slotting</div>  <div><math>D</math><br/><math>0.05D</math></div>                                                                                                  |        |                   |        | <div>Slotting</div>  <div><math>D</math><br/><math>0.03D</math></div> |        |                   |        | <div>Slotting</div>  <div><math>D</math><br/><math>0.01D</math></div>                                                          |        |                   |        |
| Notes                         | ※1 Use a rigid and precise machine and chuck holder.<br>※2 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Use oilmist coolant or air blow. |        |                   |        |                                                                                                                                                            |        |                   |        |                                                                                                                                                                                                                     |        |                   |        |

MUGEN COATING 6-Flute End Mill For Hardened Steel

Recommended Milling Conditions

6-flute with high helix angle. For finishing of prehardened steels and hardened steels (~55HRC)



- Machineable to high hardened steels (48~55HRC).
- Realized high precision finishing without the deflection.

Unit : mm

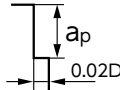
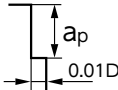
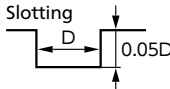
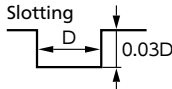
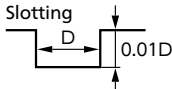
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00410-00500 | 5           | 10                   | 12°                              | 6                 | 60                    |
| 08-00410-00600 | 6           | 15                   | —                                | 6                 | 60                    |
| 08-00410-00800 | 8           | 20                   | —                                | 8                 | 65                    |
| 08-00410-01000 | 10          | 25                   | —                                | 10                | 75                    |
| 08-00410-01200 | 12          | 30                   | —                                | 12                | 80                    |

How to Order

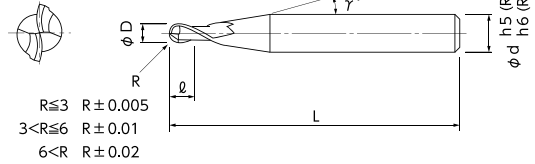
When you order, indicate MHD645 (D). ※( $\gamma$ ) is reference value.

Recommended High Speed Milling Conditions

| Work Material             | Hardened Steels<br>SKD61<br>(45~50HRC)                    |        |                   |        | Hardened Steels<br>SKD61・STAVAX・HPM-38<br>(50~55HRC) |        |                   |        | Hardened Steels<br>SKD11<br>(55HRC)                       |        |                   |        |
|---------------------------|-----------------------------------------------------------|--------|-------------------|--------|------------------------------------------------------|--------|-------------------|--------|-----------------------------------------------------------|--------|-------------------|--------|
| Dia.                      | Side Milling                                              |        | Slotting          |        | Side Milling                                         |        | Slotting          |        | Side Milling                                              |        | Slotting          |        |
|                           | Spindle Speed                                             | Feed   | Spindle Speed     | Feed   | Spindle Speed                                        | Feed   | Spindle Speed     | Feed   | Spindle Speed                                             | Feed   | Spindle Speed     | Feed   |
|                           | min <sup>-1</sup>                                         | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                         | mm/min | min <sup>-1</sup> | mm/min |
| 5                         | 5,100                                                     | 1,200  | 2,600             | 600    | 4,500                                                | 1,000  | 2,300             | 500    | 3,800                                                     | 800    | 1,900             | 400    |
| 6                         | 4,200                                                     | 1,300  | 2,500             | 780    | 3,700                                                | 1,100  | 2,200             | 660    | 3,200                                                     | 680    | 1,600             | 340    |
| 8                         | 3,200                                                     | 1,500  | 1,900             | 900    | 2,800                                                | 1,300  | 1,700             | 780    | 2,400                                                     | 750    | 1,200             | 380    |
| 10                        | 2,600                                                     | 1,500  | 1,600             | 900    | 2,200                                                | 1,300  | 1,300             | 780    | 1,900                                                     | 900    | 950               | 450    |
| 12                        | 2,100                                                     | 1,300  | 1,300             | 780    | 1,900                                                | 1,100  | 1,150             | 660    | 1,600                                                     | 960    | 800               | 480    |
| Depth of Cut<br>(D: Dia.) | Side Milling<br>$a_p$<br>$\phi 5 \sim 12 = 1.5D$<br>0.02D |        |                   |        |                                                      |        |                   |        | Side Milling<br>$a_p$<br>$\phi 5 \sim 12 = 1.5D$<br>0.01D |        |                   |        |
|                           | Slotting<br>D<br>0.05D                                    |        |                   |        | Slotting<br>D<br>0.03D                               |        |                   |        | Slotting<br>D<br>0.01D                                    |        |                   |        |

| Recommended High Speed Milling Conditions |                                                                                                                                                                                                                                                                                                |                                                                                                                                       |                   |        |                                                      |                                                                                                                                       |                   |        |                                                                                                                                                                                             |                                                                                                                                       |                   |        |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|
| Work Material                             | Hardened Steels<br>SKD61<br>(45~50HRC)                                                                                                                                                                                                                                                         |                                                                                                                                       |                   |        | Hardened Steels<br>SKD61・STAVAX・HPM-38<br>(50~55HRC) |                                                                                                                                       |                   |        | Hardened Steels<br>SKD11<br>(55HRC)                                                                                                                                                         |                                                                                                                                       |                   |        |
| Dia.                                      | Side Milling                                                                                                                                                                                                                                                                                   |                                                                                                                                       | Slotting          |        | Side Milling                                         |                                                                                                                                       | Slotting          |        | Side Milling                                                                                                                                                                                |                                                                                                                                       | Slotting          |        |
|                                           | Spindle Speed                                                                                                                                                                                                                                                                                  | Feed                                                                                                                                  | Spindle Speed     | Feed   | Spindle Speed                                        | Feed                                                                                                                                  | Spindle Speed     | Feed   | Spindle Speed                                                                                                                                                                               | Feed                                                                                                                                  | Spindle Speed     | Feed   |
|                                           | min <sup>-1</sup>                                                                                                                                                                                                                                                                              | mm/min                                                                                                                                | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                    | mm/min                                                                                                                                | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                                                                                           | mm/min                                                                                                                                | min <sup>-1</sup> | mm/min |
| 5                                         | 8,900                                                                                                                                                                                                                                                                                          | 2,100                                                                                                                                 | 4,500             | 1,100  | 7,600                                                | 1,800                                                                                                                                 | 3,800             | 900    | 5,100                                                                                                                                                                                       | 1,100                                                                                                                                 | 2,600             | 550    |
| 6                                         | 7,400                                                                                                                                                                                                                                                                                          | 2,200                                                                                                                                 | 4,500             | 1,320  | 6,400                                                | 1,900                                                                                                                                 | 3,900             | 1,150  | 5,300                                                                                                                                                                                       | 1,100                                                                                                                                 | 2,700             | 550    |
| 8                                         | 5,600                                                                                                                                                                                                                                                                                          | 2,600                                                                                                                                 | 3,400             | 1,560  | 4,800                                                | 2,200                                                                                                                                 | 2,900             | 1,320  | 4,000                                                                                                                                                                                       | 1,300                                                                                                                                 | 2,000             | 650    |
| 10                                        | 4,500                                                                                                                                                                                                                                                                                          | 2,600                                                                                                                                 | 2,700             | 1,560  | 3,800                                                | 2,200                                                                                                                                 | 2,300             | 1,320  | 3,200                                                                                                                                                                                       | 1,500                                                                                                                                 | 1,600             | 750    |
| 12                                        | 3,700                                                                                                                                                                                                                                                                                          | 2,200                                                                                                                                 | 2,200             | 1,320  | 3,200                                                | 1,900                                                                                                                                 | 2,000             | 1,150  | 2,600                                                                                                                                                                                       | 1,600                                                                                                                                 | 1,300             | 800    |
| Depth of Cut                              | <div>Side Milling</div> <div></div> <div><math>a_p</math><br/><math>\phi 5 \sim 12 = 1.5D</math></div>                                                                                                    |                                                                                                                                       |                   |        |                                                      |                                                                                                                                       |                   |        | <div>Side Milling</div> <div></div> <div><math>a_p</math><br/><math>\phi 5 \sim 12 = 1.5D</math></div> |                                                                                                                                       |                   |        |
|                                           | (D: Dia.)                                                                                                                                                                                                                                                                                      | <div>Slotting</div> <div></div> <div>0.05D</div> |                   |        |                                                      | <div>Slotting</div> <div></div> <div>0.03D</div> |                   |        |                                                                                                                                                                                             | <div>Slotting</div> <div></div> <div>0.01D</div> |                   |        |
| Notes                                     | <div>※1 Use a rigid and precise machine and chuck holder.</div> <div>※2 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.</div> <div>※3 Adjust both spindle speed and feed at the same rate.</div> <div>※4 Use oilmist coolant or air blow.</div> |                                                                                                                                       |                   |        |                                                      |                                                                                                                                       |                   |        |                                                                                                                                                                                             |                                                                                                                                       |                   |        |

## MUGEN COATING 2-Flute Ball End Mill



Unit : mm

| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 08-00501-00075 | R0.75      | 2.3               | 1.5      | 15°                  | 4              | 50                 |
| 08-00500-00075 | R0.75      | 2.3               | 1.5      | 15°                  | 6              | 50                 |
| 08-00501-00080 | R0.8       | 2.4               | 1.6      | 15°                  | 4              | 50                 |
| 08-00500-00080 | R0.8       | 2.4               | 1.6      | 15°                  | 6              | 50                 |
| 08-00500-00085 | R0.85      | 2.6               | 1.7      | 15°                  | 6              | 50                 |
| 08-00500-00090 | R0.9       | 2.7               | 1.8      | 15°                  | 6              | 50                 |
| 08-00500-00095 | R0.95      | 2.9               | 1.9      | 15°                  | 6              | 50                 |
| 08-00501-00100 | R1         | 3                 | 2        | 9°                   | 4              | 60                 |
| 08-00500-00100 | R1         | 3                 | 2        | 9°                   | 6              | 60                 |
| 08-00500-00105 | R1.05      | 3.2               | 2.1      | 9°                   | 6              | 60                 |
| 08-00500-00110 | R1.1       | 3.3               | 2.2      | 9°                   | 6              | 60                 |
| 08-00500-00115 | R1.15      | 3.5               | 2.3      | 9°                   | 6              | 60                 |
| 08-00500-00120 | R1.2       | 3.6               | 2.4      | 9°                   | 6              | 60                 |
| 08-00501-00125 | R1.25      | 3.8               | 2.5      | 9°                   | 4              | 60                 |
| 08-00500-00125 | R1.25      | 3.8               | 2.5      | 9°                   | 6              | 60                 |
| 08-00500-00130 | R1.3       | 3.9               | 2.6      | 9°                   | 6              | 60                 |
| 08-00500-00135 | R1.35      | 4.1               | 2.7      | 9°                   | 6              | 60                 |
| 08-00500-00140 | R1.4       | 4.2               | 2.8      | 9°                   | 6              | 60                 |
| 08-00500-00145 | R1.45      | 4.4               | 2.9      | 9°                   | 6              | 60                 |
| 08-00501-00150 | R1.5       | 5                 | 3        | 9°                   | 4              | 60                 |
| 08-00500-00150 | R1.5       | 5                 | 3        | 9°                   | 6              | 60                 |
| 08-00500-00155 | R1.55      | 5                 | 3.1      | 9°                   | 6              | 60                 |
| 08-00500-00160 | R1.6       | 5                 | 3.2      | 9°                   | 6              | 60                 |
| 08-00500-00165 | R1.65      | 5                 | 3.3      | 9°                   | 6              | 60                 |
| 08-00500-00170 | R1.7       | 5.1               | 3.4      | 9°                   | 6              | 60                 |
| 08-00500-00175 | R1.75      | 5.3               | 3.5      | 9°                   | 6              | 60                 |

| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 08-00500-00180 | R1.8       | 5.4               | 3.6      | 9°                   | 6              | 60                 |
| 08-00500-00185 | R1.85      | 5.6               | 3.7      | 9°                   | 6              | 60                 |
| 08-00500-00190 | R1.9       | 5.7               | 3.8      | 9°                   | 6              | 60                 |
| 08-00500-00195 | R1.95      | 5.9               | 3.9      | 9°                   | 6              | 60                 |
| 08-00500-00200 | R2         | 6                 | 4        | 9°                   | 6              | 70                 |
| 08-00500-00205 | R2.05      | 6.2               | 4.1      | 9°                   | 6              | 70                 |
| 08-00500-00210 | R2.1       | 6.3               | 4.2      | 9°                   | 6              | 70                 |
| 08-00500-00215 | R2.15      | 6.5               | 4.3      | 9°                   | 6              | 70                 |
| 08-00500-00220 | R2.2       | 6.6               | 4.4      | 9°                   | 6              | 70                 |
| 08-00500-00225 | R2.25      | 6.8               | 4.5      | 9°                   | 6              | 70                 |
| 08-00500-00230 | R2.3       | 6.9               | 4.6      | 9°                   | 6              | 70                 |
| 08-00500-00235 | R2.35      | 7.1               | 4.7      | 9°                   | 6              | 70                 |
| 08-00500-00240 | R2.4       | 7.2               | 4.8      | 9°                   | 6              | 70                 |
| 08-00500-00245 | R2.45      | 7.4               | 4.9      | 9°                   | 6              | 70                 |
| 08-00500-00250 | R2.5       | 8                 | 5        | 9°                   | 6              | 70                 |
| 08-00500-00255 | R2.55      | 8                 | 5.1      | 9°                   | 6              | 70                 |
| 08-00500-00260 | R2.6       | 8                 | 5.2      | 9°                   | 6              | 70                 |
| 08-00500-00265 | R2.65      | 8                 | 5.3      | 9°                   | 6              | 70                 |
| 08-00500-00270 | R2.7       | 8.1               | 5.4      | 9°                   | 6              | 70                 |
| 08-00500-00275 | R2.75      | 8.3               | 5.5      | 9°                   | 6              | 70                 |
| 08-00500-00280 | R2.8       | 8.4               | 5.6      | 9°                   | 6              | 70                 |
| 08-00500-00285 | R2.85      | 8.6               | 5.7      | 9°                   | 6              | 70                 |
| 08-00500-00290 | R2.9       | 8.7               | 5.8      | 9°                   | 6              | 70                 |
| 08-00500-00295 | R2.95      | 8.9               | 5.9      | 9°                   | 6              | 70                 |
| 08-00500-00300 | R3         | 10                | 6        | —                    | 6              | 80                 |
| 08-00500-00350 | R3.5       | 10.5              | 7        | —                    | 6              | 80                 |

| Unit : mm        |            |                   |          |                      |                |                    |
|------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| Code No.         | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 08-00500-00400   | R4         | 12                | 8        | —                    | 8              | 90                 |
| 08-00500-00450   | R4.5       | 13.5              | 9        | —                    | 8              | 90                 |
| 08-00500-00500   | R5         | 15                | 10       | —                    | 10             | 100                |
| 08-00500-00550   | R5.5       | 16.5              | 11       | —                    | 10             | 100                |
| 08-00500-00600   | R6         | 20                | 12       | —                    | 12             | 110                |
| ▲ 08-00500-00700 | R7         | 21                | 14       | —                    | 12             | 160                |
| ▲ 08-00500-00800 | R8         | 25                | 16       | —                    | 16             | 160                |
| ▲ 08-00500-00900 | R9         | 27                | 18       | —                    | 16             | 170                |
| ▲ 08-00500-01000 | R10        | 30                | 20       | —                    | 20             | 170                |

**H** Hardened Steel  $\sim 55$  HRC



MSB230

Recommended Milling Conditions

| Work Material              | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                  |        | Alloy Steels<br>Prehardened Steels<br>SCM・SKD・SUS・HPM・NAK |        | Hardened Steels<br>SKD61<br>(~52HRC) |        | Aluminium Alloy   |        | Copper            |        |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------|--------|--------------------------------------|--------|-------------------|--------|-------------------|--------|
| Cutting Speed              | 150m/min                                                                                                                                                                                                                                                                                               |        | 120~150m/min                                              |        | 80~100m/min                          |        | 150m/min~         |        | 100~150m/min      |        |
| Radius                     | Spindle Speed                                                                                                                                                                                                                                                                                          | Feed   | Spindle Speed                                             | Feed   | Spindle Speed                        | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   |
|                            | min <sup>-1</sup>                                                                                                                                                                                                                                                                                      | mm/min | min <sup>-1</sup>                                         | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 0.05                       | 50,000                                                                                                                                                                                                                                                                                                 | 200    | 50,000                                                    | 150    | 50,000                               | 100    | 50,000            | 250    | 50,000            | 250    |
| 0.1                        | 50,000                                                                                                                                                                                                                                                                                                 | 400    | 50,000                                                    | 340    | 50,000                               | 200    | 50,000            | 500    | 50,000            | 500    |
| 0.2                        | 50,000                                                                                                                                                                                                                                                                                                 | 630    | 50,000                                                    | 600    | 50,000                               | 630    | 50,000            | 600    | 50,000            | 600    |
| 0.3                        | 50,000                                                                                                                                                                                                                                                                                                 | 930    | 50,000                                                    | 940    | 48,000                               | 900    | 50,000            | 750    | 50,000            | 750    |
| 0.4                        | 50,000                                                                                                                                                                                                                                                                                                 | 1,200  | 48,000                                                    | 1,200  | 36,000                               | 900    | 50,000            | 1,000  | 50,000            | 1,000  |
| 0.5                        | 48,000                                                                                                                                                                                                                                                                                                 | 1,430  | 38,000                                                    | 1,200  | 29,000                               | 900    | 50,000            | 1,250  | 48,000            | 1,000  |
| 0.6                        | 40,000                                                                                                                                                                                                                                                                                                 | 1,430  | 32,000                                                    | 1,200  | 24,000                               | 810    | 50,000            | 1,480  | 40,000            | 1,080  |
| 0.8                        | 30,000                                                                                                                                                                                                                                                                                                 | 1,270  | 24,000                                                    | 1,000  | 18,000                               | 670    | 50,000            | 1,900  | 30,000            | 1,160  |
| 1                          | 24,000                                                                                                                                                                                                                                                                                                 | 1,160  | 19,000                                                    | 800    | 14,300                               | 600    | 48,000            | 2,400  | 24,000            | 1,200  |
| 1.5                        | 16,000                                                                                                                                                                                                                                                                                                 | 930    | 13,000                                                    | 600    | 9,600                                | 460    | 32,000            | 2,400  | 16,000            | 1,200  |
| 2                          | 12,000                                                                                                                                                                                                                                                                                                 | 930    | 10,000                                                    | 570    | 7,200                                | 450    | 24,000            | 2,400  | 12,000            | 1,200  |
| 2.5                        | 9,600                                                                                                                                                                                                                                                                                                  | 930    | 8,000                                                     | 560    | 5,700                                | 450    | 19,000            | 2,400  | 9,600             | 1,200  |
| 3                          | 8,000                                                                                                                                                                                                                                                                                                  | 930    | 6,400                                                     | 540    | 4,800                                | 450    | 16,000            | 2,400  | 8,000             | 1,200  |
| 4                          | 6,000                                                                                                                                                                                                                                                                                                  | 900    | 4,800                                                     | 540    | 3,600                                | 450    | 12,000            | 2,400  | 6,000             | 1,200  |
| 5                          | 4,800                                                                                                                                                                                                                                                                                                  | 900    | 3,800                                                     | 540    | 2,900                                | 450    | 9,600             | 2,300  | 4,800             | 1,150  |
| 6                          | 4,000                                                                                                                                                                                                                                                                                                  | 900    | 3,200                                                     | 540    | 2,400                                | 450    | 8,000             | 2,100  | 4,000             | 1,050  |
| 7                          | 3,400                                                                                                                                                                                                                                                                                                  | 900    | 2,750                                                     | 540    | 2,050                                | 450    | 6,800             | 2,000  | 3,400             | 1,000  |
| 8                          | 3,000                                                                                                                                                                                                                                                                                                  | 900    | 2,400                                                     | 540    | 1,800                                | 450    | 6,000             | 2,000  | 3,000             | 1,000  |
| 9                          | 2,650                                                                                                                                                                                                                                                                                                  | 900    | 2,100                                                     | 520    | 1,600                                | 450    | 5,300             | 2,000  | 2,650             | 1,000  |
| 10                         | 2,400                                                                                                                                                                                                                                                                                                  | 900    | 1,900                                                     | 520    | 1,450                                | 450    | 4,800             | 2,000  | 2,400             | 1,000  |
| Depth of Cut<br>(R:Radius) | <div><div><div><div></div><div>0.1×R (~45HRC)<br/>~0.08×R (~55HRC)</div></div><div><div>~0.15×R R&lt;0.1<br/>~0.2×R 0.1≤R≤0.5<br/>~0.3×R R&gt;0.5</div><div><div></div><div>~0.16×R R≤0.3 (~45HRC)<br/>~0.25×R R≤3 (~45HRC)<br/>~0.3×R R≥4 (~45HRC)<br/>~0.05×R (~55HRC)</div></div></div></div></div> |        |                                                           |        |                                      |        |                   |        |                   |        |
| Notes                      | ※1 When slotting, reduce the feed by 60% from the above values.<br>※2 Length of overhang is 4 times Dia. as standard. When it is longer than 4 times Dia., adjust the conditions listed above.<br>※3 Recommended oil mist or airflow.<br>※4 Adjust both spindle speed and feed at the same rate.       |        |                                                           |        |                                      |        |                   |        |                   |        |

MSB230

Recommended High Speed Milling Conditions

| Work Material              | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                               |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Hardened Steels<br>SKD61<br>(~52HRC) |        |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|--------------------------------------|--------|
| Cutting Speed              | 250m/min                                                                                                                                                                                                                                                                                                            |        | 200m/min                    |        | 180m/min                      |        | 100m/min                             |        |
| Radius                     | Spindle Speed                                                                                                                                                                                                                                                                                                       | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed                        | Feed   |
|                            | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                   | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                    | mm/min |
| 0.2                        | ~50,000                                                                                                                                                                                                                                                                                                             | ~1,500 | ~50,000                     | ~1,200 | ~50,000                       | ~1,000 | ~50,000                              | 600    |
| 0.3                        | ~50,000                                                                                                                                                                                                                                                                                                             | ~1,500 | ~50,000                     | ~1,200 | ~50,000                       | ~1,000 | ~50,000                              | 700    |
| 0.4                        | ~50,000                                                                                                                                                                                                                                                                                                             | ~3,000 | ~50,000                     | ~2,500 | ~50,000                       | ~2,200 | 40,000                               | 1,000  |
| 0.5                        | ~50,000                                                                                                                                                                                                                                                                                                             | ~3,000 | ~50,000                     | ~2,500 | ~50,000                       | ~2,200 | 32,000                               | 1,500  |
| 1                          | 40,000                                                                                                                                                                                                                                                                                                              | 5,000  | 32,000                      | 3,200  | 29,000                        | 2,900  | 16,000                               | 1,500  |
| 1.5                        | 27,000                                                                                                                                                                                                                                                                                                              | 5,000  | 21,000                      | 3,200  | 19,000                        | 2,900  | 10,600                               | 1,500  |
| 2                          | 20,000                                                                                                                                                                                                                                                                                                              | 5,000  | 16,000                      | 3,200  | 14,000                        | 2,900  | 8,000                                | 1,500  |
| 3                          | 13,500                                                                                                                                                                                                                                                                                                              | 3,000  | 10,600                      | 2,000  | 9,500                         | 1,800  | 5,300                                | 1,200  |
| 4                          | 10,000                                                                                                                                                                                                                                                                                                              | 3,000  | 8,000                       | 2,000  | 7,200                         | 1,800  | 4,000                                | 1,200  |
| 5                          | 8,000                                                                                                                                                                                                                                                                                                               | 3,000  | 6,400                       | 2,000  | 5,700                         | 1,800  | 3,200                                | 1,200  |
| 6                          | 6,700                                                                                                                                                                                                                                                                                                               | 2,500  | 5,300                       | 1,800  | 4,800                         | 1,600  | 2,700                                | 1,200  |
| 8                          | 5,000                                                                                                                                                                                                                                                                                                               | 2,000  | 4,000                       | 1,500  | 3,600                         | 1,300  | 2,000                                | 800    |
| 10                         | 4,000                                                                                                                                                                                                                                                                                                               | 1,500  | 3,200                       | 1,200  | 2,900                         | 1,000  | 1,600                                | 800    |
| Depth of Cut<br>(R:Radius) | <div><div><div><div></div><div>0.1×R (~45HRC)<br/>~0.08×R (~55HRC)</div></div><div><div>0.2×R<br/>(R0.2~R0.5=0.1×R)</div><div><div></div><div>0.1×R</div></div></div></div></div>                                                                                                                                   |        |                             |        |                               |        |                                      |        |
| Notes                      | ※1 When slotting, reduce the feed by 60% from the above values.<br>※2 Recommended air blow or oil mist.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Use a rigid machine and chuck holder.<br>※5 Adjust milling conditions according to the volume of depth of cut and rigidity of the machine. |        |                             |        |                               |        |                                      |        |



Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

Coating

Ball

MSB230G2

Size R0.05 ~ R3

∞

≤55  
HRC

MUGEN COATING Profit Ball End Mill

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

Coating

Ball

Radius tolerance ±0.002mm. 2-flute high accurate end mill

MG

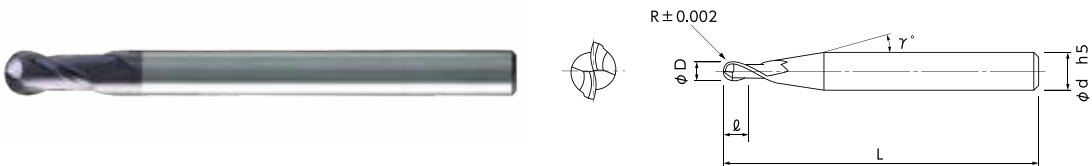
2

30°

R ±0.002

φd h5

3D



● Utmost accuracy ! R-tolerance : ±0.002mm

● Improved MUGEN COATING guarantees long-lasting machining.

Unit : mm

| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| 08-00505-00005 | R0.05      | 0.1               | 0.1      | 15°                  | 4              | 50                 |
| 08-00505-00010 | R0.1       | 0.2               | 0.2      | 15°                  | 4              | 50                 |
| 08-00505-00015 | R0.15      | 0.3               | 0.3      | 15°                  | 4              | 50                 |
| 08-00505-00020 | R0.2       | 0.6               | 0.4      | 15°                  | 4              | 50                 |
| 08-00505-00025 | R0.25      | 0.8               | 0.5      | 15°                  | 4              | 50                 |
| 08-00505-00030 | R0.3       | 0.9               | 0.6      | 15°                  | 4              | 50                 |
| 08-00505-00040 | R0.4       | 1.2               | 0.8      | 15°                  | 4              | 50                 |
| 08-00505-00050 | R0.5       | 1.5               | 1        | 15°                  | 4              | 50                 |
| 08-00505-00075 | R0.75      | 2.3               | 1.5      | 15°                  | 4              | 50                 |
| 08-00505-00100 | R1         | 3                 | 2        | 9°                   | 4              | 60                 |
| 08-00505-00150 | R1.5       | 5                 | 3        | 9°                   | 6              | 60                 |
| 08-00505-00200 | R2         | 6                 | 4        | 9°                   | 6              | 70                 |
| 08-00505-00250 | R2.5       | 8                 | 5        | 9°                   | 6              | 70                 |
| 08-00505-00300 | R3         | 10                | 6        | —                    | 6              | 80                 |

How to Order

When you order, indicate MSB230G2 (R).    ※ (γ) is reference value.

Recommended Milling Conditions

| Work Material           | Carbon Steels S50C                                                                                                                                                                                                                                                                                                                                                | Alloy Steels Prehardened Steels SCM・SKD・SUS・HPM・NAK | Hardened Steels SKD61 (～52HRC)     | Aluminium Alloy | Copper                             |                |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------|-----------------|------------------------------------|----------------|
| Cutting Speed           | 150m/min                                                                                                                                                                                                                                                                                                                                                          | 120～150m/min                                        | 80～100m/min                        | 150m/min～       | 100～150m/min                       |                |
| Radius                  | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                | Feed<br>mm/min                                      | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min  | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |
| 0.05                    | 50,000                                                                                                                                                                                                                                                                                                                                                            | 200                                                 | 50,000                             | 150             | 50,000                             | 100            |
| 0.1                     | 50,000                                                                                                                                                                                                                                                                                                                                                            | 400                                                 | 50,000                             | 340             | 50,000                             | 200            |
| 0.2                     | 50,000                                                                                                                                                                                                                                                                                                                                                            | 630                                                 | 50,000                             | 600             | 50,000                             | 300            |
| 0.3                     | 50,000                                                                                                                                                                                                                                                                                                                                                            | 930                                                 | 50,000                             | 940             | 50,000                             | 400            |
| 0.4                     | 50,000                                                                                                                                                                                                                                                                                                                                                            | 1,200                                               | 48,000                             | 1,200           | 50,000                             | 500            |
| 0.5                     | 48,000                                                                                                                                                                                                                                                                                                                                                            | 1,430                                               | 38,000                             | 1,200           | 29,000                             | 900            |
| 1                       | 24,000                                                                                                                                                                                                                                                                                                                                                            | 1,160                                               | 19,000                             | 800             | 14,300                             | 600            |
| 1.5                     | 16,000                                                                                                                                                                                                                                                                                                                                                            | 930                                                 | 13,000                             | 600             | 9,600                              | 460            |
| 2                       | 12,000                                                                                                                                                                                                                                                                                                                                                            | 930                                                 | 10,000                             | 570             | 7,200                              | 450            |
| 2.5                     | 9,600                                                                                                                                                                                                                                                                                                                                                             | 930                                                 | 8,000                              | 560             | 5,700                              | 450            |
| 3                       | 8,000                                                                                                                                                                                                                                                                                                                                                             | 930                                                 | 6,400                              | 540             | 4,800                              | 450            |
| Depth of Cut (R:Radius) | <div><div><div>~0.15×R</div><div>~0.2×R</div><div>~0.3×R</div></div><div><div>R&lt;0.1</div><div>0.1≤R≤0.5</div><div>R&gt;0.5</div></div><div><div>0.1×R (～45HRC)</div><div>～0.08×R (～55HRC)</div></div><div><div>～0.16×R</div><div>～0.25×R</div><div>～0.05×R</div></div><div><div>R≤0.3 (～45HRC)</div><div>R≤3 (～45HRC)</div><div>R≥4 (～55HRC)</div></div></div> |                                                     |                                    |                 |                                    |                |

Recommended High Speed Milling Conditions

| Work Material           | Carbon Steels S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Alloy Steels SCM・SKD・SUS | Prehardened Steels HPM・NAK         | Hardened Steels SKD61 (～52HRC) |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------|--------------------------------|
| Cutting Spee            | 250m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 200m/min                 | 180m/min                           | 100m/min                       |
| Radius                  | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Feed<br>mm/min           | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min                 |
| 0.2                     | ～50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ～1,500                   | ～50,000                            | ～1,200                         |
| 0.3                     | ～50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ～1,500                   | ～50,000                            | ～1,200                         |
| 0.4                     | ～50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ～3,000                   | ～50,000                            | ～2,500                         |
| 0.5                     | ～50,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ～3,000                   | ～50,000                            | ～2,500                         |
| 1                       | 40,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5,000                    | 32,000                             | 3,200                          |
| 1.5                     | 27,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5,000                    | 21,000                             | 3,200                          |
| 2                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5,000                    | 16,000                             | 3,200                          |
| 3                       | 13,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3,000                    | 10,600                             | 2,000                          |
| Depth of Cut (R:Radius) | <div><div><div>0.1×R (～45HRC)</div><div>～0.08×R (～55HRC)</div></div><div><div>0.2×R</div><div>(R0.2～R0.5=0.1×R)</div><div>0.1×R</div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |                                    |                                |
| Notes                   | <div>※1 When slotting, reduce the feed by 60% from the above values.</div> <div>※2 Recommended air blow or oil mist.</div> <div>※3 Under normal speed milling condition, length of overhang is 4 times Dia. as standard. When it is longer than 4 times Dia., adjust the conditions listed above.</div> <div>※4 Adjust both spindle speed and feed at the same rate.</div> <div>※5 Under high speed milling condition, recommend to use a rigid machine and chuck holder.</div> <div>※6 Use a rigid machine and chuck holder.</div> <div>※7 Adjust milling conditions according to the volume of depth of cut and rigidity of the machine.</div> |                          |                                    |                                |

H-062

H-063

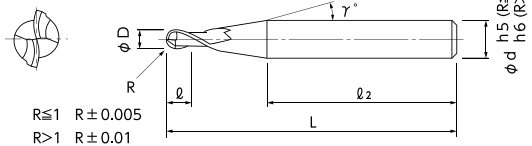






# MSB230SF

## Recommended Milling Conditions



- It fits for Shrink Chuck System.

| Unit : mm      |            |                   |          |                      |                |                                |                    |
|----------------|------------|-------------------|----------|----------------------|----------------|--------------------------------|--------------------|
| Code No.       | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Shank Length (ℓ <sub>2</sub> ) | Overall Length (L) |
| 08-00504-00010 | R0.1       | 0.2               | 0.2      | 15°                  | 4              | 27.3                           | 35                 |
| 08-00504-00020 | R0.2       | 0.4               | 0.4      | 15°                  | 4              | 27.2                           | 35                 |
| 08-00504-00030 | R0.3       | 0.6               | 0.6      | 15°                  | 4              | 27.3                           | 35                 |
| 08-00504-00040 | R0.4       | 0.8               | 0.8      | 15°                  | 4              | 27.4                           | 35                 |
| 08-00504-00050 | R0.5       | 1                 | 1        | 15°                  | 4              | 32.5                           | 40                 |
| 08-00504-00060 | R0.6       | 1.2               | 1.2      | 15°                  | 4              | 32.5                           | 40                 |
| 08-00504-00075 | R0.75      | 1.5               | 1.5      | 15°                  | 4              | 32.6                           | 40                 |
| 08-00504-00100 | R1         | 2                 | 2        | 9°                   | 4              | 30.1                           | 40                 |
| 08-00504-00150 | R1.5       | 3                 | 3        | 9°                   | 4              | 31.8                           | 40                 |
| 08-00504-00200 | R2         | 4                 | 4        | 9°                   | 6              | 27.6                           | 40                 |
| 08-00504-00250 | R2.5       | 5                 | 5        | 9°                   | 6              | 39.8                           | 50                 |
| 08-00504-00300 | R3         | 6                 | 6        | —                    | 6              | 34.9                           | 50                 |
| 08-00504-00400 | R4         | 8                 | 8        | —                    | 8              | 41.1                           | 60                 |
| 08-00504-00500 | R5         | 10                | 10       | —                    | 10             | 36.6                           | 60                 |
| 08-00504-00600 | R6         | 12                | 12       | —                    | 12             | 33.6                           | 60                 |

**How to Order** When you order, indicate MSB230SF (R). ※(γ) is reference value.

[illegible]

## Recommended High Speed Milling Conditions

[illegible]

Regular Line  
MUGEN COATING  
Full Cutting Length Type

Carbon Steel

P

Alloy Steel

P

Aluminium Alloy

N

Copper

N

Resin

N

MSBL230

Size R0.1 ~ R5

∞

≤40  
HRC

MUGEN COATING 2-Flute Long Ball End Mill

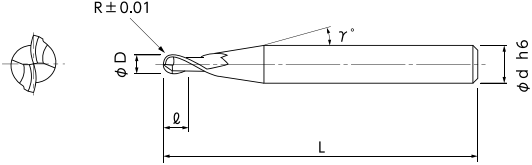
2-flute long ball end mill. Overall length is 150mm at R3

MG

2

30°

3D



- Our original MUGEN COATING has been put on 2-flute long ball end mill.
- The available sizes are from radius 0.1 to 5.
- Take advantage of long shank feature.
- **I** : Semi-standard item, please inquire for price and delivery.

Unit : mm

| Code No.                | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|-------------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| <b>I</b> 08-00510-00010 | R0.1       | 0.5               | 0.2      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00015 | R0.15      | 0.75              | 0.3      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00020 | R0.2       | 1                 | 0.4      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00025 | R0.25      | 1.25              | 0.5      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00030 | R0.3       | 1.5               | 0.6      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00035 | R0.35      | 1.75              | 0.7      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00040 | R0.4       | 2                 | 0.8      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00045 | R0.45      | 2.25              | 0.9      | 9°                   | 3              | 70                 |
| 08-00510-00050          | R0.5       | 2.5               | 1        | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00055 | R0.55      | 2.75              | 1.1      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00060 | R0.6       | 3                 | 1.2      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00065 | R0.65      | 3.25              | 1.3      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00070 | R0.7       | 3.5               | 1.4      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00075 | R0.75      | 3.75              | 1.5      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00080 | R0.8       | 4                 | 1.6      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00085 | R0.85      | 4.25              | 1.7      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00090 | R0.9       | 4.5               | 1.8      | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00095 | R0.95      | 4.75              | 1.9      | 9°                   | 3              | 70                 |
| 08-00510-00100          | R1         | 5                 | 2        | 9°                   | 3              | 70                 |
| <b>I</b> 08-00510-00110 | R1.1       | 5.5               | 2.2      | 9°                   | 3              | 80                 |
| <b>I</b> 08-00510-00120 | R1.2       | 6                 | 2.4      | 9°                   | 3              | 80                 |
| <b>I</b> 08-00510-00125 | R1.25      | 6.25              | 2.5      | 9°                   | 3              | 80                 |
| <b>I</b> 08-00510-00130 | R1.3       | 6.5               | 2.6      | 9°                   | 3              | 80                 |
| <b>I</b> 08-00510-00140 | R1.4       | 7                 | 2.8      | 9°                   | 3              | 80                 |
| 08-00510-00150          | R1.5       | 7.5               | 3        | —                    | 3              | 80                 |
| <b>I</b> 08-00510-00160 | R1.6       | 8                 | 3.2      | —                    | 3              | 120                |

How to Order

When you order, indicate MSBL230 (R).      ※( γ ) is reference value.

MSBXL230

Size R0.5 ~ R5

∞

≤40  
HRC

MUGEN COATING 2-Flute Extra Long Ball End Mill

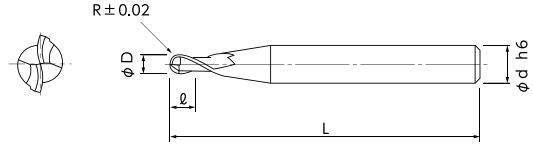
Long overall length allows deeper area milling

MG

2

30°

3D



- **I** : Semi-standard item, please inquire for price and delivery.

Unit : mm

| Code No.                | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Shank Dia. (d) | Overall Length (L) |
|-------------------------|------------|-------------------|----------|----------------|--------------------|
| <b>I</b> 08-00511-00050 | R0.5       | 2.5               | 1        | 3              | 100                |
| <b>I</b> 08-00511-00100 | R1         | 5                 | 2        | 3              | 100                |
| <b>I</b> 08-00511-00150 | R1.5       | 7.5               | 3        | 3              | 120                |
| <b>I</b> 08-00511-00200 | R2         | 10                | 4        | 4              | 150                |
| <b>I</b> 08-00511-00250 | R2.5       | 12.5              | 5        | 6              | 180                |
| <b>I</b> 08-00511-00300 | R3         | 15                | 6        | 6              | 180                |
| <b>I</b> 08-00511-00400 | R4         | 20                | 8        | 8              | 200                |
| <b>I</b> 08-00511-00500 | R5         | 25                | 10       | 10             | 250                |

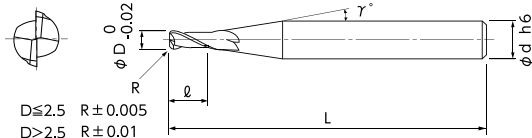
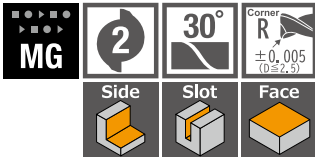
How to Order

When you order, indicate MSBXL230 (R).      ※( γ ) is reference value.

H-072

H-073

2-flute standard type corner radius end mill with helix angle 30°  
For multi-purpose from roughing to finishing



- New  $\phi 6$  size of 2-Flute MUGEN COATING corner radius end mill.
- Total 38 sizes for suitable selection.
- ■ : Semi-standard item, please inquire for price and delivery.

◆ New Size

| Code No.       | Dia. (D) | Corner Radius (R) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|-------------------|----------------------|----------------|--------------------|
| 08-00700-01001 | 1        | R0.1              | 2                 | 9°                   | 4              | 60                 |
| 08-00700-01002 |          | R0.2              |                   |                      |                |                    |
| 08-00700-01003 |          | R0.3              |                   |                      |                |                    |
| 08-00700-01501 | 1.5      | R0.1              | 3                 | 9°                   | 4              | 60                 |
| 08-00700-01502 |          | R0.2              |                   |                      |                |                    |
| 08-00700-01503 |          | R0.3              |                   |                      |                |                    |
| 08-00700-01505 |          | R0.5              |                   |                      |                |                    |
| 08-00700-02001 | 2        | R0.1              | 4                 | 9°                   | 4              | 60                 |
| 08-00700-02002 |          | R0.2              |                   |                      |                |                    |
| 08-00700-02003 |          | R0.3              |                   |                      |                |                    |
| 08-00700-02005 |          | R0.5              |                   |                      |                |                    |
| 08-00700-02501 | 2.5      | R0.1              | 5                 | 9°                   | 4              | 60                 |
| 08-00700-02502 |          | R0.2              |                   |                      |                |                    |
| 08-00700-02503 |          | R0.3              |                   |                      |                |                    |
| 08-00700-02505 |          | R0.5              |                   |                      |                |                    |
| 08-00700-03001 | 3        | R0.1              | 6                 | 9°                   | 6              | 60                 |
| 08-00700-03002 |          | R0.2              |                   |                      |                |                    |
| 08-00700-03003 |          | R0.3              |                   |                      |                |                    |
| 08-00700-03005 |          | R0.5              |                   |                      |                |                    |
| 08-00700-03010 |          | R1                |                   |                      |                |                    |
| 08-00700-04001 | 4        | R0.1              | 8                 | 9°                   | 6              | 65                 |
| 08-00700-04002 |          | R0.2              |                   |                      |                |                    |
| 08-00700-04003 |          | R0.3              |                   |                      |                |                    |
| 08-00700-04005 |          | R0.5              |                   |                      |                |                    |
| 08-00700-04010 |          | R1                |                   |                      |                |                    |

| Code No.       | Dia. (D) | Corner Radius (R) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|-------------------|----------------------|----------------|--------------------|
| 08-00700-05001 | 5        | R0.1              | 10                | 9°                   | 6              | 70                 |
| 08-00700-05002 |          | R0.2              |                   |                      |                |                    |
| 08-00700-05003 |          | R0.3              |                   |                      |                |                    |
| 08-00700-05005 |          | R0.5              |                   |                      |                |                    |
| 08-00700-05010 |          | R1                |                   |                      |                |                    |
| 08-00700-05015 |          | R1.5              |                   |                      |                |                    |
| 08-00700-06001 | 6        | R0.1              | 12                | —                    | 6              | 80                 |
| 08-00700-06002 |          | R0.2              |                   |                      |                |                    |
| 08-00700-06003 |          | R0.3              |                   |                      |                |                    |
| 08-00700-06005 |          | R0.5              |                   |                      |                |                    |
| 08-00700-06010 |          | R1                |                   |                      |                |                    |
| 08-00700-06015 |          | R1.5              |                   |                      |                |                    |
| 08-00700-06020 |          | R2                |                   |                      |                |                    |

Unit : mm

| Work Material          | Carbon Steels S50C                                                                                                                                                                                                                              |              |          | Alloy Steels SCM・SKD・SUS |              |          | Prehardened Steels HPM・NAK |              |          | Hardened Steels SKD61 (~52HRC) |              |          |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|--------------------------|--------------|----------|----------------------------|--------------|----------|--------------------------------|--------------|----------|
| Cutting Speed          | 60~80m/min                                                                                                                                                                                                                                      |              |          | 50~70m/min               |              |          | 30~50m/min                 |              |          | 20~30m/min                     |              |          |
| Dia.                   | Spindle Speed                                                                                                                                                                                                                                   | Feed         |          | Spindle Speed            | Feed         |          | Spindle Speed              | Feed         |          | Spindle Speed                  | Feed         |          |
|                        | min <sup>-1</sup>                                                                                                                                                                                                                               | mm/min       |          | min <sup>-1</sup>        | mm/min       |          | min <sup>-1</sup>          | mm/min       |          | min <sup>-1</sup>              | mm/min       |          |
|                        |                                                                                                                                                                                                                                                 | Side Milling | Slotting |                          | Side Milling | Slotting |                            | Side Milling | Slotting |                                | Side Milling | Slotting |
| 1                      | 25,500                                                                                                                                                                                                                                          | 200          | 100      | 19,200                   | 130          | 50       | 12,800                     | 80           | 40       | 6,400                          | 60           | 30       |
| 1.5                    | 17,100                                                                                                                                                                                                                                          | 340          | 120      | 12,800                   | 180          | 60       | 8,500                      | 90           | 45       | 4,200                          | 70           | 35       |
| 2                      | 12,800                                                                                                                                                                                                                                          | 400          | 150      | 9,600                    | 210          | 70       | 6,400                      | 110          | 55       | 3,200                          | 80           | 40       |
| 2.5                    | 10,200                                                                                                                                                                                                                                          | 400          | 150      | 7,700                    | 210          | 70       | 5,100                      | 110          | 55       | 2,500                          | 80           | 40       |
| 3                      | 8,500                                                                                                                                                                                                                                           | 450          | 160      | 6,400                    | 250          | 80       | 4,300                      | 120          | 60       | 2,100                          | 100          | 50       |
| 4                      | 6,400                                                                                                                                                                                                                                           | 450          | 160      | 4,800                    | 250          | 80       | 3,200                      | 120          | 60       | 1,600                          | 100          | 50       |
| 5                      | 5,100                                                                                                                                                                                                                                           | 600          | 200      | 3,800                    | 300          | 90       | 2,600                      | 150          | 75       | 1,300                          | 120          | 60       |
| 6                      | 4,300                                                                                                                                                                                                                                           | 600          | 220      | 3,200                    | 300          | 100      | 2,200                      | 150          | 90       | 1,100                          | 130          | 70       |
| Depth of Cut (D: Dia.) | <div>Side Milling: 1.5D, 0.1D</div> <div>Slotting: D, 0.3D以下</div> <div>Side Milling: 1D, 0.02D</div> <div>Slotting: D, φ 1~3=0.05D, φ 4~6=0.1D</div>                                                                                           |              |          |                          |              |          |                            |              |          |                                |              |          |
| Notes                  | ※ 1 Adjust feed according to inclined angle.<br>※ 2 When corner machining, reduce the feed by approximately 50%~30%.<br>※ 3 Adjust spindle speed and feed at the same rate also reduce Depth of Cut, if the machine spindle speed insufficient. |              |          |                          |              |          |                            |              |          |                                |              |          |

How to Order

When you order, indicate MSRS230 (D)×(R). ※( γ ) is reference value.



## Recommended Milling Conditions

Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------|----------------------------|----------------------|--------------------------|
| 08-00710-06001 | 6           | R0.1                    | 12                      | —                          | 6                    | 80                       |
| 08-00710-06002 |             | R0.2                    |                         |                            |                      |                          |
| 08-00710-06003 |             | R0.3                    |                         |                            |                      |                          |
| 08-00710-06005 |             | R0.5                    |                         |                            |                      |                          |
| 08-00710-06010 |             | R1                      |                         |                            |                      |                          |
| 08-00710-06015 |             | R1.5                    |                         |                            |                      |                          |
| 08-00710-06020 | R2          |                         |                         |                            |                      |                          |
| 08-00710-08001 | 8           | R0.1                    | 16                      | —                          | 8                    | 90                       |
| 08-00710-08002 |             | R0.2                    |                         |                            |                      |                          |
| 08-00710-08005 |             | R0.5                    |                         |                            |                      |                          |
| 08-00710-08010 |             | R1                      |                         |                            |                      |                          |
| 08-00710-08015 |             | R1.5                    |                         |                            |                      |                          |
| 08-00710-08020 |             | R2                      |                         |                            |                      |                          |
| 08-00710-08025 | R2.5        |                         |                         |                            |                      |                          |
| 08-00710-08030 | R3          |                         |                         |                            |                      |                          |
| 08-00710-10001 | 10          | R0.1                    | 20                      | —                          | 10                   | 100                      |
| 08-00710-10002 |             | R0.2                    |                         |                            |                      |                          |
| 08-00710-10003 |             | R0.3                    |                         |                            |                      |                          |
| 08-00710-10005 |             | R0.5                    |                         |                            |                      |                          |
| 08-00710-10010 |             | R1                      |                         |                            |                      |                          |
| 08-00710-10015 |             | R1.5                    |                         |                            |                      |                          |
| 08-00710-10020 | R2          |                         |                         |                            |                      |                          |
| 08-00710-10025 | R2.5        |                         |                         |                            |                      |                          |
| 08-00710-10030 | R3          |                         |                         |                            |                      |                          |
| 08-00710-12001 | 12          | R0.1                    | 24                      | —                          | 12                   | 110                      |
| 08-00710-12002 |             | R0.2                    |                         |                            |                      |                          |
| 08-00710-12003 |             | R0.3                    |                         |                            |                      |                          |
| 08-00710-12005 |             | R0.5                    |                         |                            |                      |                          |
| 08-00710-12010 |             | R1                      |                         |                            |                      |                          |
| 08-00710-12015 |             | R1.5                    |                         |                            |                      |                          |
| 08-00710-12020 | R2          |                         |                         |                            |                      |                          |
| 08-00710-12025 | R2.5        |                         |                         |                            |                      |                          |
| 08-00710-12030 | R3          |                         |                         |                            |                      |                          |

When you order, indicate MSRS430 (D)x(R).

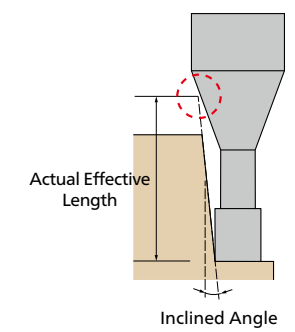
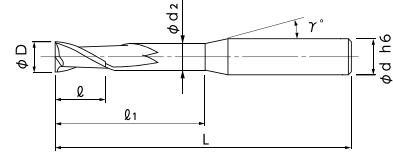
Side Milling

- ※ 1 Adjust feed according to inclined angle.
- ※ 2 When corner machining, reduce the feed by approximately 50%~30%.
- ※ 3 Adjust spindle speed and feed at the same rate also reduce Depth of Cut, if the machine spindle speed insufficient.



| Model                                            | Size                                                                                                    | Maximum Cutting Depth                                  | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                |        |       |          |                       |                          |                |        |        | Number of Sizes | Page  |       |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------|---------|-----------------|-------------|--------------|--------------|--------------|------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|----------|-----------------------|--------------------------|----------------|--------|--------|-----------------|-------|-------|
|                                                  |                                                                                                         |                                                        |         |                 |             |              |              |              |            | P             | P           | P                 | M               | N              | N      | N     | N        | S                     | H                        | Hardened Steel |        |        |                 |       |       |
|                                                  |                                                                                                         |                                                        |         |                 |             |              |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC         | 65 HRC | 70 HRC |                 |       |       |
| Long Neck Square                                 |                                                                                                         |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
| MHR                                              | MHR230                                                                                                  | $\phi 0.1 \sim \phi 6$                                 | 30D     |                 |             |              |              |              |            | -             |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 | 217   | I-004 |
|                                                  | 2-flute long neck square end mill. Maximum L/D=30                                                       |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
|                                                  | MHR430                                                                                                  | $\phi 1 \sim \phi 10$                                  | 20D     |                 |             |              |              |              |            | -             |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 | 103   | I-016 |
|                                                  | 4-flute long neck square end mill. Maximum L/D=20                                                       |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
|                                                  | MHRLN230-6                                                                                              | $\phi 0.3 \sim \phi 2$                                 | 12.5D   |                 |             |              |              |              |            | -             |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 | 19    | I-024 |
| 2-flute long neck square end mill. Shank Dia.6mm |                                                                                                         |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
| Long Neck Ball                                   |                                                                                                         |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
| MRB                                              | MRB230                                                                                                  | R0.05 ~ R3                                             | 22D     |                 |             |              | -            | -            |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        | 282             | I-026 |       |
|                                                  | Standard type long neck ball end mill. Sufficient variations with 282 sizes                             |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
|                                                  | MRB230SF                                                                                                | R0.1 ~ R1.5                                            | 10D     |                 |             |              | -            | -            |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        | 60              | I-038 |       |
|                                                  | Standard type long neck ball end mill. Suitable for shrink fit holder                                   |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
|                                                  | MRBLN230-6                                                                                              | R0.15 ~ R1                                             | 10D     |                 |             |              | -            | -            |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        | 10              | I-042 |       |
| 2-flute long neck ball end mill. Shank Dia.6mm   |                                                                                                         |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
| Long Neck Tapered Ball                           |                                                                                                         |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
| MRBTN                                            | MRBTN230                                                                                                | R0.1×neck taper angle30°<br>~ R2×neck taper angle1°    | 36D     |                 |             |              | -            | -            |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        | 196             | I-044 |       |
|                                                  | Taper neck to improve tool rigidity. L/D up to 36. Option of same taper angle as inclined working angle |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |
|                                                  | MRBTN230L                                                                                               | R0.1×neck taper angle30°<br>~ R5×neck taper angle1°30' | 80D     |                 |             |              | -            | -            |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        | 150             | I-054 |       |
|                                                  | Taper neck to improve tool rigidity. L/D up to 80. Option of same taper angle as inclined working angle |                                                        |         |                 |             |              |              |              |            |               |             |                   |                 |                |        |       |          |                       |                          |                |        |        |                 |       |       |

| Model                           | Size                                                                           | Maximum Cutting Depth                                                                                                           | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                 |        |       |          |                       |                          |        |                |        | Number of Sizes | Page |       |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------|-----------------|-------------|--------------|--------------|--------------|------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|----------|-----------------------|--------------------------|--------|----------------|--------|-----------------|------|-------|
|                                 |                                                                                |                                                                                                                                 |         |                 |             |              |              |              |            | P             | P           | P                 | M               | N               | N      | N     | N        | N                     | S                        | H      | Hardened Steel |        |                 |      |       |
|                                 |                                                                                |                                                                                                                                 |         |                 |             |              |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | 55 HRC | 65 HRC         | 70 HRC |                 |      |       |
| Long Neck Corner Radius         |                                                                                |                                                                                                                                 |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 |      |       |
| MHR•R                           | MHR230R                                                                        | $\phi 0.2 \times R0.05$<br>~ $\phi 6 \times R1$                                                                                 | 20D     |                 |             |              |              |              |            | -             |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 | 387  | I-058 |
|                                 | 2-flute long neck corner radius end mill. Maximum L/D=20                       |                                                                                                                                 |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 |      |       |
|                                 | MHR430R                                                                        | $\phi 1 \times R0.05$<br>~ $\phi 6 \times R1$                                                                                   | 12.5D   |                 |             |              |              |              |            | -             |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 | 146  | I-072 |
|                                 | 4-flute long neck corner radius end mill. Maximum L/D=12                       |                                                                                                                                 |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 |      |       |
| Long Neck Tapered Corner Radius |                                                                                |                                                                                                                                 |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 |      |       |
| MSTNR                           | MSTNR230                                                                       | $\phi 0.2 \times R0.05 \times \text{neck taper angle} 1^\circ$<br>~ $\phi 3 \times R0.5 \times \text{neck taper angle} 1^\circ$ | 35D     |                 |             |              |              |              |            | -             |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 | 165  | I-078 |
|                                 | Taper neck design for significant improvement of tool rigidity! Maximum L/D=35 |                                                                                                                                 |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |        |                |        |                 |      |       |



- Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|----------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                      |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00200-04035 | 0.4         | 3.5                          | 0.6                  | 0.37                 | 12°                        | 4                    | 45                       | 3.72                                                                | 3.89  | 4.08  | 4.28  | 4.75  |
| 08-00200-04040 |             | 4                            |                      |                      |                            |                      | 45                       | 4.24                                                                | 4.43  | 4.64  | 4.87  | 5.40  |
| 08-00200-04050 |             | 5                            |                      |                      |                            |                      | 45                       | 5.28                                                                | 5.52  | 5.78  | 6.06  | 6.72  |
| 08-00200-04060 |             | 6                            |                      |                      |                            |                      | 45                       | 6.33                                                                | 6.61  | 6.92  | 7.26  | 8.05  |
| 08-00200-04070 |             | 7                            |                      |                      |                            |                      | 45                       | 7.37                                                                | 7.70  | 8.06  | 8.46  | 9.38  |
| 08-00200-04080 |             | 8                            |                      |                      |                            |                      | 45                       | 8.41                                                                | 8.79  | 9.20  | 9.65  | 10.71 |
| 08-00200-04090 |             | 9                            |                      |                      |                            |                      | 45                       | 9.45                                                                | 9.88  | 10.34 | 10.85 | 12.03 |
| 08-00200-04100 |             | 10                           |                      |                      |                            |                      | 45                       | 10.50                                                               | 10.97 | 11.48 | 12.05 | 13.36 |
| 08-00200-04120 |             | 12                           |                      |                      |                            |                      | 45                       | 12.58                                                               | 13.15 | 13.76 | 14.44 | 16.02 |
| 08-00200-05010 | 0.5         | 1                            | 0.7                  | 0.46                 | 12°                        | 4                    | 45                       | 1.14                                                                | 1.19  | 1.24  | 1.30  | 1.45  |
| 08-00200-05015 |             | 1.5                          |                      |                      |                            |                      | 45                       | 1.66                                                                | 1.74  | 1.82  | 1.91  | 2.12  |
| 08-00200-05020 |             | 2                            |                      |                      |                            |                      | 45                       | 2.18                                                                | 2.28  | 2.38  | 2.50  | 2.77  |
| 08-00200-05025 |             | 2.5                          |                      |                      |                            |                      | 45                       | 2.71                                                                | 2.83  | 2.96  | 3.11  | 3.45  |
| 08-00200-05030 |             | 3                            |                      |                      |                            |                      | 45                       | 3.22                                                                | 3.37  | 3.52  | 3.70  | 4.10  |
| 08-00200-05035 |             | 3.5                          |                      |                      |                            |                      | 45                       | 3.75                                                                | 3.92  | 4.10  | 4.31  | 4.78  |
| 08-00200-05040 |             | 4                            |                      |                      |                            |                      | 45                       | 4.26                                                                | 4.46  | 4.66  | 4.89  | 5.43  |
| 08-00200-05045 |             | 4.5                          |                      |                      |                            |                      | 45                       | 4.79                                                                | 5.01  | 5.24  | 5.50  | 6.12  |
| 08-00200-05050 |             | 5                            |                      |                      |                            |                      | 45                       | 5.31                                                                | 5.54  | 5.80  | 6.09  | 6.76  |
| 08-00200-05060 |             | 6                            |                      |                      |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.95  | 7.29  | 8.08  |
| 08-00200-05070 |             | 7                            |                      |                      |                            |                      | 45                       | 7.39                                                                | 7.72  | 8.09  | 8.48  | 9.41  |
| 08-00200-05080 |             | 8                            |                      |                      |                            |                      | 50                       | 8.44                                                                | 8.81  | 9.23  | 9.68  | 10.74 |
| 08-00200-05090 |             | 9                            |                      |                      |                            |                      | 50                       | 9.48                                                                | 9.90  | 10.37 | 10.88 | 12.07 |
| 08-00200-05100 |             | 10                           |                      |                      |                            |                      | 50                       | 10.52                                                               | 10.99 | 11.51 | 12.07 | 13.39 |
| 08-00200-05120 |             | 12                           |                      |                      |                            |                      | 50                       | 12.61                                                               | 13.17 | 13.79 | 14.47 | 16.05 |
| 08-00200-05150 |             | 15                           |                      |                      |                            |                      | 50                       | 15.74                                                               | 16.44 | 17.21 | 18.06 | 20.03 |
| 08-00200-06015 |             | 0.6                          |                      |                      |                            |                      | 1.5                      | 0.9                                                                 | 0.56  | 12°   | 4     | 45    |
| 08-00200-06020 | 2           |                              | 45                   | 2.18                 | 2.28                       | 2.38                 | 2.50                     |                                                                     |       |       |       | 2.77  |
| 08-00200-06030 | 3           |                              | 45                   | 3.22                 | 3.37                       | 3.52                 | 3.70                     |                                                                     |       |       |       | 4.10  |
| 08-00200-06040 | 4           |                              | 45                   | 4.26                 | 4.46                       | 4.66                 | 4.89                     |                                                                     |       |       |       | 5.43  |
| 08-00200-06050 | 5           |                              | 45                   | 5.31                 | 5.54                       | 5.80                 | 6.09                     |                                                                     |       |       |       | 6.76  |
| 08-00200-06060 | 6           |                              | 45                   | 6.35                 | 6.63                       | 6.95                 | 7.29                     |                                                                     |       |       |       | 8.08  |
| 08-00200-06070 | 7           |                              | 45                   | 7.39                 | 7.72                       | 8.09                 | 8.48                     |                                                                     |       |       |       | 9.41  |

**Long Neck  
Square  
Coating**

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

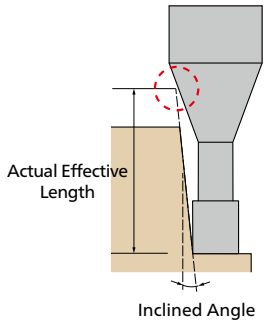
Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Square

MHR230

MUGEN COATING 2 -Flute Long Neck End Mill



Unit : mm

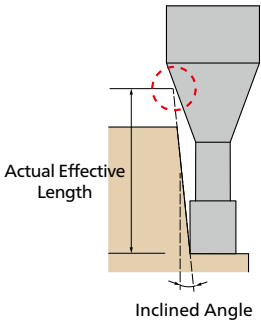
| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00200-06080 | 0.6         | 8                            | 0.9                     | 0.56                 | 12°                        | 4                    | 50                       | 8.44                                                                | 8.81  | 9.23  | 9.68  | 10.74 |
| 08-00200-06090 |             |                              |                         |                      |                            |                      | 50                       | 9.48                                                                | 9.91  | 10.38 | 10.90 | 12.10 |
| 08-00200-06100 |             |                              |                         |                      |                            |                      | 50                       | 10.52                                                               | 10.99 | 11.51 | 12.07 | 13.39 |
| 08-00200-06120 |             |                              |                         |                      |                            |                      | 50                       | 12.61                                                               | 13.17 | 13.79 | 14.47 | 16.05 |
| 08-00200-06150 |             |                              |                         |                      |                            |                      | 50                       | 15.74                                                               | 16.44 | 17.21 | 18.06 | 20.03 |
| 08-00200-06180 | 0.7         | 12                           | 1                       | 0.66                 | 12°                        | 4                    | 50                       | 18.86                                                               | 19.71 | 20.63 | 21.65 | 24.01 |
| 08-00200-07020 |             |                              |                         |                      |                            |                      | 45                       | 2.18                                                                | 2.28  | 2.38  | 2.50  | 2.77  |
| 08-00200-07040 |             |                              |                         |                      |                            |                      | 45                       | 4.26                                                                | 4.46  | 4.66  | 4.89  | 5.43  |
| 08-00200-07060 |             |                              |                         |                      |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.95  | 7.29  | 8.08  |
| 08-00200-07080 |             |                              |                         |                      |                            |                      | 50                       | 8.44                                                                | 8.81  | 9.23  | 9.68  | 10.74 |
| 08-00200-07100 | 0.8         | 10                           | 1.2                     | 0.76                 | 12°                        | 4                    | 50                       | 10.52                                                               | 10.99 | 11.51 | 12.07 | 13.39 |
| 08-00200-08030 |             |                              |                         |                      |                            |                      | 45                       | 3.23                                                                | 3.37  | 3.53  | 3.71  | 4.12  |
| 08-00200-08040 |             |                              |                         |                      |                            |                      | 45                       | 4.26                                                                | 4.46  | 4.66  | 4.89  | 5.43  |
| 08-00200-08050 |             |                              |                         |                      |                            |                      | 45                       | 5.31                                                                | 5.55  | 5.81  | 6.10  | 6.78  |
| 08-00200-08060 |             |                              |                         |                      |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.95  | 7.29  | 8.08  |
| 08-00200-08080 |             |                              |                         |                      |                            |                      | 50                       | 8.44                                                                | 8.81  | 9.23  | 9.68  | 10.74 |
| 08-00200-08100 |             |                              |                         |                      |                            |                      | 50                       | 10.52                                                               | 10.99 | 11.51 | 12.07 | 13.39 |
| 08-00200-08120 |             |                              |                         |                      |                            |                      | 50                       | 12.61                                                               | 13.17 | 13.79 | 14.47 | 16.05 |
| 08-00200-08140 |             |                              |                         |                      |                            |                      | 50                       | 14.69                                                               | 15.35 | 16.07 | 16.86 | 18.70 |
| 08-00200-08160 |             |                              |                         |                      |                            |                      | 50                       | 16.78                                                               | 17.53 | 18.35 | 19.25 | 21.36 |
| 08-00200-08200 | 0.9         | 20                           | 1.4                     | 0.86                 | 12°                        | 4                    | 60                       | 20.95                                                               | 21.89 | 22.91 | 24.04 | 26.66 |
| 08-00200-08240 |             |                              |                         |                      |                            |                      | 60                       | 25.12                                                               | 26.24 | 27.47 | 28.83 | Free  |
| 08-00200-09040 |             |                              |                         |                      |                            |                      | 45                       | 4.26                                                                | 4.46  | 4.66  | 4.89  | 5.43  |
| 08-00200-09060 |             |                              |                         |                      |                            |                      | 45                       | 6.35                                                                | 6.63  | 6.95  | 7.29  | 8.08  |
| 08-00200-09080 |             |                              |                         |                      |                            |                      | 50                       | 8.44                                                                | 8.81  | 9.23  | 9.68  | 10.74 |
| 08-00200-09100 | 1           | 15                           | 1.5                     | 0.95                 | 12°                        | 4                    | 50                       | 10.52                                                               | 10.99 | 11.51 | 12.07 | 13.39 |
| 08-00200-09120 |             |                              |                         |                      |                            |                      | 50                       | 12.61                                                               | 13.18 | 13.80 | 14.49 | 16.10 |
| 08-00200-09150 |             |                              |                         |                      |                            |                      | 60                       | 15.74                                                               | 16.44 | 17.21 | 18.06 | 20.03 |
| 08-00200-10020 |             |                              |                         |                      |                            |                      | 50                       | 2.21                                                                | 2.31  | 2.42  | 2.54  | 2.82  |
| 08-00200-10030 |             |                              |                         |                      |                            |                      | 50                       | 3.25                                                                | 3.39  | 3.55  | 3.73  | 4.13  |
| 08-00200-10040 |             | 4                            |                         |                      |                            |                      | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 08-00200-10050 |             |                              |                         |                      |                            |                      | 50                       | 5.33                                                                | 5.57  | 5.83  | 6.12  | 6.79  |

How to Order

When you order, indicate MHR230 (D)×(ℓ1). ※(γ) is reference value.

MHR230

MUGEN COATING 2 -Flute Long Neck End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00200-10060 | 1           | 6                            | 1.5                     | 0.95                 | 12°                        | 4                    | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00200-10070 |             |                              |                         |                      |                            |                      | 50                       | 7.42                                                                | 7.75  | 8.11  | 8.51  | 9.44  |
| 08-00200-10080 |             |                              |                         |                      |                            |                      | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00200-10090 |             |                              |                         |                      |                            |                      | 50                       | 9.50                                                                | 9.93  | 10.39 | 10.91 | 12.10 |
| 08-00200-10100 |             |                              |                         |                      |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00200-10120 |             |                              |                         |                      |                            |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00200-10140 |             |                              |                         |                      |                            |                      | 50                       | 14.72                                                               | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00200-10160 |             |                              |                         |                      |                            |                      | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00200-10180 |             |                              |                         |                      |                            |                      | 60                       | 18.89                                                               | 19.73 | 20.66 | 21.67 | 24.04 |
| 08-00200-10200 |             |                              |                         |                      |                            |                      | 60                       | 20.97                                                               | 21.91 | 22.94 | 24.07 | 26.70 |
| 08-00200-10220 | 1.2         | 10                           | 1.8                     | 1.15                 | 12°                        | 4                    | 60                       | 23.06                                                               | 24.09 | 25.22 | 26.46 | Free  |
| 08-00200-10250 |             |                              |                         |                      |                            |                      | 70                       | 26.19                                                               | 27.36 | 28.64 | 30.05 | Free  |
| 08-00200-10300 |             |                              |                         |                      |                            |                      | 70                       | 31.40                                                               | 32.81 | 34.34 | 36.03 | Free  |
| 08-00200-12040 |             |                              |                         |                      |                            |                      | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 08-00200-12060 |             |                              |                         |                      |                            |                      | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00200-12080 | 1.4         | 8                            | 2.1                     | 1.35                 | 12°                        | 4                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00200-12100 |             |                              |                         |                      |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00200-12120 |             |                              |                         |                      |                            |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00200-12160 |             |                              |                         |                      |                            |                      | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00200-12200 |             |                              |                         |                      |                            |                      | 60                       | 20.97                                                               | 21.91 | 22.94 | 24.07 | 26.70 |
| 08-00200-14060 | 1.5         | 6                            | 2.3                     | 1.45                 | 12°                        | 4                    | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00200-14080 |             |                              |                         |                      |                            |                      | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00200-14100 |             |                              |                         |                      |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00200-14120 |             |                              |                         |                      |                            |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00200-14140 |             |                              |                         |                      |                            |                      | 60                       | 14.72                                                               | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00200-14160 |             | 16                           |                         |                      |                            |                      | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00200-14220 |             |                              |                         |                      |                            |                      | 60                       | 23.06                                                               | 24.09 | 25.22 | 26.46 | Free  |
| 08-00200-15040 |             |                              |                         |                      |                            |                      | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 08-00200-15060 |             |                              |                         |                      |                            |                      | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00200-15080 |             |                              |                         |                      |                            |                      | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00200-15100 |             | 10                           |                         |                      |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00200-15120 |             |                              |                         |                      |                            |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Square

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

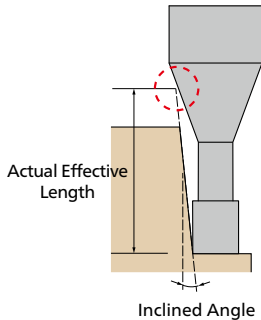
Aluminium Alloy N

Copper N

Resin N

MHR230

MUGEN COATING 2 -Flute Long Neck End Mill



Unit : mm

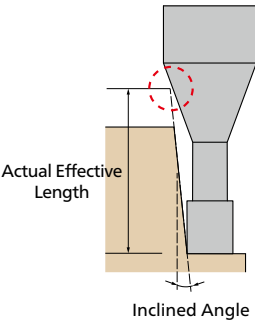
| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00200-15140 | 1.5         | 2.3                          | 2.3                     | 1.45                 | 12°                        | 4                    | 60                       | 14.72                                                               | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00200-15160 |             |                              |                         |                      |                            |                      | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00200-15180 |             |                              |                         |                      |                            |                      | 60                       | 18.89                                                               | 19.73 | 20.66 | 21.67 | 24.04 |
| 08-00200-15200 |             |                              |                         |                      |                            |                      | 60                       | 20.97                                                               | 21.91 | 22.94 | 24.07 | Free  |
| 08-00200-15250 |             |                              |                         |                      |                            |                      | 70                       | 26.19                                                               | 27.36 | 28.64 | 30.05 | Free  |
| 08-00200-15300 |             |                              |                         |                      |                            |                      | 70                       | 31.40                                                               | 32.81 | 34.34 | 36.03 | Free  |
| 08-00200-15350 |             |                              |                         |                      |                            |                      | 80                       | 36.62                                                               | 38.25 | 40.05 | Free  | Free  |
| 08-00200-15380 |             |                              |                         |                      |                            |                      | 80                       | 39.74                                                               | 41.52 | 43.47 | Free  | Free  |
| 08-00200-15400 |             |                              |                         |                      |                            |                      | 80                       | 41.83                                                               | 43.70 | 45.75 | Free  | Free  |
| 08-00200-15450 |             |                              |                         |                      |                            |                      | 80                       | 47.04                                                               | 49.15 | Free  | Free  | Free  |
| 08-00200-16060 | 1.6         | 2.4                          | 2.4                     | 1.55                 | 12°                        | 4                    | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00200-16080 |             |                              |                         |                      |                            |                      | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00200-16100 |             |                              |                         |                      |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00200-16120 |             |                              |                         |                      |                            |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00200-16140 |             |                              |                         |                      |                            |                      | 60                       | 14.72                                                               | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00200-16160 |             |                              |                         |                      |                            |                      | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00200-16180 |             |                              |                         |                      |                            |                      | 60                       | 18.89                                                               | 19.73 | 20.66 | 21.67 | Free  |
| 08-00200-16200 |             |                              |                         |                      |                            |                      | 60                       | 20.97                                                               | 21.91 | 22.94 | 24.07 | Free  |
| 08-00200-16260 |             |                              |                         |                      |                            |                      | 60                       | 27.23                                                               | 28.45 | 29.78 | 31.25 | Free  |
| 08-00200-18060 | 1.8         | 2.7                          | 2.7                     | 1.75                 | 12°                        | 4                    | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00200-18080 |             |                              |                         |                      |                            |                      | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00200-18100 |             |                              |                         |                      |                            |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00200-18120 |             |                              |                         |                      |                            |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00200-18140 |             |                              |                         |                      |                            |                      | 50                       | 14.72                                                               | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00200-18160 |             |                              |                         |                      |                            |                      | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00200-18180 |             |                              |                         |                      |                            |                      | 60                       | 18.89                                                               | 19.73 | 20.66 | 21.67 | Free  |
| 08-00200-18200 |             |                              |                         |                      |                            |                      | 60                       | 20.97                                                               | 21.91 | 22.94 | 24.07 | Free  |
| 08-00200-18250 |             |                              |                         |                      |                            |                      | 70                       | 26.19                                                               | 27.36 | 28.64 | 30.05 | Free  |
| 08-00200-20040 | 2           | 3                            | 3                       | 1.94                 | 12°                        | 4                    | 50                       | 4.32                                                                | 4.51  | 4.73  | 4.96  | 5.51  |
| 08-00200-20060 |             |                              |                         |                      |                            |                      | 50                       | 6.40                                                                | 6.69  | 7.00  | 7.34  | 8.15  |
| 08-00200-20080 |             |                              |                         |                      |                            |                      | 50                       | 8.48                                                                | 8.86  | 9.28  | 9.74  | 10.80 |
| 08-00200-20100 |             |                              |                         |                      |                            |                      | 50                       | 10.57                                                               | 11.04 | 11.56 | 12.13 | 13.45 |

How to Order

When you order, indicate MHR230 (D)×(ℓ1). ※(γ) is reference value.

MHR230

MUGEN COATING 2 -Flute Long Neck End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                                           |                         |                                   |                            |                      |                          | 30′                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00200-20120 | 2           | 12                                        | 3                       | 1.94                              | 12°                        | 4                    | 50                       | 12.66                                                               | 13.22 | 13.84 | 14.52 | 16.11 |
| 08-00200-20140 |             | 14                                        |                         |                                   |                            |                      | 60                       | 14.74                                                               | 15.40 | 16.12 | 16.92 | 18.76 |
| 08-00200-20160 |             | 16                                        |                         |                                   |                            |                      | 60                       | 16.83                                                               | 17.58 | 18.40 | 19.31 | Free  |
| 08-00200-20180 |             | 18                                        |                         |                                   |                            |                      | 60                       | 18.91                                                               | 19.76 | 20.69 | 21.70 | Free  |
| 08-00200-20200 |             | 20                                        |                         |                                   |                            |                      | 60                       | 21.00                                                               | 21.94 | 22.97 | 24.10 | Free  |
| 08-00200-20250 |             | 25                                        |                         |                                   |                            |                      | 70                       | 26.21                                                               | 27.39 | 28.67 | Free  | Free  |
| 08-00200-20300 |             | 30                                        |                         |                                   |                            |                      | 70                       | 31.43                                                               | 32.83 | 34.37 | Free  | Free  |
| 08-00200-20350 |             | 35                                        |                         |                                   |                            |                      | 80                       | 36.64                                                               | 38.28 | Free  | Free  | Free  |
| 08-00200-20400 |             | 40                                        |                         |                                   |                            |                      | 90                       | 41.85                                                               | 43.73 | Free  | Free  | Free  |
| 08-00200-20500 |             | 50                                        |                         |                                   |                            |                      | 100                      | 52.28                                                               | 54.62 | Free  | Free  | Free  |
| 08-00200-20600 | 60          | 110                                       | 62.71                   | Free                              | Free                       | Free                 | Free                     |                                                                     |       |       |       |       |
| 08-00200-25080 | 2.5         | 8                                         | 3.7                     | 2.4                               | 12°                        | 4                    | 50                       | 8.58                                                                | 8.97  | 9.39  | 9.85  | 10.93 |
| 08-00200-25100 |             | 10                                        |                         |                                   |                            |                      | 50                       | 10.67                                                               | 11.15 | 11.67 | 12.24 | 13.58 |
| 08-00200-25120 |             | 12                                        |                         |                                   |                            |                      | 50                       | 12.75                                                               | 13.32 | 13.95 | 14.64 | Free  |
| 08-00200-25140 |             | 14                                        |                         |                                   |                            |                      | 50                       | 14.84                                                               | 15.50 | 16.23 | 17.03 | Free  |
| 08-00200-25160 |             | 16                                        |                         |                                   |                            |                      | 60                       | 16.93                                                               | 17.68 | 18.51 | 19.42 | Free  |
| 08-00200-25180 |             | 18                                        |                         |                                   |                            |                      | 60                       | 19.01                                                               | 19.86 | 20.79 | 21.82 | Free  |
| 08-00200-25200 |             | 20                                        |                         |                                   |                            |                      | 60                       | 21.10                                                               | 22.04 | 23.07 | Free  | Free  |
| 08-00200-25250 |             | 25                                        |                         |                                   |                            |                      | 70                       | 26.31                                                               | 27.49 | 28.78 | Free  | Free  |
| 08-00200-25300 |             | 30                                        |                         |                                   |                            |                      | 70                       | 31.52                                                               | 32.94 | Free  | Free  | Free  |
| 08-00200-25400 |             | 40                                        |                         |                                   |                            |                      | 90                       | 41.95                                                               | 43.83 | Free  | Free  | Free  |
| 08-00200-25500 | 50          | 100                                       | 52.38                   | Free                              | Free                       | Free                 | Free                     |                                                                     |       |       |       |       |
| 08-00200-30080 | 3           | 8                                         | 4.5                     | 2.85                              | 12°                        | 6                    | 50                       | 8.71                                                                | 9.10  | 9.52  | 9.99  | 11.08 |
| 08-00200-30100 |             | 10                                        |                         |                                   |                            |                      | 50                       | 10.79                                                               | 11.27 | 11.80 | 12.38 | 13.74 |
| 08-00200-30120 |             | 12                                        |                         |                                   |                            |                      | 50                       | 12.88                                                               | 13.45 | 14.08 | 14.78 | 16.39 |
| 08-00200-30140 |             | 14                                        |                         |                                   |                            |                      | 50                       | 14.96                                                               | 15.63 | 16.36 | 17.17 | 19.04 |
| 08-00200-30160 |             | 16                                        |                         |                                   |                            |                      | 60                       | 17.05                                                               | 17.81 | 18.65 | 19.56 | 21.70 |
| 08-00200-30180 |             | 18                                        |                         |                                   |                            |                      | 60                       | 19.13                                                               | 19.99 | 20.93 | 21.96 | 24.35 |
| 08-00200-30200 |             | 20                                        |                         |                                   |                            |                      | 60                       | 21.22                                                               | 22.17 | 23.21 | 24.35 | 27.01 |
| 08-00200-30250 |             | 25                                        |                         |                                   |                            |                      | 70                       | 26.43                                                               | 27.62 | 28.91 | 30.33 | Free  |
| 08-00200-30300 |             | 30                                        |                         |                                   |                            |                      | 70                       | 31.65                                                               | 33.06 | 34.61 | 36.31 | Free  |
| 08-00200-30350 |             | 35                                        |                         |                                   |                            |                      | 80                       | 36.86                                                               | 38.51 | 40.32 | 42.30 | Free  |

Hardened Steel  
~ 55 HRC

Long Neck  
Square  
Coating

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Square

MHR230

MUGEN COATING 2 -Flute Long Neck End Mill

MHR230

Recommended Milling Conditions

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

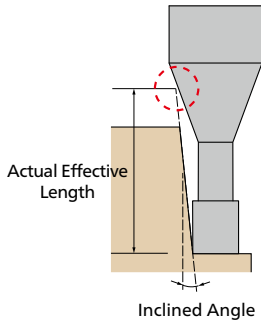
Aluminium Alloy **N**

Copper **N**

Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Square



Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00200-30400 | 3           | 40                           | 4.5                     | 2.85                 | 12°                        | 6                    | 90                       | 42.08                                                               | 43.96 | 46.02 | Free  | Free  |
| 08-00200-30500 |             | 50                           |                         |                      |                            |                      | 100                      | 52.50                                                               | 54.85 | 57.42 | Free  | Free  |
| 08-00200-40120 | 4           | 12                           | 6                       | 3.8                  | 12°                        | 6                    | 50                       | 13.00                                                               | 13.58 | 14.22 | 14.92 | 16.55 |
| 08-00200-40160 |             | 16                           |                         |                      |                            |                      | 60                       | 17.17                                                               | 17.94 | 18.78 | 19.70 | Free  |
| 08-00200-40200 |             | 20                           |                         |                      |                            |                      | 60                       | 21.34                                                               | 22.30 | 23.34 | 24.49 | Free  |
| 08-00200-40250 |             | 25                           |                         |                      |                            |                      | 70                       | 26.56                                                               | 27.74 | 29.04 | Free  | Free  |
| 08-00200-40300 |             | 30                           |                         |                      |                            |                      | 70                       | 31.77                                                               | 33.19 | 34.75 | Free  | Free  |
| 08-00200-40350 |             | 35                           |                         |                      |                            |                      | 80                       | 36.98                                                               | 38.64 | Free  | Free  | Free  |
| 08-00200-40400 |             | 40                           |                         |                      |                            |                      | 90                       | 42.20                                                               | 44.09 | Free  | Free  | Free  |
| 08-00200-40450 |             | 45                           |                         |                      |                            |                      | 90                       | 47.41                                                               | 49.53 | Free  | Free  | Free  |
| 08-00200-40500 |             | 50                           |                         |                      |                            |                      | 100                      | 52.63                                                               | 54.98 | Free  | Free  | Free  |
| 08-00200-40600 |             | 60                           |                         |                      |                            |                      | 110                      | 63.05                                                               | Free  | Free  | Free  | Free  |
| 08-00200-50160 | 5           | 16                           | 7.5                     | 4.8                  | 12°                        | 6                    | 60                       | 17.17                                                               | 17.94 | 18.78 | Free  | Free  |
| 08-00200-50200 |             | 20                           |                         |                      |                            |                      | 60                       | 21.34                                                               | 22.30 | Free  | Free  | Free  |
| 08-00200-50250 |             | 25                           |                         |                      |                            |                      | 70                       | 26.56                                                               | 27.74 | Free  | Free  | Free  |
| 08-00200-50300 |             | 30                           |                         |                      |                            |                      | 80                       | 31.77                                                               | Free  | Free  | Free  | Free  |
| 08-00200-50350 |             | 35                           |                         |                      |                            |                      | 80                       | 36.98                                                               | Free  | Free  | Free  | Free  |
| 08-00200-50400 |             | 40                           |                         |                      |                            |                      | 90                       | 42.20                                                               | Free  | Free  | Free  | Free  |
| 08-00200-50500 |             | 50                           |                         |                      |                            |                      | 110                      | 52.63                                                               | Free  | Free  | Free  | Free  |
| 08-00200-50600 |             | 60                           |                         |                      |                            |                      | 120                      | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00200-60200 | 6           | 20                           | 9                       | 5.8                  | —                          | 6                    | 80                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00200-60300 |             | 30                           |                         |                      |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00200-60400 |             | 40                           |                         |                      |                            |                      | 100                      | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00200-60500 |             | 50                           |                         |                      |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00200-60600 |             | 60                           |                         |                      |                            |                      | 120                      | Free                                                                | Free  | Free  | Free  | Free  |

How to Order

When you order, indicate MHR230 (D)×(ℓ1). ※( γ ) is reference value.

| Work Material |                   | Carbon Steels・Alloy Steels※1・<br>Stainless Steels※1<br>S50C・SCM※1・SKD※1・SUS※1 |        |              | Prehardened Steels<br>NAK55・NAK80・HPM1<br>(~43HRC) |        |              | Copper・Aluminium Alloy |        |              |
|---------------|-------------------|-------------------------------------------------------------------------------|--------|--------------|----------------------------------------------------|--------|--------------|------------------------|--------|--------------|
| Dia.          | Under Neck Length | Spindle Speed                                                                 | Feed   | Depth of Cut | Spindle Speed                                      | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut |
|               |                   | min <sup>-1</sup>                                                             | mm/min | ap mm        | min <sup>-1</sup>                                  | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        |
| 0.1           | 0.3               | 40,000                                                                        | 150    | 0.005        | 40,000                                             | 120    | 0.004        | 40,000                 | 150    | 0.006        |
|               | 0.5               | 40,000                                                                        | 100    | 0.004        | 40,000                                             | 75     | 0.003        | 40,000                 | 100    | 0.005        |
|               | 0.75              | 40,000                                                                        | 60     | 0.003        | 40,000                                             | 50     | 0.002        | 40,000                 | 60     | 0.003        |
|               | 1                 | 40,000                                                                        | 40     | 0.002        | 40,000                                             | 30     | 0.002        | 40,000                 | 40     | 0.002        |
| 0.15          | 0.3               | 40,000                                                                        | 200    | 0.005        | 40,000                                             | 150    | 0.004        | 40,000                 | 200    | 0.008        |
|               | 0.5               | 40,000                                                                        | 150    | 0.005        | 40,000                                             | 120    | 0.004        | 40,000                 | 150    | 0.008        |
|               | 0.75              | 40,000                                                                        | 100    | 0.004        | 40,000                                             | 90     | 0.003        | 40,000                 | 100    | 0.006        |
|               | 1                 | 40,000                                                                        | 80     | 0.003        | 40,000                                             | 60     | 0.002        | 40,000                 | 80     | 0.004        |
| 0.2           | 1.5               | 40,000                                                                        | 50     | 0.002        | 35,000                                             | 40     | 0.002        | 40,000                 | 50     | 0.003        |
|               | 0.5               | 40,000                                                                        | 330    | 0.01         | 40,000                                             | 250    | 0.007        | 40,000                 | 330    | 0.012        |
|               | 0.75              | 40,000                                                                        | 280    | 0.008        | 40,000                                             | 220    | 0.006        | 40,000                 | 280    | 0.01         |
|               | 1                 | 40,000                                                                        | 250    | 0.007        | 40,000                                             | 180    | 0.005        | 40,000                 | 250    | 0.008        |
|               | 1.5               | 40,000                                                                        | 180    | 0.005        | 35,000                                             | 120    | 0.004        | 40,000                 | 180    | 0.006        |
|               | 2                 | 40,000                                                                        | 100    | 0.003        | 35,000                                             | 65     | 0.002        | 40,000                 | 100    | 0.004        |
|               | 2.5               | 35,000                                                                        | 80     | 0.003        | 30,000                                             | 50     | 0.002        | 40,000                 | 90     | 0.003        |
|               | 3                 | 30,000                                                                        | 60     | 0.002        | 25,000                                             | 40     | 0.002        | 35,000                 | 70     | 0.002        |
| 0.3           | 3.5               | 25,000                                                                        | 40     | 0.002        | 22,000                                             | 30     | 0.002        | 30,000                 | 50     | 0.002        |
|               | 4                 | 23,000                                                                        | 30     | 0.001        | 20,000                                             | 20     | 0.001        | 25,000                 | 35     | 0.001        |
|               | 1                 | 40,000                                                                        | 400    | 0.02         | 35,000                                             | 260    | 0.015        | 40,000                 | 400    | 0.024        |
|               | 1.5               | 40,000                                                                        | 350    | 0.015        | 35,000                                             | 230    | 0.01         | 40,000                 | 350    | 0.018        |
|               | 2                 | 35,000                                                                        | 300    | 0.01         | 30,000                                             | 180    | 0.007        | 40,000                 | 320    | 0.012        |
|               | 2.5               | 30,000                                                                        | 250    | 0.007        | 25,000                                             | 160    | 0.005        | 35,000                 | 280    | 0.008        |
|               | 3                 | 30,000                                                                        | 200    | 0.005        | 25,000                                             | 130    | 0.004        | 35,000                 | 250    | 0.006        |
|               | 4                 | 25,000                                                                        | 120    | 0.004        | 22,000                                             | 80     | 0.003        | 30,000                 | 150    | 0.004        |
| 0.4           | 5                 | 22,000                                                                        | 80     | 0.003        | 20,000                                             | 55     | 0.002        | 25,000                 | 90     | 0.003        |
|               | 6                 | 20,000                                                                        | 60     | 0.002        | 18,000                                             | 40     | 0.002        | 22,000                 | 65     | 0.002        |
|               | 9                 | 18,000                                                                        | 30     | 0.001        | 16,000                                             | 20     | 0.001        | 20,000                 | 35     | 0.001        |
|               | 1                 | 35,000                                                                        | 500    | 0.025        | 30,000                                             | 330    | 0.018        | 40,000                 | 600    | 0.03         |
|               | 1.5               | 35,000                                                                        | 450    | 0.02         | 30,000                                             | 280    | 0.014        | 40,000                 | 500    | 0.026        |
|               | 2                 | 35,000                                                                        | 400    | 0.02         | 30,000                                             | 260    | 0.014        | 40,000                 | 450    | 0.024        |
|               | 2.5               | 30,000                                                                        | 350    | 0.015        | 25,000                                             | 230    | 0.01         | 40,000                 | 400    | 0.02         |
|               | 3                 | 30,000                                                                        | 300    | 0.015        | 25,000                                             | 190    | 0.01         | 35,000                 | 350    | 0.018        |
|               | 3.5               | 25,000                                                                        | 250    | 0.01         | 25,000                                             | 160    | 0.008        | 35,000                 | 280    | 0.015        |
|               | 4                 | 25,000                                                                        | 200    | 0.01         | 22,000                                             | 140    | 0.007        | 30,000                 | 240    | 0.012        |
|               | 5                 | 22,000                                                                        | 160    | 0.008        | 20,000                                             | 110    | 0.005        | 25,000                 | 180    | 0.01         |
|               | 6                 | 20,000                                                                        | 120    | 0.005        | 18,000                                             | 80     | 0.003        | 22,000                 | 130    | 0.006        |
| 0.5           | 7                 | 18,000                                                                        | 100    | 0.003        | 16,000                                             | 70     | 0.002        | 20,000                 | 110    | 0.003        |
|               | 8                 | 18,000                                                                        | 80     | 0.002        | 16,000                                             | 60     | 0.002        | 20,000                 | 85     | 0.002        |
|               | 9                 | 18,000                                                                        | 70     | 0.002        | 16,000                                             | 50     | 0.002        | 20,000                 | 75     | 0.002        |
|               | 10                | 18,000                                                                        | 60     | 0.002        | 16,000                                             | 40     | 0.002        | 20,000                 | 65     | 0.002        |
|               | 12                | 18,000                                                                        | 40     | 0.002        | 16,000                                             | 30     | 0.002        | 20,000                 | 45     | 0.002        |
|               | 1                 | 30,000                                                                        | 550    | 0.03         | 25,000                                             | 350    | 0.022        | 35,000                 | 650    | 0.036        |
|               | 1.5               | 30,000                                                                        | 520    | 0.028        | 25,000                                             | 330    | 0.02         | 35,000                 | 630    | 0.033        |
|               | 2                 | 30,000                                                                        | 500    | 0.025        | 25,000                                             | 320    | 0.018        | 35,000                 | 600    | 0.03         |
|               | 2.5               | 30,000                                                                        | 470    | 0.023        | 25,000                                             | 290    | 0.016        | 35,000                 | 580    | 0.027        |
|               | 3                 | 30,000                                                                        | 450    | 0.02         | 25,000                                             | 280    | 0.014        | 35,000                 | 550    | 0.024        |
|               | 3.5               | 30,000                                                                        | 420    | 0.018        | 22,000                                             | 250    | 0.012        | 30,000                 | 500    | 0.021        |
|               | 4                 | 25,000                                                                        | 350    | 0.015        | 22,000                                             | 230    | 0.01         | 30,000                 | 420    | 0.018        |
|               | 4.5               | 25,000                                                                        | 320    | 0.013        | 20,000                                             | 200    | 0.008        | 30,000                 | 380    | 0.015        |
|               | 5                 | 25,000                                                                        | 300    | 0.01         | 20,000                                             | 180    | 0.007        | 30,000                 | 350    | 0.012        |

※1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.



MHR230

Recommended Milling Conditions

| Work Material |                      | Carbon Steels•Alloy Steels*1•<br>Stainless Steels*1<br>S50C•SCM*1•SKD*1•SUS*1 |        |                 | Prehardened Steels<br>NAK55•NAK80•HPM1<br>(~43HRC) |        |                 | Copper•Aluminium Alloy |        |                 |
|---------------|----------------------|-------------------------------------------------------------------------------|--------|-----------------|----------------------------------------------------|--------|-----------------|------------------------|--------|-----------------|
| Dia.          | Under Neck<br>Length | Spindle<br>Speed                                                              | Feed   | Depth of<br>Cut | Spindle<br>Speed                                   | Feed   | Depth of<br>Cut | Spindle<br>Speed       | Feed   | Depth of<br>Cut |
|               |                      | min <sup>-1</sup>                                                             | mm/min | ap mm           | min <sup>-1</sup>                                  | mm/min | ap mm           | min <sup>-1</sup>      | mm/min | ap mm           |
| 0.5           | 6                    | 20,000                                                                        | 200    | 0.008           | 18,000                                             | 140    | 0.005           | 25,000                 | 250    | 0.01            |
|               | 7                    | 20,000                                                                        | 180    | 0.005           | 16,000                                             | 110    | 0.003           | 22,000                 | 200    | 0.006           |
|               | 8                    | 18,000                                                                        | 150    | 0.003           | 14,000                                             | 90     | 0.002           | 20,000                 | 160    | 0.003           |
|               | 9                    | 16,000                                                                        | 120    | 0.003           | 14,000                                             | 80     | 0.002           | 18,000                 | 135    | 0.003           |
|               | 10                   | 16,000                                                                        | 100    | 0.002           | 14,000                                             | 65     | 0.002           | 18,000                 | 110    | 0.002           |
|               | 12                   | 16,000                                                                        | 80     | 0.002           | 14,000                                             | 50     | 0.002           | 18,000                 | 90     | 0.002           |
|               | 15                   | 16,000                                                                        | 50     | 0.002           | 14,000                                             | 35     | 0.002           | 18,000                 | 55     | 0.002           |
| 0.6           | 1.5                  | 30,000                                                                        | 600    | 0.035           | 25,000                                             | 400    | 0.025           | 35,000                 | 700    | 0.04            |
|               | 2                    | 30,000                                                                        | 600    | 0.035           | 25,000                                             | 380    | 0.025           | 35,000                 | 700    | 0.04            |
|               | 3                    | 30,000                                                                        | 550    | 0.03            | 25,000                                             | 350    | 0.02            | 35,000                 | 650    | 0.035           |
|               | 4                    | 25,000                                                                        | 450    | 0.025           | 22,000                                             | 300    | 0.018           | 30,000                 | 550    | 0.03            |
|               | 5                    | 25,000                                                                        | 400    | 0.02            | 20,000                                             | 240    | 0.014           | 30,000                 | 480    | 0.024           |
|               | 6                    | 20,000                                                                        | 300    | 0.015           | 18,000                                             | 200    | 0.01            | 25,000                 | 380    | 0.018           |
|               | 7                    | 20,000                                                                        | 250    | 0.012           | 16,000                                             | 150    | 0.008           | 22,000                 | 280    | 0.014           |
|               | 8                    | 18,000                                                                        | 200    | 0.01            | 15,000                                             | 130    | 0.007           | 20,000                 | 230    | 0.012           |
|               | 9                    | 18,000                                                                        | 180    | 0.008           | 15,000                                             | 110    | 0.005           | 20,000                 | 200    | 0.009           |
|               | 10                   | 16,000                                                                        | 150    | 0.005           | 14,000                                             | 100    | 0.003           | 18,000                 | 170    | 0.006           |
|               | 12                   | 14,000                                                                        | 120    | 0.003           | 12,000                                             | 80     | 0.002           | 16,000                 | 130    | 0.003           |
|               | 15                   | 14,000                                                                        | 90     | 0.002           | 12,000                                             | 60     | 0.002           | 16,000                 | 100    | 0.002           |
|               | 18                   | 14,000                                                                        | 60     | 0.002           | 12,000                                             | 40     | 0.002           | 16,000                 | 70     | 0.002           |
| 0.7           | 2                    | 30,000                                                                        | 650    | 0.04            | 25,000                                             | 400    | 0.03            | 35,000                 | 750    | 0.05            |
|               | 4                    | 25,000                                                                        | 500    | 0.03            | 22,000                                             | 330    | 0.02            | 30,000                 | 600    | 0.04            |
|               | 6                    | 20,000                                                                        | 350    | 0.02            | 18,000                                             | 240    | 0.015           | 25,000                 | 450    | 0.03            |
|               | 8                    | 18,000                                                                        | 280    | 0.015           | 15,000                                             | 180    | 0.01            | 22,000                 | 350    | 0.02            |
|               | 10                   | 16,000                                                                        | 220    | 0.008           | 14,000                                             | 150    | 0.005           | 20,000                 | 280    | 0.01            |
|               | 3                    | 25,000                                                                        | 700    | 0.05            | 22,000                                             | 500    | 0.03            | 35,000                 | 850    | 0.06            |
| 0.8           | 4                    | 25,000                                                                        | 600    | 0.045           | 22,000                                             | 400    | 0.03            | 30,000                 | 720    | 0.055           |
|               | 5                    | 22,000                                                                        | 500    | 0.035           | 20,000                                             | 350    | 0.025           | 30,000                 | 650    | 0.05            |
|               | 6                    | 20,000                                                                        | 450    | 0.03            | 18,000                                             | 300    | 0.02            | 25,000                 | 560    | 0.04            |
|               | 8                    | 18,000                                                                        | 350    | 0.02            | 15,000                                             | 240    | 0.015           | 22,000                 | 430    | 0.025           |
|               | 10                   | 16,000                                                                        | 300    | 0.01            | 14,000                                             | 200    | 0.007           | 20,000                 | 380    | 0.012           |
|               | 12                   | 14,000                                                                        | 250    | 0.008           | 12,000                                             | 170    | 0.005           | 16,000                 | 290    | 0.01            |
|               | 14                   | 12,000                                                                        | 200    | 0.005           | 10,000                                             | 140    | 0.003           | 14,000                 | 230    | 0.006           |
|               | 16                   | 12,000                                                                        | 150    | 0.003           | 10,000                                             | 110    | 0.002           | 14,000                 | 170    | 0.003           |
|               | 20                   | 12,000                                                                        | 120    | 0.002           | 10,000                                             | 80     | 0.002           | 14,000                 | 140    | 0.002           |
|               | 24                   | 12,000                                                                        | 80     | 0.002           | 10,000                                             | 50     | 0.002           | 14,000                 | 90     | 0.002           |
|               | 4                    | 25,000                                                                        | 900    | 0.05            | 22,000                                             | 600    | 0.035           | 30,000                 | 1,000  | 0.06            |
| 0.9           | 6                    | 20,000                                                                        | 600    | 0.04            | 18,000                                             | 400    | 0.03            | 25,000                 | 750    | 0.05            |
|               | 8                    | 18,000                                                                        | 500    | 0.03            | 16,000                                             | 330    | 0.02            | 22,000                 | 620    | 0.04            |
|               | 10                   | 16,000                                                                        | 400    | 0.02            | 14,000                                             | 260    | 0.015           | 20,000                 | 500    | 0.025           |
|               | 12                   | 14,000                                                                        | 300    | 0.01            | 12,000                                             | 200    | 0.008           | 16,000                 | 400    | 0.015           |
|               | 15                   | 12,000                                                                        | 250    | 0.008           | 10,000                                             | 160    | 0.005           | 14,000                 | 300    | 0.01            |
| 1             | 2                    | 25,000                                                                        | 1,500  | 0.07            | 22,000                                             | 1,000  | 0.06            | 30,000                 | 1,800  | 0.08            |
|               | 3                    | 25,000                                                                        | 1,200  | 0.06            | 22,000                                             | 800    | 0.05            | 30,000                 | 1,500  | 0.07            |
|               | 4                    | 25,000                                                                        | 1,100  | 0.055           | 22,000                                             | 700    | 0.045           | 30,000                 | 1,300  | 0.065           |
|               | 5                    | 22,000                                                                        | 900    | 0.05            | 20,000                                             | 600    | 0.04            | 27,000                 | 1,100  | 0.06            |
|               | 6                    | 20,000                                                                        | 800    | 0.045           | 18,000                                             | 500    | 0.035           | 25,000                 | 1,000  | 0.055           |
|               | 7                    | 20,000                                                                        | 800    | 0.04            | 18,000                                             | 500    | 0.03            | 25,000                 | 1,000  | 0.05            |
|               | 8                    | 18,000                                                                        | 700    | 0.035           | 15,000                                             | 400    | 0.025           | 22,000                 | 850    | 0.045           |
|               | 9                    | 18,000                                                                        | 700    | 0.03            | 15,000                                             | 400    | 0.02            | 22,000                 | 850    | 0.04            |
|               |                      |                                                                               |        |                 |                                                    |        |                 |                        |        |                 |

\* 1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.

MHR230

Recommended Milling Conditions

| Work Material |                      | Carbon Steels•Alloy Steels*1•<br>Stainless Steels*1<br>S50C•SCM*1•SKD*1•SUS*1 |        |                 | Prehardened Steels<br>NAK55•NAK80•HPM1<br>(~43HRC) |        |                 | Copper•Aluminium Alloy |        |                 |
|---------------|----------------------|-------------------------------------------------------------------------------|--------|-----------------|----------------------------------------------------|--------|-----------------|------------------------|--------|-----------------|
| Dia.          | Under Neck<br>Length | Spindle<br>Speed                                                              | Feed   | Depth of<br>Cut | Spindle<br>Speed                                   | Feed   | Depth of<br>Cut | Spindle<br>Speed       | Feed   | Depth of<br>Cut |
|               |                      | min <sup>-1</sup>                                                             | mm/min | ap mm           | min <sup>-1</sup>                                  | mm/min | ap mm           | min <sup>-1</sup>      | mm/min | ap mm           |
| 1             | 10                   | 16,000                                                                        | 600    | 0.025           | 14,000                                             | 350    | 0.018           | 20,000                 | 750    | 0.03            |
|               | 12                   | 14,000                                                                        | 500    | 0.02            | 12,000                                             | 300    | 0.014           | 18,000                 | 650    | 0.025           |
|               | 14                   | 13,000                                                                        | 400    | 0.015           | 11,000                                             | 250    | 0.01            | 15,000                 | 450    | 0.018           |
|               | 16                   | 12,000                                                                        | 300    | 0.01            | 10,000                                             | 200    | 0.007           | 14,000                 | 350    | 0.012           |
|               | 18                   | 12,000                                                                        | 250    | 0.008           | 10,000                                             | 150    | 0.005           | 14,000                 | 300    | 0.01            |
|               | 20                   | 11,000                                                                        | 200    | 0.005           | 9,000                                              | 120    | 0.003           | 13,000                 | 230    | 0.006           |
|               | 22                   | 11,000                                                                        | 160    | 0.003           | 9,000                                              | 100    | 0.002           | 13,000                 | 190    | 0.003           |
|               | 25                   | 10,000                                                                        | 120    | 0.002           | 8,500                                              | 80     | 0.002           | 12,000                 | 140    | 0.002           |
|               | 30                   | 10,000                                                                        | 80     | 0.002           | 8,500                                              | 50     | 0.002           | 12,000                 | 100    | 0.002           |
|               | 4                    | 23,000                                                                        | 1,200  | 0.06            | 20,000                                             | 800    | 0.05            | 27,000                 | 1,400  | 0.07            |
| 1.2           | 6                    | 20,000                                                                        | 900    | 0.05            | 18,000                                             | 600    | 0.04            | 25,000                 | 1,200  | 0.06            |
|               | 8                    | 18,000                                                                        | 800    | 0.04            | 15,000                                             | 500    | 0.03            | 22,000                 | 1,000  | 0.05            |
|               | 10                   | 16,000                                                                        | 700    | 0.03            | 14,000                                             | 450    | 0.02            | 20,000                 | 850    | 0.04            |
|               | 12                   | 14,000                                                                        | 600    | 0.025           | 12,000                                             | 350    | 0.018           | 17,000                 | 700    | 0.03            |
|               | 16                   | 12,000                                                                        | 400    | 0.015           | 10,000                                             | 250    | 0.01            | 14,000                 | 450    | 0.02            |
|               | 20                   | 10,000                                                                        | 300    | 0.01            | 8,000                                              | 180    | 0.007           | 12,000                 | 360    | 0.012           |
|               | 6                    | 20,000                                                                        | 1,200  | 0.07            | 16,000                                             | 720    | 0.06            | 24,000                 | 1,500  | 0.08            |
|               | 8                    | 18,000                                                                        | 1,000  | 0.06            | 14,000                                             | 580    | 0.05            | 22,000                 | 1,300  | 0.07            |
| 1.4           | 10                   | 16,000                                                                        | 850    | 0.05            | 13,000                                             | 520    | 0.04            | 20,000                 | 1,100  | 0.06            |
|               | 12                   | 14,000                                                                        | 700    | 0.04            | 12,000                                             | 450    | 0.03            | 17,000                 | 850    | 0.05            |
|               | 14                   | 13,000                                                                        | 600    | 0.035           | 11,000                                             | 350    | 0.025           | 15,000                 | 700    | 0.04            |
|               | 16                   | 12,000                                                                        | 500    | 0.025           | 10,000                                             | 300    | 0.018           | 13,000                 | 550    | 0.03            |
|               | 22                   | 10,000                                                                        | 350    | 0.015           | 8,000                                              | 210    | 0.01            | 10,000                 | 350    | 0.012           |
|               | 4                    | 22,000                                                                        | 1,400  | 0.09            | 18,000                                             | 860    | 0.08            | 26,000                 | 1,700  | 0.1             |
|               | 6                    | 20,000                                                                        | 1,200  | 0.08            | 16,000                                             | 720    | 0.07            | 24,000                 | 1,500  | 0.09            |
|               | 8                    | 18,000                                                                        | 1,000  | 0.07            | 14,000                                             | 580    | 0.06            | 22,000                 | 1,300  | 0.08            |
| 1.5           | 10                   | 16,000                                                                        | 850    | 0.06            | 13,000                                             | 520    | 0.05            | 20,000                 | 1,100  | 0.07            |
|               | 12                   | 14,000                                                                        | 700    | 0.05            | 12,000                                             | 450    | 0.04            | 17,000                 | 850    | 0.06            |
|               | 14                   | 13,000                                                                        | 600    | 0.04            | 11,000                                             | 380    | 0.03            | 16,000                 | 750    | 0.05            |
|               | 16                   | 12,000                                                                        | 500    | 0.035           | 10,000                                             | 320    | 0.025           | 15,000                 | 650    | 0.04            |
|               | 18                   | 11,000                                                                        | 450    | 0.03            | 9,000                                              | 280    | 0.02            | 13,000                 | 530    | 0.035           |
|               | 20                   | 10,000                                                                        | 400    | 0.02            | 8,000                                              | 240    | 0.014           | 12,000                 | 480    | 0.025           |
|               | 25                   | 9,000                                                                         | 350    | 0.015           | 7,000                                              | 200    | 0.01            | 9,000                  | 350    | 0.018           |
|               | 30                   | 8,000                                                                         | 300    | 0.008           | 6,000                                              | 170    | 0.005           | 8,000                  | 300    | 0.01            |
|               | 35                   | 7,000                                                                         | 200    | 0.005           | 5,500                                              | 130    | 0.003           | 7,000                  | 200    | 0.006           |
|               | 38                   | 6,700                                                                         | 170    | 0.003           | 5,200                                              | 110    | 0.002           | 6,700                  | 170    | 0.003           |
|               | 40                   | 6,500                                                                         | 150    | 0.002           | 5,000                                              | 90     | 0.002           | 6,500                  | 150    | 0.002           |
|               | 45                   | 6,000                                                                         | 100    | 0.002           | 4,500                                              | 60     | 0.002           | 6,000                  | 100    | 0.002           |
|               | 6                    | 20,000                                                                        | 1,200  | 0.09            | 16,000                                             | 720    | 0.08            | 24,000                 | 1,500  | 0.1             |
|               | 8                    | 18,000                                                                        | 1,000  | 0.08            | 14,000                                             | 580    | 0.07            | 22,000                 | 1,300  | 0.09            |
|               | 10                   | 16,000                                                                        | 850    | 0.07            | 13,000                                             | 520    | 0.06            | 20,000                 | 1,100  | 0.08            |
| 1.6           | 12                   | 14,000                                                                        | 700    | 0.06            | 12,000                                             | 450    | 0.05            | 18,000                 | 900    | 0.07            |
|               | 14                   | 13,000                                                                        | 600    | 0.05            | 11,000                                             | 380    | 0.04            | 16,000                 | 750    | 0.06            |
|               | 16                   | 12,000                                                                        | 500    | 0.04            | 10,000                                             | 320    | 0.03            | 14,000                 | 620    | 0.05            |
|               | 18                   | 11,000                                                                        | 450    | 0.03            | 9,000                                              | 280    | 0.025           | 13,000                 | 530    | 0.035           |
|               | 20                   | 10,000                                                                        | 400    | 0.025           | 8,000                                              | 240    | 0.018           | 12,000                 | 480    | 0.03            |
|               | 26                   | 9,000                                                                         | 350    | 0.02            | 7,000                                              | 200    | 0.014           | 9,000                  | 350    | 0.025           |
|               |                      |                                                                               |        |                 |                                                    |        |                 |                        |        |                 |

\* 1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

P

Alloy Steel

P

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

N

Copper

N

Resin

N

~ 55 HRC

Hardened Steel

H

Coating

Long Neck Square

MHR230

Recommended Milling Conditions

| Work Material |                   | Carbon Steels•Alloy Steels※1•<br>Stainless Steels※1<br>S50C•SCM※1•SKD※1•SUS※1 |        |              | Prehardened Steels<br>NAK55•NAK80•HPM1<br>(~43HRC) |        |              | Copper•Aluminium Alloy |        |              |
|---------------|-------------------|-------------------------------------------------------------------------------|--------|--------------|----------------------------------------------------|--------|--------------|------------------------|--------|--------------|
| Dia.          | Under Neck Length | Spindle Speed                                                                 | Feed   | Depth of Cut | Spindle Speed                                      | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut |
|               |                   | min <sup>-1</sup>                                                             | mm/min | ap mm        | min <sup>-1</sup>                                  | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        |
| 1.8           | 6                 | 18,000                                                                        | 1,300  | 0.1          | 14,000                                             | 760    | 0.09         | 22,000                 | 1,600  | 0.12         |
|               | 8                 | 18,000                                                                        | 1,100  | 0.09         | 14,000                                             | 640    | 0.08         | 22,000                 | 1,400  | 0.11         |
|               | 10                | 16,000                                                                        | 900    | 0.08         | 13,000                                             | 550    | 0.07         | 20,000                 | 1,200  | 0.1          |
|               | 12                | 14,000                                                                        | 750    | 0.07         | 12,000                                             | 480    | 0.06         | 17,000                 | 900    | 0.085        |
|               | 14                | 13,000                                                                        | 650    | 0.06         | 11,000                                             | 420    | 0.05         | 16,000                 | 800    | 0.07         |
|               | 16                | 12,000                                                                        | 550    | 0.05         | 10,000                                             | 350    | 0.04         | 15,000                 | 700    | 0.06         |
|               | 18                | 11,000                                                                        | 500    | 0.04         | 9,000                                              | 310    | 0.03         | 13,000                 | 600    | 0.05         |
|               | 20                | 10,000                                                                        | 450    | 0.035        | 8,000                                              | 270    | 0.025        | 12,000                 | 540    | 0.04         |
|               | 25                | 9,000                                                                         | 400    | 0.025        | 7,000                                              | 230    | 0.018        | 11,000                 | 480    | 0.03         |
| 2             | 4                 | 16,000                                                                        | 1,500  | 0.13         | 13,000                                             | 900    | 0.12         | 20,000                 | 1,850  | 0.15         |
|               | 6                 | 16,000                                                                        | 1,400  | 0.12         | 13,000                                             | 850    | 0.1          | 20,000                 | 1,750  | 0.14         |
|               | 8                 | 16,000                                                                        | 1,300  | 0.11         | 13,000                                             | 800    | 0.09         | 20,000                 | 1,650  | 0.13         |
|               | 10                | 16,000                                                                        | 1,200  | 0.1          | 13,000                                             | 750    | 0.08         | 20,000                 | 1,500  | 0.12         |
|               | 12                | 14,000                                                                        | 1,000  | 0.09         | 12,000                                             | 650    | 0.07         | 17,000                 | 1,200  | 0.11         |
|               | 14                | 13,000                                                                        | 900    | 0.08         | 11,000                                             | 570    | 0.06         | 16,000                 | 1,100  | 0.1          |
|               | 16                | 12,000                                                                        | 800    | 0.07         | 10,000                                             | 500    | 0.05         | 15,000                 | 1,000  | 0.085        |
|               | 18                | 11,000                                                                        | 700    | 0.06         | 9,000                                              | 430    | 0.04         | 13,000                 | 800    | 0.07         |
|               | 20                | 10,000                                                                        | 600    | 0.05         | 8,000                                              | 360    | 0.035        | 12,000                 | 720    | 0.06         |
|               | 25                | 9,000                                                                         | 500    | 0.03         | 7,000                                              | 300    | 0.02         | 11,000                 | 600    | 0.035        |
|               | 30                | 8,000                                                                         | 400    | 0.02         | 6,000                                              | 220    | 0.014        | 9,000                  | 450    | 0.025        |
|               | 35                | 7,000                                                                         | 300    | 0.01         | 5,500                                              | 180    | 0.007        | 7,000                  | 300    | 0.012        |
|               | 40                | 6,000                                                                         | 200    | 0.005        | 5,000                                              | 140    | 0.003        | 6,000                  | 200    | 0.006        |
|               | 50                | 5,000                                                                         | 150    | 0.003        | 4,000                                              | 90     | 0.002        | 5,000                  | 150    | 0.003        |
|               | 60                | 4,500                                                                         | 100    | 0.002        | 3,500                                              | 60     | 0.002        | 4,500                  | 100    | 0.002        |
| 2.5           | 8                 | 13,000                                                                        | 1,400  | 0.15         | 11,000                                             | 900    | 0.12         | 16,000                 | 1,700  | 0.18         |
|               | 10                | 13,000                                                                        | 1,300  | 0.14         | 11,000                                             | 800    | 0.11         | 16,000                 | 1,600  | 0.17         |
|               | 12                | 13,000                                                                        | 1,200  | 0.13         | 11,000                                             | 750    | 0.1          | 16,000                 | 1,500  | 0.16         |
|               | 14                | 12,000                                                                        | 1,000  | 0.12         | 10,000                                             | 650    | 0.09         | 14,000                 | 1,200  | 0.15         |
|               | 16                | 11,000                                                                        | 900    | 0.1          | 9,000                                              | 550    | 0.07         | 13,000                 | 1,100  | 0.12         |
|               | 18                | 10,000                                                                        | 800    | 0.09         | 8,000                                              | 480    | 0.06         | 12,000                 | 950    | 0.11         |
|               | 20                | 9,000                                                                         | 700    | 0.08         | 7,000                                              | 400    | 0.05         | 11,000                 | 850    | 0.1          |
|               | 25                | 8,000                                                                         | 600    | 0.05         | 6,000                                              | 330    | 0.035        | 10,000                 | 750    | 0.06         |
|               | 30                | 7,000                                                                         | 500    | 0.03         | 5,500                                              | 280    | 0.02         | 8,500                  | 600    | 0.035        |
|               | 40                | 6,000                                                                         | 300    | 0.015        | 4,500                                              | 180    | 0.01         | 6,000                  | 300    | 0.018        |
|               | 50                | 5,000                                                                         | 200    | 0.01         | 4,000                                              | 120    | 0.007        | 5,000                  | 200    | 0.012        |
| 3             | 8                 | 11,000                                                                        | 1,500  | 0.2          | 9,000                                              | 1,000  | 0.16         | 13,000                 | 1,800  | 0.24         |
|               | 10                | 11,000                                                                        | 1,400  | 0.18         | 9,000                                              | 900    | 0.14         | 13,000                 | 1,700  | 0.22         |
|               | 12                | 11,000                                                                        | 1,300  | 0.16         | 9,000                                              | 800    | 0.12         | 13,000                 | 1,600  | 0.2          |
|               | 14                | 11,000                                                                        | 1,200  | 0.14         | 9,000                                              | 700    | 0.1          | 13,000                 | 1,400  | 0.17         |
|               | 16                | 10,000                                                                        | 1,000  | 0.12         | 8,000                                              | 600    | 0.09         | 12,000                 | 1,200  | 0.15         |
|               | 18                | 10,000                                                                        | 900    | 0.11         | 8,000                                              | 550    | 0.08         | 12,000                 | 1,100  | 0.13         |
|               | 20                | 9,000                                                                         | 800    | 0.1          | 7,000                                              | 450    | 0.07         | 11,000                 | 1,000  | 0.12         |
|               | 25                | 8,000                                                                         | 700    | 0.08         | 6,000                                              | 380    | 0.06         | 10,000                 | 900    | 0.1          |
|               | 30                | 7,000                                                                         | 600    | 0.06         | 5,000                                              | 300    | 0.045        | 8,500                  | 730    | 0.07         |
|               | 35                | 6,000                                                                         | 500    | 0.03         | 4,500                                              | 260    | 0.02         | 7,200                  | 600    | 0.035        |
|               | 40                | 5,000                                                                         | 400    | 0.025        | 4,000                                              | 220    | 0.018        | 6,000                  | 480    | 0.03         |
| 50            | 4,500             | 300                                                                           | 0.015  | 3,500        | 180                                                | 0.01   | 4,500        | 300                    | 0.018  |              |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

P

Alloy Steel

P

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

N

Copper

N

Resin

N

~ 55 HRC

Hardened Steel

H

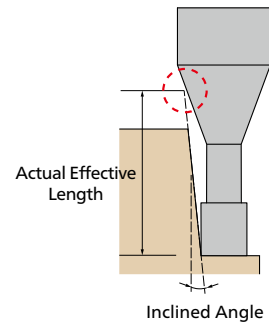
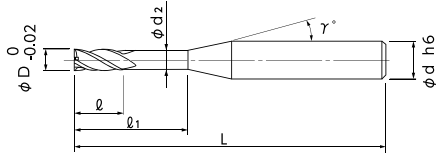
Coating

Long Neck Square

MHR230

Recommended Milling Conditions

| Work Material |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Carbon Steels•Alloy Steels※1•<br>Stainless Steels※1<br>S50C•SCM※1•SKD※1•SUS※1 |        |              | Prehardened Steels<br>NAK55•NAK80•HPM1<br>(~43HRC) |        |              | Copper•Aluminium Alloy |        |              |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------|--------------|----------------------------------------------------|--------|--------------|------------------------|--------|--------------|
| Dia.          | Under Neck Length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Spindle Speed                                                                 | Feed   | Depth of Cut | Spindle Speed                                      | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | min <sup>-1</sup>                                                             | mm/min | ap mm        | min <sup>-1</sup>                                  | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        |
| 4             | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 8,000                                                                         | 1,500  | 0.3          | 6,000                                              | 850    | 0.25         | 10,000                 | 1,900  | 0.36         |
|               | 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 8,000                                                                         | 1,400  | 0.25         | 6,000                                              | 800    | 0.2          | 10,000                 | 1,800  | 0.3          |
|               | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 8,000                                                                         | 1,300  | 0.2          | 6,000                                              | 730    | 0.15         | 10,000                 | 1,600  | 0.24         |
|               | 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7,000                                                                         | 1,100  | 0.15         | 5,000                                              | 600    | 0.1          | 8,500                  | 1,300  | 0.18         |
|               | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7,000                                                                         | 1,000  | 0.12         | 5,000                                              | 540    | 0.08         | 8,500                  | 1,200  | 0.15         |
|               | 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6,000                                                                         | 800    | 0.1          | 4,500                                              | 450    | 0.07         | 7,200                  | 1,000  | 0.12         |
|               | 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5,000                                                                         | 600    | 0.08         | 4,000                                              | 360    | 0.06         | 6,000                  | 720    | 0.1          |
|               | 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4,500                                                                         | 500    | 0.06         | 3,500                                              | 300    | 0.04         | 5,400                  | 600    | 0.07         |
|               | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4,000                                                                         | 400    | 0.04         | 3,000                                              | 220    | 0.03         | 4,800                  | 480    | 0.05         |
|               | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3,500                                                                         | 300    | 0.02         | 2,500                                              | 160    | 0.014        | 4,200                  | 360    | 0.025        |
|               | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 16                                                                            | 6,000  | 1,400        | 0.35                                               | 4,500  | 800          | 0.3                    | 7,200  | 1,700        |
| 20            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6,000                                                                         | 1,300  | 0.3          | 4,500                                              | 730    | 0.25         | 7,200                  | 1,600  | 0.36         |
| 25            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6,000                                                                         | 1,200  | 0.25         | 4,500                                              | 680    | 0.2          | 7,200                  | 1,500  | 0.3          |
| 30            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5,000                                                                         | 900    | 0.2          | 4,000                                              | 540    | 0.15         | 6,000                  | 1,100  | 0.24         |
| 35            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5,000                                                                         | 800    | 0.15         | 3,500                                              | 420    | 0.1          | 6,000                  | 1,000  | 0.18         |
| 40            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4,000                                                                         | 600    | 0.1          | 3,000                                              | 340    | 0.07         | 4,800                  | 720    | 0.12         |
| 50            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3,500                                                                         | 450    | 0.07         | 2,500                                              | 240    | 0.05         | 4,200                  | 540    | 0.085        |
| 6             | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3,000                                                                         | 350    | 0.04         | 2,200                                              | 200    | 0.03         | 3,600                  | 420    | 0.05         |
|               | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5,000                                                                         | 1,200  | 0.4          | 3,500                                              | 630    | 0.35         | 6,000                  | 1,500  | 0.48         |
|               | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4,000                                                                         | 900    | 0.35         | 3,000                                              | 500    | 0.3          | 4,800                  | 1,100  | 0.42         |
|               | 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3,500                                                                         | 650    | 0.25         | 2,700                                              | 380    | 0.2          | 4,200                  | 780    | 0.3          |
|               | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3,000                                                                         | 500    | 0.15         | 2,200                                              | 280    | 0.1          | 3,600                  | 600    | 0.18         |
| 60            | 2,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 400                                                                           | 0.05   | 2,000        | 220                                                | 0.04   | 3,200        | 480                    | 0.06   |              |
| Notes         | ※1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.<br>※2 These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.<br>※3 ap:Axial Depth of Cut.<br>※4 Select a cutting fluid appropriate to work material, milling shape and machining content.<br>※5 Coolant supply and chip disposal in the deep portion are very important.<br>※6 Recommend to apply ramping for approaching into axial direction.<br>※7 Recommend reciprocating cutting.<br>※8 Recommend guide slotting process with short neck tool before milling with L/D 5 times or longer neck tool.<br>※9 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※10 Major adjustment of milling conditions appropriately on milling profile, machine tool and etc. required for the tools smaller than Dia. 0.5mm, or L/D 15 times longer.<br>※11 Major adjustment of milling conditions, e.g. adjust spindle and feed speed at same rate, required on condition of a tool overhang length exceeding a shank diameter 5 times due to possible accuracy impact by chuck runout etc. |                                                                               |        |              |                                                    |        |              |                        |        |              |



- MUGEN COATING has been put on our original end mill for deep rib.
- The Long Neck type is suitable for narrow and deep machining.

| Unit : mm      |          |                                     |                   |                             |                      |                |                    |                                                                  |       |       |       |       |
|----------------|----------|-------------------------------------|-------------------|-----------------------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
| Code No.       | Dia. (D) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|                |          |                                     |                   |                             |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00210-01606 | 1.6      | 6                                   | 2.4               | 1.55                        | 12°                  | 4              | 50                 | 6.37                                                             | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00210-01608 |          | 8                                   |                   |                             |                      |                | 50                 | 8.46                                                             | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00210-01610 |          | 10                                  |                   |                             |                      |                | 50                 | 10.55                                                            | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00210-01612 |          | 12                                  |                   |                             |                      |                | 50                 | 12.63                                                            | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00210-01614 |          | 14                                  |                   |                             |                      |                | 60                 | 14.72                                                            | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00210-01616 |          | 16                                  |                   |                             |                      |                | 60                 | 16.80                                                            | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00210-01618 |          | 18                                  |                   |                             |                      |                | 60                 | 18.89                                                            | 19.73 | 20.66 | 21.67 | Free  |
| 08-00210-01620 |          | 20                                  |                   |                             |                      |                | 60                 | 20.97                                                            | 21.91 | 22.94 | 24.07 | Free  |
| 08-00210-01626 |          | 26                                  |                   |                             |                      |                | 70                 | 27.23                                                            | 28.45 | 29.78 | 31.25 | Free  |
| 08-00210-01706 |          | 1.7                                 |                   |                             |                      |                | 6                  | 2.5                                                              | 1.65  | 12°   | 4     | 50    |
| 08-00210-01714 | 14       |                                     | 60                | 14.72                       | 15.38                | 16.10          | 16.89              |                                                                  |       |       |       | 18.73 |
| 08-00210-01724 | 24       |                                     | 70                | 25.15                       | 26.27                | 27.50          | 28.85              |                                                                  |       |       |       | Free  |
| 08-00210-01806 | 1.8      | 6                                   | 2.7               | 1.74                        | 12°                  | 4              | 50                 | 6.37                                                             | 6.66  | 6.97  | 7.32  | 8.11  |
| 08-00210-01808 |          | 8                                   |                   |                             |                      |                | 50                 | 8.46                                                             | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00210-01810 |          | 10                                  |                   |                             |                      |                | 50                 | 10.55                                                            | 11.02 | 11.53 | 12.10 | 13.42 |
| 08-00210-01812 |          | 12                                  |                   |                             |                      |                | 50                 | 12.63                                                            | 13.20 | 13.82 | 14.49 | 16.08 |
| 08-00210-01814 |          | 14                                  |                   |                             |                      |                | 60                 | 14.72                                                            | 15.38 | 16.10 | 16.89 | 18.73 |
| 08-00210-01816 |          | 16                                  |                   |                             |                      |                | 60                 | 16.80                                                            | 17.55 | 18.38 | 19.28 | 21.39 |
| 08-00210-01818 |          | 18                                  |                   |                             |                      |                | 60                 | 18.89                                                            | 19.73 | 20.66 | 21.67 | Free  |
| 08-00210-01820 |          | 20                                  |                   |                             |                      |                | 60                 | 20.97                                                            | 21.91 | 22.94 | 24.07 | Free  |
| 08-00210-01825 |          | 25                                  |                   |                             |                      |                | 70                 | 26.19                                                            | 27.36 | 28.64 | 30.05 | Free  |
| 08-00210-01906 |          | 1.9                                 |                   |                             |                      |                | 6                  | 2.8                                                              | 1.84  | 12°   | 4     | 50    |
| 08-00210-01916 | 16       |                                     | 60                | 16.83                       | 17.58                | 18.40          | 19.31              |                                                                  |       |       |       | Free  |
| 08-00210-01928 | 28       |                                     | 70                | 29.34                       | 30.65                | 32.09          | Free               |                                                                  |       |       |       | Free  |
| 08-00210-02006 | 2        | 6                                   | 3                 | 1.94                        | 12°                  | 4              | 50                 | 6.40                                                             | 6.69  | 7.00  | 7.34  | 8.15  |
| 08-00210-02008 |          | 8                                   |                   |                             |                      |                | 50                 | 8.48                                                             | 8.86  | 9.28  | 9.74  | 10.80 |
| 08-00210-02010 |          | 10                                  |                   |                             |                      |                | 50                 | 10.57                                                            | 11.04 | 11.56 | 12.13 | 13.45 |
| 08-00210-02012 |          | 12                                  |                   |                             |                      |                | 50                 | 12.66                                                            | 13.22 | 13.84 | 14.52 | 16.11 |
| 08-00210-02014 |          | 14                                  |                   |                             |                      |                | 60                 | 14.74                                                            | 15.40 | 16.12 | 16.92 | 18.76 |
| 08-00210-02016 |          | 16                                  |                   |                             |                      |                | 60                 | 16.83                                                            | 17.58 | 18.40 | 19.31 | Free  |
| 08-00210-02018 |          | 18                                  |                   |                             |                      |                | 60                 | 18.91                                                            | 19.76 | 20.69 | 21.70 | Free  |
| 08-00210-02020 |          | 20                                  |                   |                             |                      |                | 60                 | 21.00                                                            | 21.94 | 22.97 | 24.10 | Free  |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

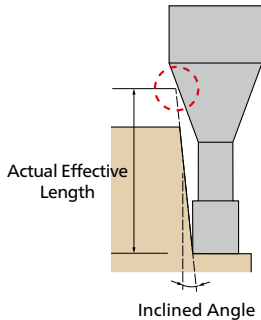
Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Square

MHR430

MUGEN COATING 4 -Flute Long Neck End Mill



Unit : mm

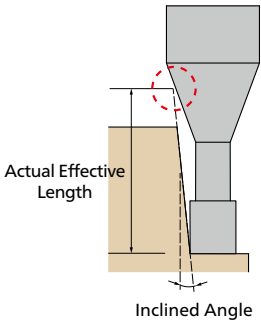
| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00210-02025 | 2           | 25                           | 3                       | 1.94                 | 12°                        | 4                    | 70                       | 26.21                                                               | 27.39 | 28.67 | Free  | Free  |
| 08-00210-02030 |             | 30                           |                         |                      |                            |                      | 70                       | 31.43                                                               | 32.83 | 34.37 | Free  | Free  |
| 08-00210-02508 | 2.5         | 8                            | 3.7                     | 2.4                  | 12°                        | 4                    | 50                       | 8.58                                                                | 8.97  | 9.39  | 9.85  | 10.93 |
| 08-00210-02512 |             | 12                           |                         |                      |                            |                      | 50                       | 12.75                                                               | 13.32 | 13.95 | 14.64 | Free  |
| 08-00210-02516 |             | 16                           |                         |                      |                            |                      | 60                       | 16.93                                                               | 17.68 | 18.51 | 19.42 | Free  |
| 08-00210-02520 |             | 20                           |                         |                      |                            |                      | 60                       | 21.10                                                               | 22.04 | 23.07 | Free  | Free  |
| 08-00210-02525 |             | 25                           |                         |                      |                            |                      | 70                       | 26.31                                                               | 27.49 | 28.78 | Free  | Free  |
| 08-00210-03008 | 3           | 8                            | 4.5                     | 2.85                 | 12°                        | 6                    | 50                       | 8.71                                                                | 9.10  | 9.52  | 9.99  | 11.08 |
| 08-00210-03012 |             | 12                           |                         |                      |                            |                      | 50                       | 12.88                                                               | 13.45 | 14.08 | 14.78 | 16.39 |
| 08-00210-03016 |             | 16                           |                         |                      |                            |                      | 60                       | 17.05                                                               | 17.81 | 18.65 | 19.56 | 21.70 |
| 08-00210-03020 |             | 20                           |                         |                      |                            |                      | 60                       | 21.22                                                               | 22.17 | 23.21 | 24.35 | 27.01 |
| 08-00210-03025 |             | 25                           |                         |                      |                            |                      | 70                       | 26.43                                                               | 27.62 | 28.91 | 30.33 | Free  |
| 08-00210-03030 |             | 30                           |                         |                      |                            |                      | 70                       | 31.65                                                               | 33.06 | 34.61 | 36.31 | Free  |
| 08-00210-03515 | 3.5         | 15                           | 5.5                     | 3.35                 | 12°                        | 6                    | 60                       | 16.01                                                               | 16.72 | 17.50 | 18.37 | 20.37 |
| 08-00210-03525 |             | 25                           |                         |                      |                            |                      | 70                       | 26.43                                                               | 27.62 | 28.91 | 30.33 | Free  |
| 08-00210-03535 |             | 35                           |                         |                      |                            |                      | 80                       | 36.86                                                               | 38.51 | 40.32 | Free  | Free  |
| 08-00210-04012 | 4           | 12                           | 6                       | 3.8                  | 12°                        | 6                    | 50                       | 13.00                                                               | 13.58 | 14.22 | 14.92 | 16.55 |
| 08-00210-04016 |             | 16                           |                         |                      |                            |                      | 60                       | 17.17                                                               | 17.94 | 18.78 | 19.70 | Free  |
| 08-00210-04020 |             | 20                           |                         |                      |                            |                      | 60                       | 21.34                                                               | 22.30 | 23.34 | 24.49 | Free  |
| 08-00210-04025 |             | 25                           |                         |                      |                            |                      | 70                       | 26.56                                                               | 27.74 | 29.04 | Free  | Free  |
| 08-00210-04030 |             | 30                           |                         |                      |                            |                      | 70                       | 31.77                                                               | 33.19 | 34.75 | Free  | Free  |
| 08-00210-04035 |             | 35                           |                         |                      |                            |                      | 80                       | 36.98                                                               | 38.64 | Free  | Free  | Free  |
| 08-00210-04040 |             | 40                           |                         |                      |                            |                      | 90                       | 42.20                                                               | 44.09 | Free  | Free  | Free  |
| 08-00210-04045 |             | 45                           |                         |                      |                            |                      | 90                       | 47.41                                                               | 49.53 | Free  | Free  | Free  |
| 08-00210-04050 |             | 50                           |                         |                      |                            |                      | 100                      | 52.63                                                               | 54.98 | Free  | Free  | Free  |
| 08-00210-05016 | 5           | 16                           | 7.5                     | 4.8                  | 12°                        | 6                    | 60                       | 17.17                                                               | 17.94 | 18.78 | Free  | Free  |
| 08-00210-05025 |             | 25                           |                         |                      |                            |                      | 70                       | 26.56                                                               | 27.74 | Free  | Free  | Free  |
| 08-00210-05035 |             | 35                           |                         |                      |                            |                      | 80                       | 36.98                                                               | Free  | Free  | Free  | Free  |
| 08-00210-05050 |             | 50                           |                         |                      |                            |                      | 110                      | 52.63                                                               | Free  | Free  | Free  | Free  |
| 08-00210-06020 | 6           | 20                           | 9                       | 5.8                  | —                          | 6                    | 80                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00210-06030 |             | 30                           |                         |                      |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00210-06040 |             | 40                           |                         |                      |                            |                      | 100                      | Free                                                                | Free  | Free  | Free  | Free  |

How to Order

When you order, indicate MHR430 (D)×(ℓ1). ※( γ ) is reference value.

MHR430

MUGEN COATING 4 -Flute Long Neck End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |      |
|----------------|-------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|------|
|                |             |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°   | 1°30´ | 2°   | 3°   |
| 08-00210-06050 | 6           | 50                           | 9                       | 5.8                  | —                          | 6                    | 110                      | Free                                                                | Free | Free  | Free | Free |
| 08-00210-08030 | 8           | 30                           | 12                      | 7.8                  | —                          | 8                    | 100                      | Free                                                                | Free | Free  | Free | Free |
| 08-00210-08050 |             | 50                           |                         |                      |                            |                      | 120                      | Free                                                                | Free | Free  | Free | Free |
| 08-00210-08060 |             | 60                           |                         |                      |                            |                      | 130                      | Free                                                                | Free | Free  | Free | Free |
| 08-00210-10040 | 10          | 40                           | 15                      | 9.8                  | —                          | 10                   | 110                      | Free                                                                | Free | Free  | Free | Free |
| 08-00210-10060 |             | 60                           |                         |                      |                            |                      | 130                      | Free                                                                | Free | Free  | Free | Free |
| 08-00210-10080 |             | 80                           |                         |                      |                            |                      | 150                      | Free                                                                | Free | Free  | Free | Free |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Square

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Square

MHR430

Recommended Milling Conditions

| Work Material |                   | Carbon Steels・Alloy Steels※1・Stainless Steels※1<br>S50C・SCM※1・SKD※1・SUS※1 |        |              |       | Prehardened Steels<br>NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       |
|---------------|-------------------|---------------------------------------------------------------------------|--------|--------------|-------|----------------------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                             | Feed   | Depth of Cut |       | Spindle Speed                                      | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                         | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                  | mm/min | ap mm        | ae mm |
| 1             | 4                 | 25,000                                                                    | 1,700  | 0.055        | 0.6   | 22,000                                             | 1,100  | 0.045        | 0.6   |
|               | 6                 | 20,000                                                                    | 1,200  | 0.045        | 0.6   | 18,000                                             | 750    | 0.035        | 0.6   |
|               | 8                 | 18,000                                                                    | 1,050  | 0.035        | 0.6   | 15,000                                             | 600    | 0.025        | 0.6   |
|               | 10                | 16,000                                                                    | 900    | 0.025        | 0.6   | 14,000                                             | 520    | 0.018        | 0.6   |
|               | 12                | 14,000                                                                    | 750    | 0.02         | 0.6   | 12,000                                             | 450    | 0.014        | 0.6   |
|               | 16                | 12,000                                                                    | 450    | 0.01         | 0.6   | 10,000                                             | 300    | 0.007        | 0.6   |
| 1.1           | 6                 | 20,000                                                                    | 1,300  | 0.05         | 0.66  | 18,000                                             | 820    | 0.04         | 0.66  |
|               | 10                | 16,000                                                                    | 1,000  | 0.03         | 0.66  | 14,000                                             | 600    | 0.02         | 0.66  |
|               | 16                | 12,000                                                                    | 550    | 0.015        | 0.66  | 10,000                                             | 330    | 0.01         | 0.66  |
| 1.2           | 6                 | 20,000                                                                    | 1,400  | 0.05         | 0.72  | 18,000                                             | 900    | 0.04         | 0.72  |
|               | 8                 | 18,000                                                                    | 1,200  | 0.04         | 0.72  | 15,000                                             | 750    | 0.03         | 0.72  |
|               | 10                | 16,000                                                                    | 1,050  | 0.03         | 0.72  | 14,000                                             | 670    | 0.02         | 0.72  |
|               | 12                | 14,000                                                                    | 900    | 0.025        | 0.72  | 12,000                                             | 530    | 0.018        | 0.72  |
|               | 16                | 12,000                                                                    | 600    | 0.015        | 0.72  | 10,000                                             | 380    | 0.01         | 0.72  |
| 1.3           | 6                 | 20,000                                                                    | 1,500  | 0.06         | 0.78  | 17,000                                             | 1,000  | 0.05         | 0.78  |
|               | 12                | 14,000                                                                    | 1,000  | 0.03         | 0.78  | 12,000                                             | 600    | 0.025        | 0.78  |
|               | 18                | 11,000                                                                    | 600    | 0.015        | 0.78  | 9,000                                              | 380    | 0.01         | 0.78  |
| 1.4           | 6                 | 20,000                                                                    | 1,800  | 0.07         | 0.84  | 16,000                                             | 1,100  | 0.06         | 0.84  |
|               | 8                 | 18,000                                                                    | 1,500  | 0.06         | 0.84  | 14,000                                             | 900    | 0.05         | 0.84  |
|               | 10                | 16,000                                                                    | 1,300  | 0.05         | 0.84  | 13,000                                             | 780    | 0.04         | 0.84  |
|               | 12                | 14,000                                                                    | 1,050  | 0.04         | 0.84  | 12,000                                             | 670    | 0.03         | 0.84  |
|               | 14                | 13,000                                                                    | 900    | 0.035        | 0.84  | 11,000                                             | 530    | 0.025        | 0.84  |
|               | 16                | 12,000                                                                    | 750    | 0.025        | 0.84  | 10,000                                             | 450    | 0.018        | 0.84  |
|               | 22                | 10,000                                                                    | 550    | 0.015        | 0.84  | 8,000                                              | 320    | 0.01         | 0.84  |
|               |                   |                                                                           |        |              |       |                                                    |        |              |       |
| 1.5           | 6                 | 20,000                                                                    | 1,800  | 0.08         | 0.9   | 16,000                                             | 1,100  | 0.07         | 0.9   |
|               | 8                 | 18,000                                                                    | 1,500  | 0.07         | 0.9   | 14,000                                             | 900    | 0.06         | 0.9   |
|               | 10                | 16,000                                                                    | 1,300  | 0.06         | 0.9   | 13,000                                             | 780    | 0.05         | 0.9   |
|               | 12                | 14,000                                                                    | 1,050  | 0.05         | 0.9   | 12,000                                             | 670    | 0.04         | 0.9   |
|               | 14                | 13,000                                                                    | 900    | 0.04         | 0.9   | 11,000                                             | 570    | 0.03         | 0.9   |
|               | 16                | 12,000                                                                    | 750    | 0.035        | 0.9   | 10,000                                             | 480    | 0.025        | 0.9   |
|               | 18                | 11,000                                                                    | 680    | 0.03         | 0.9   | 9,000                                              | 420    | 0.02         | 0.9   |
|               | 20                | 10,000                                                                    | 600    | 0.02         | 0.9   | 8,000                                              | 360    | 0.014        | 0.9   |
| 1.6           | 6                 | 20,000                                                                    | 1,800  | 0.09         | 0.96  | 16,000                                             | 1,100  | 0.08         | 0.96  |
|               | 8                 | 18,000                                                                    | 1,500  | 0.08         | 0.96  | 14,000                                             | 900    | 0.07         | 0.96  |
|               | 10                | 16,000                                                                    | 1,300  | 0.07         | 0.96  | 13,000                                             | 780    | 0.06         | 0.96  |
|               | 12                | 14,000                                                                    | 1,050  | 0.06         | 0.96  | 12,000                                             | 670    | 0.05         | 0.96  |
|               | 14                | 13,000                                                                    | 900    | 0.05         | 0.96  | 11,000                                             | 570    | 0.04         | 0.96  |
|               | 16                | 12,000                                                                    | 750    | 0.04         | 0.96  | 10,000                                             | 480    | 0.03         | 0.96  |
|               | 18                | 11,000                                                                    | 680    | 0.03         | 0.96  | 9,000                                              | 420    | 0.025        | 0.96  |
|               | 20                | 10,000                                                                    | 600    | 0.025        | 0.96  | 8,000                                              | 360    | 0.018        | 0.96  |
| 1.7           | 26                | 9,000                                                                     | 530    | 0.02         | 0.96  | 7,000                                              | 300    | 0.014        | 0.96  |
|               | 6                 | 19,000                                                                    | 1,900  | 0.095        | 1.02  | 15,000                                             | 1,150  | 0.085        | 1.02  |
|               | 14                | 13,000                                                                    | 950    | 0.055        | 1.02  | 11,000                                             | 630    | 0.045        | 1.02  |
|               | 24                | 9,000                                                                     | 550    | 0.025        | 1.02  | 7,000                                              | 330    | 0.018        | 1.02  |

\* 1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.

MHR430

Recommended Milling Conditions

| Work Material |                   | Carbon Steels・Alloy Steels※1・Stainless Steels※1<br>S50C・SCM※1・SKD※1・SUS※1 |        |              |       | Prehardened Steels<br>NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       |
|---------------|-------------------|---------------------------------------------------------------------------|--------|--------------|-------|----------------------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                             | Feed   | Depth of Cut |       | Spindle Speed                                      | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                         | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                  | mm/min | ap mm        | ae mm |
| 1.8           | 6                 | 18,000                                                                    | 2,000  | 0.1          | 1.08  | 14,000                                             | 1,200  | 0.09         | 1.08  |
|               | 8                 | 18,000                                                                    | 1,700  | 0.09         | 1.08  | 14,000                                             | 1,000  | 0.08         | 1.08  |
|               | 10                | 16,000                                                                    | 1,400  | 0.08         | 1.08  | 13,000                                             | 850    | 0.07         | 1.08  |
|               | 12                | 14,000                                                                    | 1,100  | 0.07         | 1.08  | 12,000                                             | 720    | 0.06         | 1.08  |
|               | 14                | 13,000                                                                    | 1,000  | 0.06         | 1.08  | 11,000                                             | 630    | 0.05         | 1.08  |
|               | 16                | 12,000                                                                    | 850    | 0.05         | 1.08  | 10,000                                             | 530    | 0.04         | 1.08  |
|               | 18                | 11,000                                                                    | 750    | 0.04         | 1.08  | 9,000                                              | 470    | 0.03         | 1.08  |
|               | 20                | 10,000                                                                    | 680    | 0.035        | 1.08  | 8,000                                              | 400    | 0.025        | 1.08  |
|               | 25                | 9,000                                                                     | 600    | 0.025        | 1.08  | 7,000                                              | 340    | 0.018        | 1.08  |
|               |                   |                                                                           |        |              |       |                                                    |        |              |       |
| 1.9           | 6                 | 17,000                                                                    | 2,100  | 0.11         | 1.14  | 14,000                                             | 1,250  | 0.095        | 1.14  |
|               | 16                | 12,000                                                                    | 1,000  | 0.06         | 1.14  | 10,000                                             | 630    | 0.045        | 1.14  |
|               | 28                | 8,000                                                                     | 550    | 0.02         | 1.14  | 6,000                                              | 300    | 0.014        | 1.14  |
| 2             | 6                 | 16,000                                                                    | 2,100  | 0.12         | 1.2   | 13,000                                             | 1,300  | 0.1          | 1.2   |
|               | 8                 | 16,000                                                                    | 2,000  | 0.11         | 1.2   | 13,000                                             | 1,200  | 0.09         | 1.2   |
|               | 10                | 16,000                                                                    | 1,800  | 0.1          | 1.2   | 13,000                                             | 1,100  | 0.08         | 1.2   |
|               | 12                | 14,000                                                                    | 1,500  | 0.09         | 1.2   | 12,000                                             | 1,000  | 0.07         | 1.2   |
|               | 14                | 13,000                                                                    | 1,350  | 0.08         | 1.2   | 11,000                                             | 850    | 0.06         | 1.2   |
|               | 16                | 12,000                                                                    | 1,200  | 0.07         | 1.2   | 10,000                                             | 750    | 0.05         | 1.2   |
|               | 18                | 11,000                                                                    | 1,000  | 0.06         | 1.2   | 9,000                                              | 650    | 0.04         | 1.2   |
|               | 20                | 10,000                                                                    | 900    | 0.05         | 1.2   | 8,000                                              | 550    | 0.035        | 1.2   |
|               | 25                | 9,000                                                                     | 750    | 0.03         | 1.2   | 7,000                                              | 450    | 0.02         | 1.2   |
|               | 30                | 8,000                                                                     | 600    | 0.02         | 1.2   | 6,000                                              | 330    | 0.014        | 1.2   |
| 2.5           | 8                 | 13,000                                                                    | 2,100  | 0.15         | 1.5   | 11,000                                             | 1,400  | 0.12         | 1.5   |
|               | 12                | 13,000                                                                    | 1,800  | 0.13         | 1.5   | 11,000                                             | 1,100  | 0.1          | 1.5   |
|               | 16                | 11,000                                                                    | 1,400  | 0.1          | 1.5   | 9,000                                              | 850    | 0.07         | 1.5   |
|               | 20                | 9,000                                                                     | 1,100  | 0.08         | 1.5   | 7,000                                              | 600    | 0.05         | 1.5   |
| 3             | 25                | 8,000                                                                     | 900    | 0.05         | 1.5   | 6,000                                              | 500    | 0.035        | 1.5   |
|               | 8                 | 11,000                                                                    | 2,300  | 0.2          | 1.8   | 9,000                                              | 1,500  | 0.16         | 1.8   |
|               | 12                | 11,000                                                                    | 2,000  | 0.16         | 1.8   | 9,000                                              | 1,200  | 0.12         | 1.8   |
|               | 16                | 10,000                                                                    | 1,500  | 0.12         | 1.8   | 8,000                                              | 900    | 0.09         | 1.8   |
|               | 20                | 9,000                                                                     | 1,200  | 0.1          | 1.8   | 7,000                                              | 680    | 0.07         | 1.8   |
|               | 25                | 8,000                                                                     | 1,050  | 0.08         | 1.8   | 6,000                                              | 570    | 0.06         | 1.8   |
|               | 30                | 7,000                                                                     | 900    | 0.06         | 1.8   | 5,000                                              | 450    | 0.045        | 1.8   |
|               |                   |                                                                           |        |              |       |                                                    |        |              |       |
| 3.5           | 15                | 9,000                                                                     | 2,000  | 0.18         | 2.1   | 7,000                                              | 1,200  | 0.15         | 2.1   |
|               | 25                | 7,500                                                                     | 1,500  | 0.12         | 2.1   | 6,000                                              | 850    | 0.08         | 2.1   |
|               | 35                | 6,000                                                                     | 1,000  | 0.07         | 2.1   | 4,500                                              | 520    | 0.05         | 2.1   |
| 4             | 12                | 8,000                                                                     | 2,200  | 0.3          | 2.4   | 6,000                                              | 1,300  | 0.25         | 2.4   |
|               | 16                | 8,000                                                                     | 2,100  | 0.25         | 2.4   | 6,000                                              | 1,200  | 0.2          | 2.4   |
|               | 20                | 8,000                                                                     | 2,000  | 0.2          | 2.4   | 6,000                                              | 1,100  | 0.15         | 2.4   |
|               | 25                | 7,000                                                                     | 1,700  | 0.15         | 2.4   | 5,000                                              | 900    | 0.1          | 2.4   |
|               | 30                | 7,000                                                                     | 1,500  | 0.12         | 2.4   | 5,000                                              | 800    | 0.08         | 2.4   |
|               | 35                | 6,000                                                                     | 1,200  | 0.1          | 2.4   | 4,500                                              | 670    | 0.07         | 2.4   |
|               | 40                | 5,000                                                                     | 900    | 0.08         | 2.4   | 4,000                                              | 540    | 0.06         | 2.4   |
|               | 45                | 4,500                                                                     | 750    | 0.06         | 2.4   | 3,500                                              | 450    | 0.04         | 2.4   |
|               | 50                | 4,000                                                                     | 600    | 0.04         | 2.4   | 3,000                                              | 330    | 0.03         | 2.4   |
|               |                   |                                                                           |        |              |       |                                                    |        |              |       |
| 5             | 16                | 6,000                                                                     | 2,100  | 0.35         | 3     | 4,500                                              | 1,200  | 0.3          | 3     |
|               | 25                | 6,000                                                                     | 1,800  | 0.25         | 3     | 4,500                                              | 1,000  | 0.2          | 3     |
|               | 35                | 5,000                                                                     | 1,200  | 0.15         | 3     | 3,500                                              | 630    | 0.1          | 3     |
|               | 50                | 3,500                                                                     | 680    | 0.07         | 3     | 2,500                                              | 360    | 0.05         | 3     |

\* 1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Square



Regular Line  
MUGEN COATING  
Long Neck Type

 Carbon Steel **P**

 Alloy Steel **P**

 Prehardened Steel **P**

 Stainless Steel **M**

 Aluminium Alloy **N**

 Copper **N**

 Resin **N**

 ~ 55 HRC  
Hardened Steel **H**

 Long Neck  
Square  
Coating

MHR430

Recommended Milling Conditions

| Work Material |                   | Carbon Steels・Alloy Steels※1・Stainless Steels※1<br>S50C・SCM※1・SKD※1・SUS※1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |              |       | Prehardened Steels<br>NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       |
|---------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|----------------------------------------------------|--------|--------------|-------|
| Dia.          | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Feed   | Depth of Cut |       | Spindle Speed                                      | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                  | mm/min | ap mm        | ae mm |
| 6             | 20                | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1,800  | 0.4          | 3.6   | 3,500                                              | 1,000  | 0.35         | 3.6   |
|               | 30                | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1,400  | 0.35         | 3.6   | 3,000                                              | 750    | 0.3          | 3.6   |
|               | 40                | 3,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1,000  | 0.25         | 3.6   | 2,700                                              | 570    | 0.2          | 3.6   |
|               | 50                | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 750    | 0.15         | 3.6   | 2,200                                              | 420    | 0.1          | 3.6   |
| 8             | 30                | 3,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1,400  | 0.6          | 4.8   | 2,800                                              | 900    | 0.45         | 4.8   |
|               | 50                | 2,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 820    | 0.4          | 4.8   | 2,100                                              | 600    | 0.3          | 4.8   |
|               | 60                | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 680    | 0.3          | 4.8   | 1,800                                              | 450    | 0.2          | 4.8   |
| 10            | 40                | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1,200  | 0.8          | 6     | 2,200                                              | 750    | 0.55         | 6     |
|               | 60                | 2,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 750    | 0.6          | 6     | 1,600                                              | 520    | 0.45         | 6     |
|               | 80                | 1,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 520    | 0.4          | 6     | 1,300                                              | 360    | 0.3          | 6     |
| Notes         |                   | ※1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.<br>※2 These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.<br>※3 ap:Axial Depth of Cut, ae:Radial Depth of Cut.<br>※4 Select a cutting fluid appropriate to work material, milling shape and machining content.<br>※5 Coolant supply and chip disposal in the deep portion are very important.<br>※6 Recommend to apply herical or ramping for approaching into axial direction.<br>※7 Reduction of feed and Depth of Cut to reduce machining load around side wall.<br>※8 For slotting, recommend reciprocating milling by adjusting feed at 80% of recommended milling conditions as a reference value.<br>Recommend guide slotting process with short neck tool before milling with L/D 5 time or longer neck tool.<br>※9 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※10 Major adjustment of milling conditions, e.g. adjust spindle and feed speed at same rate, required on condition of a tool overhang length exceeding a shank diameter 5 times due to possible accuracy impact by chuck runout etc. |        |              |       |                                                    |        |              |       |

MHR430

Regular Line  
MUGEN COATING  
Long Neck Type

**P** Carbon Steel 

**P** Alloy Steel 

**P** Prehardened Steel 

**M** Stainless Steel 

**N** Aluminium Alloy 

**N** Copper 

**N** Resin 

**H** ~ 55 HRC  
Hardened Steel 

 Long Neck  
Square  
Coating



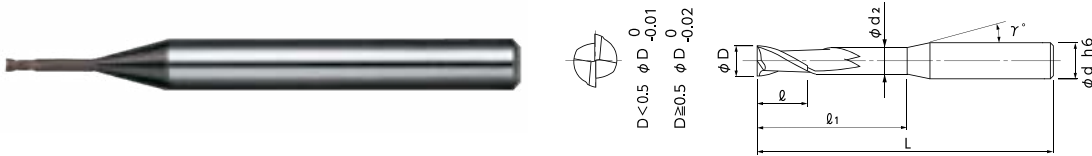


# MHRLN230-6

## MUGEN COATING 2-Flute Long Neck End Mill (Shank Dia. 6)

## Recommended Milling Conditions

2-flute long neck square end mill. Shank Dia.6mm



● ■ : Semi-standard item, please inquire for price and delivery.

| Unit : mm      |          |                        |                   |                |                      |                |                    |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Under Neck Length (L1) | Length of Cut (L) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 08-00202-03030 | 0.3      | 3                      | 0.4               | 0.28           | 15°                  | 6              | 60                 |
| 08-00202-04030 | 0.4      | 3                      | 0.6               | 0.37           | 15°                  | 6              | 60                 |
| 08-00202-04040 |          | 4                      | 0.6               | 0.37           | 15°                  | 6              | 60                 |
| 08-00202-04050 |          | 5                      | 0.6               | 0.37           | 15°                  | 6              | 60                 |
| 08-00202-05040 | 0.5      | 4                      | 0.7               | 0.46           | 15°                  | 6              | 60                 |
| 08-00202-05050 |          | 5                      | 0.7               | 0.46           | 15°                  | 6              | 60                 |
| 08-00202-05060 |          | 6                      | 0.7               | 0.46           | 15°                  | 6              | 60                 |
| 08-00202-06040 | 0.6      | 4                      | 0.9               | 0.56           | 15°                  | 6              | 60                 |
| 08-00202-06060 |          | 6                      | 0.9               | 0.56           | 15°                  | 6              | 60                 |
| 08-00202-08080 | 0.8      | 8                      | 1.2               | 0.76           | 15°                  | 6              | 60                 |
| 08-00202-10030 | 1        | 3                      | 1.5               | 0.95           | 15°                  | 6              | 60                 |
| 08-00202-10060 |          | 6                      | 1.5               | 0.95           | 15°                  | 6              | 60                 |
| 08-00202-10080 |          | 8                      | 1.5               | 0.95           | 15°                  | 6              | 60                 |
| 08-00202-10100 |          | 10                     | 1.5               | 0.95           | 15°                  | 6              | 60                 |
| 08-00202-15030 | 1.5      | 3                      | 2.3               | 1.45           | 15°                  | 6              | 60                 |
| 08-00202-15050 |          | 5                      | 2.3               | 1.45           | 15°                  | 6              | 60                 |
| 08-00202-15100 |          | 10                     | 2.3               | 1.45           | 15°                  | 6              | 60                 |
| 08-00202-15150 |          | 15                     | 2.3               | 1.45           | 15°                  | 6              | 60                 |
| 08-00202-20200 | 2        | 20                     | 3                 | 1.94           | 15°                  | 6              | 60                 |

## How to Order

When you order, indicate MHRLN230-6 (D)×(ℓ1). ※(γ) is reference value.

| Work Material |                   | Carbon Steels・Alloy Steels※ <sub>1</sub><br>・Stainless Steels※ <sub>1</sub><br>S50C・SCM※ <sub>1</sub> ・SKD※ <sub>1</sub> ・SUS※ <sub>1</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |              | Prehardened Steels<br>NAK55・NAK80・HPM1<br>(~43HRC) |        |              | Copper・Aluminium Alloy |        |              |
|---------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|----------------------------------------------------|--------|--------------|------------------------|--------|--------------|
| Dia.          | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Feed   | Depth of Cut | Spindle Speed                                      | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut |
|               |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | mm/min | ap mm        | min <sup>-1</sup>                                  | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        |
| 0.3           | 3                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 200    | 0.005        | 25,000                                             | 130    | 0.004        | 35,000                 | 250    | 0.006        |
|               | 3                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 300    | 0.015        | 25,000                                             | 190    | 0.01         | 35,000                 | 350    | 0.018        |
| 0.4           | 4                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 200    | 0.01         | 22,000                                             | 140    | 0.007        | 30,000                 | 240    | 0.012        |
|               | 5                 | 22,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 160    | 0.008        | 20,000                                             | 110    | 0.005        | 25,000                 | 180    | 0.01         |
| 0.5           | 4                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 350    | 0.015        | 22,000                                             | 230    | 0.01         | 30,000                 | 420    | 0.018        |
|               | 5                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 300    | 0.01         | 20,000                                             | 180    | 0.007        | 30,000                 | 350    | 0.012        |
|               | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 200    | 0.008        | 18,000                                             | 140    | 0.005        | 25,000                 | 250    | 0.01         |
| 0.6           | 4                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 450    | 0.025        | 22,000                                             | 300    | 0.018        | 30,000                 | 550    | 0.03         |
|               | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 300    | 0.015        | 18,000                                             | 200    | 0.01         | 25,000                 | 380    | 0.018        |
| 0.8           | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 350    | 0.02         | 15,000                                             | 240    | 0.015        | 22,000                 | 430    | 0.025        |
| 1             | 3                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,200  | 0.06         | 22,000                                             | 800    | 0.05         | 30,000                 | 1,500  | 0.07         |
|               | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 0.045        | 18,000                                             | 500    | 0.035        | 25,000                 | 1,000  | 0.055        |
|               | 8                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 0.035        | 15,000                                             | 400    | 0.025        | 22,000                 | 850    | 0.045        |
|               | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 600    | 0.025        | 14,000                                             | 350    | 0.018        | 20,000                 | 750    | 0.03         |
| 1.5           | 3                 | 22,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,400  | 0.09         | 18,000                                             | 860    | 0.08         | 26,000                 | 1,700  | 0.1          |
|               | 5                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,200  | 0.08         | 16,000                                             | 720    | 0.07         | 24,000                 | 1,500  | 0.09         |
|               | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 850    | 0.06         | 13,000                                             | 520    | 0.05         | 20,000                 | 1,100  | 0.07         |
|               | 15                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500    | 0.035        | 10,000                                             | 320    | 0.025        | 15,000                 | 650    | 0.04         |
| 2             | 20                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 600    | 0.05         | 8,000                                              | 360    | 0.035        | 12,000                 | 720    | 0.06         |
| Notes         |                   | ※1 Reference value for Alloy and Stainless Steels are 80% of recommended cutting conditions.<br>※2 These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.<br>※3 ap:Axial Depth of Cut.<br>※4 Select a cutting fluid appropriate to work material, milling shape and machining content.<br>※5 Coolant supply and chip disposal in the deep portion are very important.<br>※6 Recommend to apply ramping for approaching into axial direction.<br>※7 Recommend reciprocating cutting.<br>※8 Recommend guide slotting process with short neck tool before milling with L/D 5 time or longer neck tool.<br>※9 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※10 Major adjustment of milling conditions appropriately on milling profile, machine tool and etc. required for the tools smaller than Dia. 0.5mm.<br>※11 Major adjustment of milling conditions, e.g. adjust spindle and feed speed at same rate, required on condition of a tool overhang length exceeding a shank diameter 5 times due to possible accuracy impact by chuck runout etc. |        |              |                                                    |        |              |                        |        |              |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~55 HRC  
Hardened Steel  
H

Coating  
Long Neck  
Ball

MRB230

Size R0.05 ~ R3

MG

R ±0.005  
(R ≦ 1.5)

2

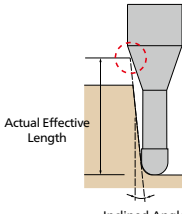
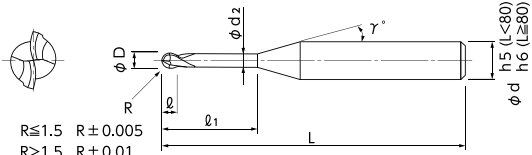
φd h5  
(L < 80)

30°

3D

MUGEN COATING 2-Flute Long Neck Ball End Mill

Standard type long neck ball end mill. Sufficient variations with 282 sizes



● The Long Neck type is suitable for narrow and deep machining.

● It is possible to have deep and precision three-dimensional cutting in the low to high speed range.

● Total 282 sizes!

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ°) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|----------------|------------|------------------------|-------------------|----------|----------------|-----------------------|----------------|--------------------|------------------------------------------------------------------|------|-------|------|------|
|                |            |                        |                   |          |                |                       |                |                    | 30°                                                              | 1°   | 1°30′ | 2°   | 3°   |
| 08-00520-20051 | R0.05      | 0.3                    | 0.07              | 0.1      | 0.085          | 12°                   | 4              | 45                 | 0.34                                                             | 0.36 | 0.37  | 0.39 | 0.42 |
| 08-00520-20052 |            | 0.5                    | 0.07              | 0.1      | 0.085          | 12°                   | 4              | 45                 | 0.55                                                             | 0.57 | 0.60  | 0.63 | 0.69 |
| 08-00520-40075 | R0.075     | 0.3                    | 0.1               | 0.15     | 0.13           | 12°                   | 4              | 45                 | 0.36                                                             | 0.37 | 0.39  | 0.40 | 0.44 |
| 08-00520-40076 |            | 0.5                    | 0.1               | 0.15     | 0.13           | 12°                   | 4              | 45                 | 0.57                                                             | 0.59 | 0.61  | 0.64 | 0.70 |
| 08-00520-40077 |            | 1                      | 0.1               | 0.15     | 0.13           | 12°                   | 4              | 45                 | 1.09                                                             | 1.13 | 1.18  | 1.24 | 1.37 |
| 08-00520-00101 |            | 0.5                    | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 0.57                                                             | 0.59 | 0.62  | 0.64 | 0.70 |
| 08-00521-00101 |            | 0.5                    | 0.15              | 0.2      | 0.18           | 12°                   | 6              | 50                 | 0.57                                                             | 0.59 | 0.62  | 0.64 | 0.70 |
| 08-00520-10101 |            | 0.75                   | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 0.83                                                             | 0.87 | 0.90  | 0.94 | 1.04 |
| 08-00520-00102 |            | 1                      | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 1.09                                                             | 1.14 | 1.19  | 1.24 | 1.37 |
| 08-00521-00102 |            | 1                      | 0.15              | 0.2      | 0.18           | 12°                   | 6              | 50                 | 1.09                                                             | 1.14 | 1.19  | 1.24 | 1.37 |
| 08-00520-10102 |            | 1.25                   | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 1.36                                                             | 1.41 | 1.47  | 1.54 | 1.70 |
| 08-00520-00103 |            | 1.5                    | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 1.62                                                             | 1.68 | 1.76  | 1.84 | 2.03 |
| 08-00521-00103 |            | 1.5                    | 0.15              | 0.2      | 0.18           | 12°                   | 6              | 50                 | 1.62                                                             | 1.68 | 1.76  | 1.84 | 2.03 |
| 08-00520-10103 |            | 1.75                   | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 1.88                                                             | 1.96 | 2.04  | 2.14 | 2.36 |
| 08-00520-00104 |            | 2                      | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 2.14                                                             | 2.23 | 2.33  | 2.44 | 2.70 |
| 08-00521-00104 |            | 2                      | 0.15              | 0.2      | 0.18           | 12°                   | 6              | 50                 | 2.14                                                             | 2.23 | 2.33  | 2.44 | 2.70 |
| 08-00520-00105 |            | 2.5                    | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 2.66                                                             | 2.77 | 2.90  | 3.04 | 3.36 |
| 08-00520-00106 |            | 3                      | 0.15              | 0.2      | 0.18           | 12°                   | 4              | 45                 | 3.18                                                             | 3.32 | 3.47  | 3.64 | 4.02 |
| 08-00520-40151 |            | 0.5                    | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 0.56                                                             | 0.58 | 0.60  | 0.63 | 0.68 |
| 08-00520-10151 |            | 0.6                    | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 0.68                                                             | 0.70 | 0.73  | 0.75 | 0.82 |
| 08-00520-40152 |            | 0.75                   | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 0.82                                                             | 0.86 | 0.89  | 0.93 | 1.01 |
| 08-00520-00151 |            | 1                      | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 1.09                                                             | 1.14 | 1.18  | 1.23 | 1.35 |
| 08-00521-00151 |            | 1                      | 0.2               | 0.3      | 0.28           | 12°                   | 6              | 50                 | 1.09                                                             | 1.14 | 1.18  | 1.23 | 1.35 |
| 08-00520-30153 |            | 1.25                   | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 1.34                                                             | 1.39 | 1.45  | 1.52 | 1.67 |
| 08-00520-10152 |            | 1.5                    | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 1.61                                                             | 1.68 | 1.75  | 1.83 | 2.02 |
| 08-00521-00152 |            | 1.5                    | 0.2               | 0.3      | 0.28           | 12°                   | 6              | 50                 | 1.61                                                             | 1.68 | 1.75  | 1.83 | 2.02 |
| 08-00520-30154 |            | 1.75                   | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 1.86                                                             | 1.94 | 2.02  | 2.12 | 2.33 |
| 08-00520-00152 |            | 2                      | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 2.14                                                             | 2.22 | 2.32  | 2.43 | 2.68 |
| 08-00521-00153 |            | 2                      | 0.2               | 0.3      | 0.28           | 12°                   | 6              | 50                 | 2.14                                                             | 2.22 | 2.32  | 2.43 | 2.68 |
| 08-00520-30155 |            | 2.25                   | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 2.38                                                             | 2.48 | 2.59  | 2.71 | 3.00 |
| 08-00520-10153 |            | 2.5                    | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 2.66                                                             | 2.77 | 2.89  | 3.03 | 3.34 |
| 08-00520-30156 |            | 2.75                   | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 2.91                                                             | 3.03 | 3.16  | 3.31 | 3.66 |

How to Order

When you order, indicate MRB230 (R)×(ℓ1)×(d).      ※(γ) is reference value.

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

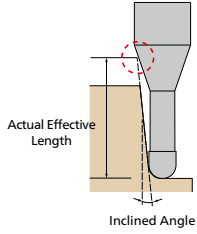
Resin N

~55 HRC  
Hardened Steel  
H

Coating  
Long Neck  
Ball

MRB230

MUGEN COATING 2-Flute Long Neck Ball End Mill

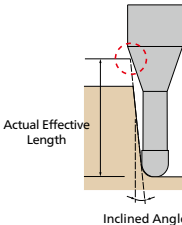
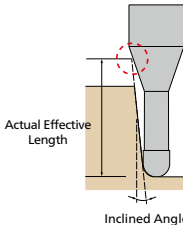


Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ°) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|------------------------|-------------------|----------|----------------|-----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                        |                   |          |                |                       |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| 08-00520-10154 | R0.15      | 3                      | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 3.18                                                             | 3.31  | 3.46  | 3.63  | 4.01  |
| 08-00520-30157 |            | 3.5                    | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 3.69                                                             | 3.85  | 4.02  | 4.21  | 4.65  |
| 08-00520-20151 |            | 4                      | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 4.21                                                             | 4.39  | 4.59  | 4.81  | 5.32  |
| 08-00520-30158 |            | 4.5                    | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 4.73                                                             | 4.94  | 5.16  | 5.41  | 5.98  |
| 08-00520-20152 |            | 5                      | 0.2               | 0.3      | 0.28           | 12°                   | 4              | 45                 | 5.25                                                             | 5.48  | 5.73  | 6.01  | 6.65  |
| 08-00520-40201 | R0.2       | 0.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 0.59                                                             | 0.60  | 0.62  | 0.64  | 0.69  |
| 08-00520-10201 |            | 0.75                   | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 0.85                                                             | 0.88  | 0.92  | 0.95  | 1.04  |
| 08-00520-00201 |            | 1                      | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 1.12                                                             | 1.16  | 1.20  | 1.25  | 1.37  |
| 08-00521-00201 |            | 1                      | 0.3               | 0.4      | 0.37           | 12°                   | 6              | 50                 | 1.12                                                             | 1.16  | 1.20  | 1.25  | 1.37  |
| 08-00520-00204 |            | 1.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 1.64                                                             | 1.70  | 1.77  | 1.85  | 2.03  |
| 08-00521-00202 |            | 1.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 6              | 50                 | 1.64                                                             | 1.70  | 1.77  | 1.85  | 2.03  |
| 08-00520-00202 |            | 2                      | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 2.16                                                             | 2.25  | 2.34  | 2.45  | 2.70  |
| 08-00521-00203 |            | 2                      | 0.3               | 0.4      | 0.37           | 12°                   | 6              | 50                 | 2.16                                                             | 2.25  | 2.34  | 2.45  | 2.70  |
| 08-00520-00205 |            | 2.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 2.68                                                             | 2.79  | 2.91  | 3.05  | 3.36  |
| 08-00521-00204 |            | 2.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 6              | 50                 | 2.68                                                             | 2.79  | 2.91  | 3.05  | 3.36  |
| 08-00520-00203 |            | 3                      | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 3.20                                                             | 3.34  | 3.48  | 3.64  | 4.02  |
| 08-00521-00205 |            | 3                      | 0.3               | 0.4      | 0.37           | 12°                   | 6              | 50                 | 3.20                                                             | 3.34  | 3.48  | 3.64  | 4.02  |
| 08-00520-10202 |            | 3.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 3.72                                                             | 3.88  | 4.05  | 4.24  | 4.69  |
| 08-00520-00206 |            | 4                      | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 4.24                                                             | 4.42  | 4.62  | 4.84  | 5.35  |
| 08-00520-10203 |            | 4.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 4.76                                                             | 4.97  | 5.19  | 5.44  | 6.01  |
| 08-00520-00207 | R0.25      | 5                      | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 5.29                                                             | 5.51  | 5.76  | 6.04  | 6.68  |
| 08-00520-10204 |            | 5.5                    | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 5.81                                                             | 6.06  | 6.33  | 6.64  | 7.34  |
| 08-00520-10205 |            | 6                      | 0.3               | 0.4      | 0.37           | 12°                   | 4              | 45                 | 6.33                                                             | 6.60  | 6.90  | 7.23  | 8.00  |
| 08-00520-30251 |            | 1                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 1.13                                                             | 1.16  | 1.21  | 1.26  | 1.37  |
| 08-00520-10251 |            | 1.5                    | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 1.65                                                             | 1.71  | 1.78  | 1.85  | 2.03  |
| 08-00521-00251 |            | 1.5                    | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 50                 | 1.65                                                             | 1.71  | 1.78  | 1.85  | 2.03  |
| 08-00520-00251 |            | 2                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 2.17                                                             | 2.25  | 2.35  | 2.45  | 2.69  |
| 08-00521-00252 |            | 2                      | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 50                 | 2.17                                                             | 2.25  | 2.35  | 2.45  | 2.69  |
| 08-00520-10252 |            | 2.5                    | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 2.69                                                             | 2.80  | 2.92  | 3.05  | 3.36  |
| 08-00520-10253 |            | 3                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 3.21                                                             | 3.34  | 3.49  | 3.65  | 4.02  |
| 08-00520-10254 | R0.25      | 3.5                    | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 3.73                                                             | 3.89  | 4.06  | 4.25  | 4.69  |
| 08-00520-00252 |            | 4                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 4.25                                                             | 4.43  | 4.63  | 4.85  | 5.35  |
| 08-00521-00253 |            | 4                      | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 50                 | 4.25                                                             | 4.43  | 4.63  | 4.85  | 5.35  |
| 08-00520-10255 |            | 4.5                    | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 4.78                                                             | 4.98  | 5.20  | 5.44  | 6.01  |
| 08-00520-00255 |            | 5                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 5.30                                                             | 5.52  | 5.77  | 6.04  | 6.68  |
| 08-00521-00254 |            | 5                      | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 50                 | 5.30                                                             | 5.52  | 5.77  | 6.04  | 6.68  |
| 08-00520-10256 |            | 5.5                    | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 5.82                                                             | 6.07  | 6.34  | 6.64  | 7.34  |
| 08-00520-00253 |            | 6                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 6.34                                                             | 6.61  | 6.91  | 7.24  | 8.00  |
| 08-00521-00255 |            | 6                      | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 50                 | 6.34                                                             | 6.61  | 6.91  | 7.24  | 8.00  |
| 08-00520-10257 |            | 7                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 7.38                                                             | 7.70  | 8.05  | 8.44  | 9.33  |
| 08-00520-00254 | R0.25      | 8                      | 0.35              | 0.5      | 0.46           | 12°                   | 4              | 45                 | 8.42                                                             | 8.79  | 9.19  | 9.63  | 10.66 |
| 08-00521-00256 |            | 8                      | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 50                 | 8.42                                                             | 8.79  | 9.19  | 9.63  | 10.66 |
| 08-00521-30251 |            | 9                      | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 55                 | 9.47                                                             | 9.88  | 10.33 | 10.83 | 11.99 |
| 08-00521-30252 |            | 10                     | 0.35              | 0.5      | 0.46           | 12°                   | 6              | 55                 | 10.51                                                            | 10.97 | 11.47 | 12.03 | 13.31 |

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|                                                 |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|-------------------------------------------------|--|------------------------------------------------------------------------------------|----------------|----------|----------------|------------------------|------------------------------------------------------------------------|----------|----------------|----------------------|----------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------|-------|-------|-------|-------|-------|--|--|--|-------------------------------------------------|--|--|--|--|--|--|--|--|--|
| Regular Line<br>MUGEN COATING<br>Long Neck Type |  | MRB230                                                                             |                |          |                |                        |                                                                        |          |                |                      |                | MRB230                                                                              |                                                                  |       |       |       |       |       |  |  |  | Regular Line<br>MUGEN COATING<br>Long Neck Type |  |  |  |  |  |  |  |  |  |
| MUGEN COATING 2-Flute Long Neck Ball End Mill   |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  | MUGEN COATING 2-Flute Long Neck Ball End Mill   |  |  |  |  |  |  |  |  |  |
| Carbon Steel P                                  |  |  |                |          |                |                        |                                                                        |          |                |                      |                |  |                                                                  |       |       |       |       |       |  |  |  | Carbon Steel P                                  |  |  |  |  |  |  |  |  |  |
| Alloy Steel P                                   |  | Unit : mm                                                                          |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| Prehardened Steel P                             |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| Stainless Steel M                               |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| Aluminium Alloy N                               |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| Copper N                                        |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| Resin N                                         |  |                                                                                    |                |          |                |                        |                                                                        |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| ~ 55 HRC<br>Hardened Steel H                    |  | Coating<br>Long Neck Ball                                                          |                | Code No. | Radius (R)     | Under Neck Length (ℓ1) | Length of Cut (ℓ)                                                      | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L)                                                                  | Actual effective length depending on inclined angle of workpiece |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                | 30′      | 1°             | 1°30′                  | 2°                                                                     | 3°       |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
| Coating<br>Long Neck Ball                       |  | R0.3                                                                               | 08-00520-40301 | R0.3     | 1              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 1.13                                                                                | 1.17                                                             | 1.21  | 1.25  | 1.36  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10301 |          | 1.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 1.64                                                                                | 1.71                                                             | 1.77  | 1.84  | 2.02  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00301 |          | 2              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 2.17                                                                                | 2.25                                                             | 2.34  | 2.44  | 2.68  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00521-00301 |          | 2              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 6                    | 50             | 2.17                                                                                | 2.25                                                             | 2.34  | 2.44  | 2.68  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10302 |          | 2.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 2.69                                                                                | 2.79                                                             | 2.91  | 3.04  | 3.34  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00305 |          | 3              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 3.21                                                                                | 3.34                                                             | 3.48  | 3.64  | 4.01  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00521-00302 |          | 3              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 6                    | 50             | 3.21                                                                                | 3.34                                                             | 3.48  | 3.64  | 4.01  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10303 |          | 3.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 3.73                                                                                | 3.88                                                             | 4.05  | 4.24  | 4.67  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00302 |          | 4              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 4.25                                                                                | 4.43                                                             | 4.62  | 4.84  | 5.33  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00521-00303 |          | 4              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 6                    | 50             | 4.25                                                                                | 4.43                                                             | 4.62  | 4.84  | 5.33  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10304 |          | 4.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 4.77                                                                                | 4.97                                                             | 5.19  | 5.43  | 6.00  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00306 |          | 5              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 5.23                                                                                | 5.40                                                             | 5.59  | 5.79  | 6.23  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10305 |          | 5.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 5.82                                                                                | 6.06                                                             | 6.33  | 6.63  | 7.32  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00303 |          | 6              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 6.34                                                                                | 6.61                                                             | 6.90  | 7.23  | 7.99  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00521-00304 |          | 6              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 6                    | 50             | 6.34                                                                                | 6.61                                                             | 6.90  | 7.23  | 7.99  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10306 |          | 6.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 6.86                                                                                | 7.15                                                             | 7.47  | 7.83  | 8.65  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00307 |          | 7              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 7.38                                                                                | 7.70                                                             | 8.04  | 8.43  | 9.31  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10307 |          | 7.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 7.90                                                                                | 8.24                                                             | 8.61  | 9.02  | 9.98  |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-00304 |          | 8              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 8.42                                                                                | 8.79                                                             | 9.18  | 9.62  | 10.64 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00521-00305 |          | 8              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 6                    | 50             | 8.42                                                                                | 8.79                                                             | 9.18  | 9.62  | 10.64 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10308 |          | 8.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 8.94                                                                                | 9.33                                                             | 9.76  | 10.22 | 11.31 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10309 |          | 9              | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 9.47                                                                                | 9.88                                                             | 10.33 | 10.82 | 11.97 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10310 |          | 9.5            | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 9.99                                                                                | 10.42                                                            | 10.90 | 11.42 | 12.63 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10311 |          | 10             | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 10.51                                                                               | 10.97                                                            | 11.47 | 12.02 | 13.30 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00521-00306 |          | 10             | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 6                    | 50             | 10.40                                                                               | 10.75                                                            | 11.13 | 11.54 | 12.45 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10312 |          | 11             | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 11.55                                                                               | 12.06                                                            | 12.61 | 13.21 | 14.62 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    | 08-00520-10313 |          | 12             | 0.45                   | 0.6                                                                    | 0.56     | 12°            | 4                    | 45             | 12.59                                                                               | 13.14                                                            | 13.75 | 14.41 | 15.95 |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  | Coating<br>Long Neck Ball                                                          |                | R0.35    | 08-00520-40351 | R0.35                  | 2                                                                      | 0.5      | 0.7            | 0.66                 | 12°            | 4                                                                                   | 45                                                               | 2.17  | 2.25  | 2.34  | 2.44  | 2.67  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-40352 |                        | 4                                                                      | 0.5      | 0.7            | 0.66                 | 12°            | 4                                                                                   | 45                                                               | 4.25  | 4.43  | 4.62  | 4.84  | 5.33  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-40353 |                        | 6                                                                      | 0.5      | 0.7            | 0.66                 | 12°            | 4                                                                                   | 45                                                               | 6.34  | 6.61  | 6.91  | 7.23  | 8.00  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-40354 |                        | 8                                                                      | 0.5      | 0.7            | 0.66                 | 12°            | 4                                                                                   | 45                                                               | 8.43  | 8.79  | 9.19  | 9.63  | 10.66 |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                | R0.4     | 08-00520-00400 | R0.4                   | 2                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 2.16  | 2.24  | 2.33  | 2.42  | 2.65  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00521-00401 |                        | 2                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 6                                                                                   | 50                                                               | 2.16  | 2.24  | 2.33  | 2.42  | 2.65  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-10401 |                        | 3                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 3.20  | 3.33  | 3.47  | 3.62  | 3.97  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00521-00402 |                        | 3                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 6                                                                                   | 50                                                               | 3.20  | 3.33  | 3.47  | 3.62  | 3.97  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-00401 |                        | 4                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 4.25  | 4.42  | 4.61  | 4.82  | 5.30  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00521-00403 |                        | 4                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 6                                                                                   | 50                                                               | 4.25  | 4.42  | 4.61  | 4.82  | 5.30  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-00405 |                        | 5                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 5.29  | 5.51  | 5.75  | 6.01  | 6.63  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-00402 |                        | 6                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 6.33  | 6.60  | 6.89  | 7.21  | 7.96  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00521-00404 |                        | 6                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 6                                                                                   | 50                                                               | 6.33  | 6.60  | 6.89  | 7.21  | 7.96  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-00406 |                        | 7                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 7.29  | 7.53  | 7.79  | 8.07  | 8.70  |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-00403 |                        | 8                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 8.42  | 8.78  | 9.17  | 9.60  | 10.61 |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00521-00405 |                        | 8                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 6                                                                                   | 50                                                               | 8.42  | 8.78  | 9.17  | 9.60  | 10.61 |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | 08-00520-30401 |                        | 9                                                                      | 0.6      | 0.8            | 0.76                 | 12°            | 4                                                                                   | 45                                                               | 9.46  | 9.87  | 10.31 | 10.80 | 11.94 |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |
|                                                 |  |                                                                                    |                |          | How to Order   |                        | When you order, indicate MRB230 (R)×(ℓ1)×(d). ※(γ) is reference value. |          |                |                      |                |                                                                                     |                                                                  |       |       |       |       |       |  |  |  |                                                 |  |  |  |  |  |  |  |  |  |



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

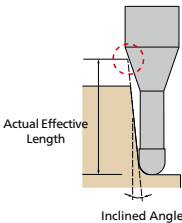
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Ball  
End

MRB230

MUGEN COATING 2-Flute Long Neck Ball End Mill



Unit : mm

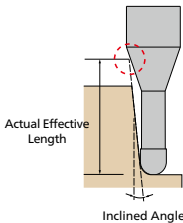
| Code No.       | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°    | 1°30' | 2°    | 3°    |
| 08-00520-10602 | R0.6       | 16                     | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 50                 | 16.78                                                            | 17.50 | 18.29 | 19.17 | 21.20 |
| 08-00521-00605 |            | 16                     | 0.9               | 1.2      | 1.15           | 12°                  | 6              | 60                 | 16.78                                                            | 17.50 | 18.29 | 19.17 | 21.20 |
| 08-00520-20602 |            | 18                     | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 55                 | 18.86                                                            | 19.68 | 20.58 | 21.56 | 23.85 |
| 08-00520-30601 |            | 20                     | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 55                 | 20.95                                                            | 21.86 | 22.86 | 23.95 | 26.50 |
| 08-00520-20603 | R0.7       | 24                     | 0.9               | 1.2      | 1.15           | 12°                  | 4              | 60                 | 25.12                                                            | 26.22 | 27.42 | 28.74 | Free  |
| 08-00520-30701 |            | 8                      | 1                 | 1.4      | 1.35           | 12°                  | 4              | 45                 | 8.43                                                             | 8.78  | 9.16  | 9.57  | 10.55 |
| 08-00520-30702 |            | 12                     | 1                 | 1.4      | 1.35           | 12°                  | 4              | 50                 | 12.60                                                            | 13.13 | 13.72 | 14.36 | 15.85 |
| 08-00520-30703 |            | 16                     | 1                 | 1.4      | 1.35           | 12°                  | 4              | 50                 | 16.77                                                            | 17.49 | 18.28 | 19.15 | 21.16 |
| 08-00520-30751 | R0.75      | 3                      | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 3.21                                                             | 3.33  | 3.45  | 3.58  | 3.89  |
| 08-00520-30751 |            | 4                      | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 4.26                                                             | 4.41  | 4.59  | 4.78  | 5.22  |
| 08-00520-30752 |            | 6                      | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 6.34                                                             | 6.59  | 6.87  | 7.17  | 7.88  |
| 08-00520-00751 |            | 8                      | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 8.43                                                             | 8.77  | 9.15  | 9.56  | 10.53 |
| 08-00521-00751 |            | 8                      | 1.1               | 1.5      | 1.45           | 12°                  | 6              | 50                 | 8.43                                                             | 8.77  | 9.15  | 9.56  | 10.53 |
| 08-00520-00752 |            | 10                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 10.51                                                            | 10.95 | 11.43 | 11.96 | 13.18 |
| 08-00520-00753 |            | 12                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 45                 | 12.60                                                            | 13.13 | 13.71 | 14.35 | 15.84 |
| 08-00521-00752 |            | 12                     | 1.1               | 1.5      | 1.45           | 12°                  | 6              | 50                 | 12.60                                                            | 13.13 | 13.71 | 14.35 | 15.84 |
| 08-00520-00754 |            | 14                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 50                 | 14.69                                                            | 15.31 | 15.99 | 16.74 | 18.49 |
| 08-00520-00755 |            | 16                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 50                 | 16.77                                                            | 17.49 | 18.27 | 19.14 | 21.15 |
| 08-00521-00755 |            | 16                     | 1.1               | 1.5      | 1.45           | 12°                  | 6              | 60                 | 16.77                                                            | 17.49 | 18.27 | 19.14 | 21.15 |
| 08-00520-00756 |            | 18                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 55                 | 18.86                                                            | 19.67 | 20.55 | 21.53 | 23.80 |
| 08-00520-00757 |            | 20                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 55                 | 20.94                                                            | 21.85 | 22.84 | 23.92 | Free  |
| 08-00521-00757 |            | 20                     | 1.1               | 1.5      | 1.45           | 12°                  | 6              | 60                 | 20.94                                                            | 21.85 | 22.84 | 23.92 | 26.46 |
| 08-00520-10751 |            | 22                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 55                 | 23.03                                                            | 24.02 | 25.12 | 26.32 | Free  |
| 08-00520-20753 |            | 30                     | 1.1               | 1.5      | 1.45           | 12°                  | 4              | 70                 | 31.37                                                            | 32.74 | 34.24 | 35.89 | Free  |
| 08-00520-20801 | R0.8       | 4                      | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 45                 | 4.25                                                             | 4.41  | 4.58  | 4.77  | 5.21  |
| 08-00520-00801 |            | 8                      | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 45                 | 8.43                                                             | 8.77  | 9.14  | 9.55  | 10.51 |
| 08-00520-00803 |            | 12                     | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 45                 | 12.60                                                            | 13.13 | 13.70 | 14.34 | 15.82 |
| 08-00520-00805 |            | 16                     | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 50                 | 16.77                                                            | 17.48 | 18.27 | 19.13 | 21.13 |
| 08-00520-00807 | R0.9       | 20                     | 1.2               | 1.6      | 1.55           | 12°                  | 4              | 55                 | 20.94                                                            | 21.84 | 22.83 | 23.91 | Free  |
| 08-00520-30901 |            | 8                      | 1.3               | 1.8      | 1.75           | 12°                  | 4              | 45                 | 8.42                                                             | 8.76  | 9.13  | 9.53  | 10.48 |
| 08-00520-30902 |            | 12                     | 1.3               | 1.8      | 1.75           | 12°                  | 4              | 45                 | 12.59                                                            | 13.12 | 13.69 | 14.32 | 15.79 |
| 08-00520-30903 |            | 16                     | 1.3               | 1.8      | 1.75           | 12°                  | 4              | 50                 | 16.76                                                            | 17.47 | 18.25 | 19.11 | 21.10 |
| 08-00520-30904 | R1         | 20                     | 1.3               | 1.8      | 1.75           | 12°                  | 4              | 55                 | 20.94                                                            | 21.83 | 22.81 | 23.89 | Free  |
| 08-00520-31001 |            | 3                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 3.23                                                             | 3.33  | 3.44  | 3.56  | 3.85  |
| 08-00520-01000 |            | 4                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 4.27                                                             | 4.42  | 4.58  | 4.76  | 5.17  |
| 08-00521-01000 |            | 4                      | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 4.27                                                             | 4.42  | 4.58  | 4.76  | 5.17  |
| 08-00520-01001 |            | 6                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 6.36                                                             | 6.60  | 6.86  | 7.15  | 7.83  |
| 08-00521-01001 |            | 6                      | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 6.36                                                             | 6.60  | 6.86  | 7.15  | 7.83  |
| 08-00520-01002 |            | 8                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 8.44                                                             | 8.78  | 9.14  | 9.54  | 10.48 |
| 08-00521-01002 |            | 8                      | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 8.44                                                             | 8.78  | 9.14  | 9.54  | 10.48 |
| 08-00520-01003 |            | 10                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 10.53                                                            | 10.95 | 11.42 | 11.94 | 13.14 |
| 08-00521-01003 |            | 10                     | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 10.53                                                            | 10.95 | 11.42 | 11.94 | 13.14 |
| 08-00520-01004 |            | 12                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 | 12.61                                                            | 13.13 | 13.70 | 14.33 | 15.79 |
| 08-00521-01004 |            | 12                     | 1.5               | 2        | 1.94           | 12°                  | 6              | 50                 | 12.61                                                            | 13.13 | 13.70 | 14.33 | 15.79 |

How to Order

When you order, indicate MRB230 (R)×(ℓ1)×(d). ※(γ) is reference value.

MRB230

MUGEN COATING 2-Flute Long Neck Ball End Mill



Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                                     |                   |          |                             |                      |                |                    | 30°                                                              | 1°    | 1°30' | 2°    | 3°    |
| 08-00520-41001 | R1         | 13                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 45                 | 13.66                                                            | 14.23 | 14.86 | 15.55 | 17.16 |
| 08-00520-01005 |            | 14                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 14.70                                                            | 15.31 | 15.98 | 16.72 | 18.45 |
| 08-00520-01006 |            | 16                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 16.78                                                            | 17.49 | 18.27 | 19.12 | Free  |
| 08-00521-01005 |            | 16                                  | 1.5               | 2        | 1.94                        | 12°                  | 6              | 60                 | 16.78                                                            | 17.49 | 18.27 | 19.12 | 21.10 |
| 08-00520-01007 |            | 18                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 55                 | 18.87                                                            | 19.67 | 20.55 | 21.51 | Free  |
| 08-00520-01008 |            | 20                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 55                 | 20.96                                                            | 21.85 | 22.83 | 23.90 | Free  |
| 08-00521-01008 |            | 20                                  | 1.5               | 2        | 1.94                        | 12°                  | 6              | 60                 | 20.96                                                            | 21.85 | 22.83 | 23.90 | 26.41 |
| 08-00520-01009 |            | 22                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 60                 | 23.04                                                            | 24.03 | 25.11 | 26.30 | Free  |
| 08-00520-01010 |            | 25                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 65                 | 26.17                                                            | 27.30 | 28.53 | 29.89 | Free  |
| 08-00521-01010 |            | 25                                  | 1.5               | 2        | 1.94                        | 12°                  | 6              | 80                 | 26.17                                                            | 27.30 | 28.53 | 29.89 | 33.04 |
| 08-00520-01011 |            | 30                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 70                 | 31.38                                                            | 32.74 | 34.23 | Free  | Free  |
| 08-00521-01012 |            | 30                                  | 1.5               | 2        | 1.94                        | 12°                  | 6              | 80                 | 31.38                                                            | 32.74 | 34.23 | 35.87 | Free  |
| 08-00520-11001 |            | 35                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 70                 | 36.60                                                            | 38.19 | 39.93 | Free  | Free  |
| 08-00521-01014 |            | 35                                  | 1.5               | 2        | 1.94                        | 12°                  | 6              | 80                 | 36.60                                                            | 38.19 | 39.93 | 41.85 | Free  |
| 08-00520-31002 |            | 40                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 90                 | 41.81                                                            | 43.64 | Free  | Free  | Free  |
| 08-00521-01015 |            | 40                                  | 1.5               | 2        | 1.94                        | 12°                  | 6              | 90                 | 41.81                                                            | 43.64 | 45.64 | 47.83 | Free  |
| 08-00520-21251 | R1.25      | 6                                   | 2.3               | 2.5      | 2.4                         | 12°                  | 4              | 45                 | 6.44                                                             | 6.68  | 6.93  | 7.21  | 7.87  |
| 08-00520-11251 |            | 10                                  | 2.3               | 2.5      | 2.4                         | 12°                  | 4              | 45                 | 10.62                                                            | 11.04 | 11.49 | 12.00 | 13.18 |
| 08-00520-11252 |            | 15                                  | 2.3               | 2.5      | 2.4                         | 12°                  | 4              | 50                 | 15.83                                                            | 16.48 | 17.20 | 17.98 | Free  |
| 08-00520-11253 |            | 20                                  | 2.3               | 2.5      | 2.4                         | 12°                  | 4              | 55                 | 21.04                                                            | 21.93 | 22.90 | Free  | Free  |
| 08-00520-11254 |            | 25                                  | 2.3               | 2.5      | 2.4                         | 12°                  | 4              | 65                 | 26.26                                                            | 27.38 | 28.60 | Free  | Free  |
| 08-00520-11255 |            | 30                                  | 2.3               | 2.5      | 2.4                         | 12°                  | 4              | 70                 | 31.47                                                            | 32.82 | Free  | Free  | Free  |
| 08-00520-21252 | 35         | 2.3                                 | 2.5               | 2.4      | 12°                         | 4                    | 70             | 36.69              | 38.27                                                            | Free  | Free  | Free  |       |
| 08-00520-31502 | R1.5       | 6                                   | 2.5               | 3        | 2.85                        | 12°                  | 4              | 60                 | 6.56                                                             | 6.78  | 7.03  | 7.31  | 7.95  |
| 08-00520-31503 |            | 6                                   | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 6.56                                                             | 6.78  | 7.03  | 7.31  | 7.95  |
| 08-00520-01500 |            | 8                                   | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 8.64                                                             | 8.96  | 9.31  | 9.70  | 10.60 |
| 08-00520-01501 |            | 10                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 10.73                                                            | 11.14 | 11.59 | 12.09 | 13.26 |
| 08-00520-31504 |            | 12                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 12.81                                                            | 13.32 | 13.88 | 14.49 | 15.91 |
| 08-00520-31505 |            | 14                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 14.90                                                            | 15.50 | 16.16 | 16.88 | 18.57 |
| 08-00520-01503 |            | 15                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 15.94                                                            | 16.59 | 17.30 | 18.08 | 19.89 |
| 08-00520-31506 |            | 16                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 16.98                                                            | 17.68 | 18.44 | 19.27 | 21.22 |
| 08-00520-01505 |            | 20                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 65                 | 21.16                                                            | 22.04 | 23.00 | 24.06 | 26.53 |
| 08-00520-01506 |            | 25                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 65                 | 26.37                                                            | 27.48 | 28.70 | 30.04 | Free  |
| 08-00520-01507 |            | 30                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 70                 | 31.58                                                            | 32.93 | 34.40 | 36.03 | Free  |
| 08-00520-01508 |            | 35                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 80                 | 36.80                                                            | 38.38 | 40.11 | 42.01 | Free  |
| 08-00520-11501 | 40         | 2.5                                 | 3                 | 2.85     | 12°                         | 6                    | 90             | 42.01              | 43.83                                                            | 45.81 | Free  | Free  |       |
| 08-00520-11751 | R1.75      | 10                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 60                 | 10.72                                                            | 11.12 | 11.56 | 12.05 | 13.18 |
| 08-00520-11752 |            | 15                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 60                 | 15.93                                                            | 16.57 | 17.26 | 18.03 | 19.81 |
| 08-00520-11753 |            | 20                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 65                 | 21.14                                                            | 22.01 | 22.96 | 24.01 | Free  |
| 08-00520-11754 |            | 25                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 65                 | 26.36                                                            | 27.46 | 28.67 | 29.99 | Free  |
| 08-00520-11755 |            | 30                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 70                 | 31.57                                                            | 32.91 | 34.37 | 35.98 | Free  |
| 08-00520-11756 |            | 35                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 80                 | 36.79                                                            | 38.36 | 40.07 | Free  | Free  |
| 08-00520-11757 |            | 40                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 90                 | 42.00                                                            | 43.80 | 45.77 | Free  | Free  |
| 08-00520-11758 |            | 45                                  | 2.8               | 3.5      | 3.35                        | 12°                  | 6              | 90                 | 47.22                                                            | 49.25 | Free  | Free  | Free  |



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

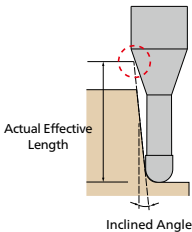
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Ball  
End Mill

MRB230

MUGEN COATING 2-Flute Long Neck Ball End Mill



Unit : mm

| Code No.       | Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length of<br>Cut<br>(ℓ) | Dia.<br>(D) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|---------------|------------------------------|-------------------------|-------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |               |                              |                         |             |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
| 08-00520-02000 | R2            | 10                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 65                       | 10.83                                                               | 11.22 | 11.66 | 12.14 | 13.25 |
| 08-00520-32001 |               | 12                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 65                       | 12.91                                                               | 13.40 | 13.94 | 14.53 | 15.91 |
| 08-00520-32002 |               | 14                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 65                       | 15.00                                                               | 15.58 | 16.22 | 16.92 | 18.56 |
| 08-00520-02001 |               | 15                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 65                       | 16.04                                                               | 16.67 | 17.36 | 18.12 | 19.89 |
| 08-00520-32003 |               | 16                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 65                       | 17.09                                                               | 17.76 | 18.50 | 19.32 | 21.22 |
| 08-00520-02003 |               | 20                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 65                       | 21.26                                                               | 22.12 | 23.06 | 24.10 | Free  |
| 08-00520-02004 |               | 25                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 70                       | 26.47                                                               | 27.57 | 28.77 | 30.09 | Free  |
| 08-00520-02005 |               | 30                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 70                       | 31.68                                                               | 33.01 | 34.47 | Free  | Free  |
| 08-00520-02006 |               | 35                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 80                       | 36.90                                                               | 38.46 | 40.17 | Free  | Free  |
| 08-00520-02007 |               | 40                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 85                       | 42.11                                                               | 43.91 | Free  | Free  | Free  |
| 08-00520-02008 | R2.5          | 45                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 90                       | 47.33                                                               | 49.36 | Free  | Free  | Free  |
| 08-00520-02009 |               | 50                           | 3                       | 4           | 3.8                  | 12°                        | 6                    | 100                      | 52.54                                                               | 54.80 | Free  | Free  | Free  |
| 08-00520-32501 |               | 10                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 70                       | 10.81                                                               | 11.18 | 11.59 | 12.04 | Free  |
| 08-00520-12501 |               | 15                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 70                       | 16.02                                                               | 16.63 | 17.29 | Free  | Free  |
| 08-00520-02501 |               | 20                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 70                       | 21.24                                                               | 22.08 | Free  | Free  | Free  |
| 08-00520-02502 |               | 25                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 70                       | 26.45                                                               | 27.52 | Free  | Free  | Free  |
| 08-00520-02503 |               | 30                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 80                       | 31.66                                                               | Free  | Free  | Free  | Free  |
| 08-00520-02504 |               | 35                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 80                       | 36.88                                                               | Free  | Free  | Free  | Free  |
| 08-00520-12502 |               | 40                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 90                       | 42.09                                                               | Free  | Free  | Free  | Free  |
| 08-00520-12503 |               | 45                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 100                      | 47.31                                                               | Free  | Free  | Free  | Free  |
| 08-00520-12504 | R3            | 50                           | 3.5                     | 5           | 4.8                  | 12°                        | 6                    | 100                      | 52.52                                                               | Free  | Free  | Free  | Free  |
| 08-00520-33001 |               | 10                           | 6                       | 6           | 5.8                  | —                          | 6                    | 70                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-43001 |               | 15                           | 6                       | 6           | 5.8                  | —                          | 6                    | 70                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-13001 |               | 20                           | 6                       | 6           | 5.8                  | —                          | 6                    | 70                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-13002 |               | 25                           | 6                       | 6           | 5.8                  | —                          | 6                    | 70                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-03001 |               | 30                           | 6                       | 6           | 5.8                  | —                          | 6                    | 80                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-13003 |               | 35                           | 6                       | 6           | 5.8                  | —                          | 6                    | 80                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-13004 |               | 40                           | 6                       | 6           | 5.8                  | —                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-13005 |               | 45                           | 6                       | 6           | 5.8                  | —                          | 6                    | 100                      | Free                                                                | Free  | Free  | Free  | Free  |
| 08-00520-03003 |               | 50                           | 6                       | 6           | 5.8                  | —                          | 6                    | 120                      | Free                                                                | Free  | Free  | Free  | Free  |

How to Order

When you order, indicate MRB230 (R)×(ℓ1)×(d). ※(γ) is reference value.

MRB230

Recommended Milling Conditions

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Ball  
End Mill

| Work Material |                   |       | Carbon Steels・Prehardened Steels<br>S50C・NAK・HPM1<br>(~45HRC) |       |               |                   | Hardened Steels<br>SKD・STAVAX・HPM38<br>(~55HRC) |       |               |                   | Copper       |       |               |                   |
|---------------|-------------------|-------|---------------------------------------------------------------|-------|---------------|-------------------|-------------------------------------------------|-------|---------------|-------------------|--------------|-------|---------------|-------------------|
| Radius        | Under Neck Length | L/D   | Depth of Cut                                                  |       | Feed          | Spindle Speed     | Depth of Cut                                    |       | Feed          | Spindle Speed     | Depth of Cut |       | Feed          | Spindle Speed     |
|               |                   |       | ap mm                                                         | ae mm | mm/min        | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min        | min <sup>-1</sup> | ap mm        | ae mm | mm/min        | min <sup>-1</sup> |
| 0.05          | 0.3               | 3     | 0.005                                                         | 0.005 | 80            | 20,000~50,000     | 0.003                                           | 0.003 | 60            | 20,000~50,000     | 0.005        | 0.005 | 80            | 20,000~50,000     |
|               | 0.5               | 5     | 0.003                                                         | 0.003 | 70            | 20,000~50,000     | 0.003                                           | 0.003 | 40            | 20,000~50,000     | 0.005        | 0.005 | 70            | 20,000~50,000     |
| 0.075         | 0.3               | 2     | 0.005                                                         | 0.015 | 150           | 20,000~50,000     | 0.003                                           | 0.005 | 120           | 20,000~50,000     | 0.008        | 0.01  | 150           | 20,000~50,000     |
|               | 0.5               | 3.33  | 0.004                                                         | 0.007 | 150           | 20,000~50,000     | 0.003                                           | 0.005 | 120           | 20,000~50,000     | 0.007        | 0.008 | 150           | 20,000~50,000     |
| 0.1           | 1                 | 6.67  | 0.003                                                         | 0.005 | 100           | 20,000~50,000     | 0.002                                           | 0.003 | 70            | 20,000~50,000     | 0.005        | 0.007 | 100           | 20,000~50,000     |
|               | 0.5               | 2.5   | 0.01                                                          | 0.02  | 250           | 20,000~50,000     | 0.01                                            | 0.01  | 210           | 20,000~50,000     | 0.01         | 0.02  | 250           | 20,000~50,000     |
|               | 0.75              | 3.75  | 0.007                                                         | 0.01  | 250           | 20,000~50,000     | 0.005                                           | 0.01  | 210           | 20,000~50,000     | 0.01         | 0.015 | 250           | 20,000~50,000     |
|               | 1                 | 5     | 0.005                                                         | 0.01  | 250           | 20,000~50,000     | 0.003                                           | 0.005 | 210           | 20,000~50,000     | 0.008        | 0.015 | 250           | 20,000~50,000     |
|               | 1.25              | 6.25  | 0.003                                                         | 0.01  | 150           | 20,000~50,000     | 0.003                                           | 0.005 | 120           | 20,000~50,000     | 0.005        | 0.015 | 150           | 20,000~50,000     |
|               | 1.5               | 7.5   | 0.003                                                         | 0.01  | 150           | 20,000~50,000     | 0.003                                           | 0.005 | 120           | 20,000~50,000     | 0.005        | 0.015 | 150           | 20,000~50,000     |
|               | 1.75              | 8.75  | 0.003                                                         | 0.007 | 150           | 20,000~50,000     | 0.002                                           | 0.005 | 120           | 20,000~50,000     | 0.005        | 0.01  | 150           | 20,000~50,000     |
|               | 2                 | 10    | 0.003                                                         | 0.005 | 100           | 20,000~50,000     | 0.002                                           | 0.003 | 80            | 20,000~50,000     | 0.005        | 0.007 | 100           | 20,000~50,000     |
|               | 2.5               | 12.5  | 0.003                                                         | 0.005 | 100           | 20,000~50,000     | 0.002                                           | 0.003 | 80            | 20,000~50,000     | 0.005        | 0.007 | 100           | 20,000~50,000     |
|               | 3                 | 15    | 0.002                                                         | 0.003 | 80            | 20,000~50,000     | 0.002                                           | 0.002 | 60            | 20,000~50,000     | 0.003        | 0.004 | 80            | 20,000~50,000     |
| 0.15          | 0.5               | 1.7   | 0.01                                                          | 0.02  | 250           | 20,000~50,000     | 0.01                                            | 0.015 | 210           | 20,000~50,000     | 0.012        | 0.025 | 250           | 20,000~50,000     |
|               | 0.6               | 2     | 0.01                                                          | 0.02  | 250           | 20,000~50,000     | 0.01                                            | 0.015 | 210           | 20,000~50,000     | 0.012        | 0.025 | 250           | 20,000~50,000     |
|               | 0.75              | 2.5   | 0.008                                                         | 0.015 | 250           | 20,000~50,000     | 0.007                                           | 0.01  | 210           | 20,000~50,000     | 0.01         | 0.02  | 250           | 20,000~50,000     |
|               | 1                 | 3.3   | 0.007                                                         | 0.01  | 250           | 20,000~50,000     | 0.005                                           | 0.01  | 210           | 20,000~50,000     | 0.01         | 0.02  | 250           | 20,000~50,000     |
|               | 1.25              | 4.2   | 0.005                                                         | 0.01  | 250           | 20,000~50,000     | 0.005                                           | 0.005 | 210           | 20,000~50,000     | 0.008        | 0.015 | 250           | 20,000~50,000     |
|               | 1.5               | 5     | 0.005                                                         | 0.01  | 200           | 20,000~50,000     | 0.005                                           | 0.005 | 170           | 20,000~50,000     | 0.008        | 0.015 | 200           | 20,000~50,000     |
|               | 1.75              | 5.8   | 0.005                                                         | 0.01  | 200           | 20,000~50,000     | 0.005                                           | 0.005 | 170           | 20,000~50,000     | 0.008        | 0.015 | 200           | 20,000~50,000     |
|               | 2                 | 6.7   | 0.003                                                         | 0.01  | 150           | 20,000~50,000     | 0.003                                           | 0.005 | 120           | 20,000~50,000     | 0.005        | 0.012 | 150           | 20,000~50,000     |
|               | 2.25              | 7.5   | 0.003                                                         | 0.01  | 150           | 20,000~50,000     | 0.003                                           | 0.005 | 120           | 20,000~50,000     | 0.005        | 0.012 | 150           | 20,000~50,000     |
|               | 2.5               | 8.3   | 0.003                                                         | 0.007 | 150           | 20,000~50,000     | 0.003                                           | 0.003 | 120           | 20,000~50,000     | 0.005        | 0.01  | 150           | 20,000~50,000     |
|               | 2.75              | 9.2   | 0.003                                                         | 0.007 | 150           | 20,000~50,000     | 0.003                                           | 0.003 | 120           | 20,000~50,000     | 0.005        | 0.01  | 150           | 20,000~50,000     |
|               | 3                 | 10    | 0.003                                                         | 0.005 | 150           | 20,000~50,000     | 0.003                                           | 0.003 | 120           | 20,000~50,000     | 0.005        | 0.007 | 150           | 20,000~50,000     |
|               | 3.5               | 11.7  | 0.003                                                         | 0.005 | 100           | 20,000~50,000     | 0.003                                           | 0.003 | 80            | 20,000~50,000     | 0.005        | 0.007 | 100           | 20,000~50,000     |
|               | 4                 | 13.3  | 0.003                                                         | 0.005 | 100           | 20,000~50,000     | 0.003                                           | 0.003 | 80            | 20,000~50,000     | 0.005        | 0.007 | 100           | 20,000~50,000     |
|               | 4.5               | 15    | 0.003                                                         | 0.003 | 80            | 20,000~50,000     | 0.003                                           | 0.003 | 80            | 20,000~50,000     | 0.005        | 0.005 | 80            | 20,000~50,000     |
| 5             | 16.7              | 0.003 | 0.003                                                         | 80    | 20,000~50,000 | 0.003             | 0.003                                           | 80    | 20,000~50,000 | 0.005             | 0.005        | 80    | 20,000~50,000 |                   |
| 0.2           | 0.5               | 1.25  | 0.02                                                          | 0.05  | 800           | 20,000~50,000     | 0.02                                            | 0.03  | 650           | 20,000~50,000     | 0.03         | 0.07  | 800           | 20,000~50,000     |
|               | 0.75              | 1.9   | 0.02                                                          | 0.05  | 800           | 20,000~50,000     | 0.02                                            | 0.03  | 650           | 20,000~50,000     | 0.03         | 0.07  | 800           | 20,000~50,000     |
|               | 1                 | 2.5   | 0.02                                                          | 0.05  | 800           | 20,000~50,000     | 0.02                                            | 0.03  | 650           | 20,000~50,000     | 0.03         | 0.07  | 800           | 20,000~50,000     |
|               | 1.5               | 3.8   | 0.02                                                          | 0.03  | 700           | 20,000~50,000     | 0.01                                            | 0.02  | 600           | 20,000~50,000     | 0.03         | 0.05  | 700           | 20,000~50,000     |
|               | 2                 | 5     | 0.015                                                         | 0.02  | 600           | 20,000~50,000     | 0.01                                            | 0.015 | 500           | 20,000~50,000     | 0.02         | 0.03  | 600           | 20,000~50,000     |
|               | 2.5               | 6.3   | 0.015                                                         | 0.02  | 450           | 20,000~50,000     | 0.01                                            | 0.015 | 380           | 20,000~50,000     | 0.02         | 0.03  | 450           | 20,000~50,000     |
|               | 3                 | 7.5   | 0.01                                                          | 0.02  | 400           | 20,000~30,000     | 0.01                                            | 0.01  | 340           | 20,000~30,000     | 0.015        | 0.03  | 400           | 20,000~30,000     |
|               | 3.5               | 8.8   | 0.01                                                          | 0.015 | 350           | 20,000~30,000     | 0.01                                            | 0.01  | 300           | 20,000~30,000     | 0.015        | 0.02  | 350           | 20,000~30,000     |
|               | 4                 | 10    | 0.005                                                         | 0.01  | 250           | 20,000~30,000     | 0.005                                           | 0.007 | 210           | 20,000~30,000     | 0.008        | 0.015 | 250           | 20,000~30,000     |
|               | 4.5               | 11.3  | 0.005                                                         | 0.007 | 200           | 20,000~30,000     | 0.005                                           | 0.005 | 170           | 20,000~30,000     | 0.008        | 0.01  | 200           | 20,000~30,000     |
|               | 5                 | 12.5  | 0.003                                                         | 0.005 | 150           | 20,000~30,000     | 0.003                                           | 0.005 | 120           | 20,000~30,000     | 0.005        | 0.007 | 150           | 20,000~30,000     |
|               | 5.5               | 13.8  | 0.003                                                         | 0.005 | 100           | 20,000~30,000     | 0.003                                           | 0.005 | 80            | 20,000~30,000     | 0.005        | 0.007 | 100           | 20,000~30,000     |
| 6             | 15                | 0.003 | 0.003                                                         | 80    | 20,000~30,000 | 0.003             | 0.003                                           | 60    | 20,000~30,000 | 0.005             | 0.005        | 80    | 20,000~30,000 |                   |
| 0.25          | 1                 | 2     | 0.03                                                          | 0.05  | 800           | 20,000~50,000     | 0.02                                            | 0.05  | 680           | 20,000~50,000     | 0.045        | 0.07  | 800           | 20,000~50,000     |
|               | 1.5               | 3     | 0.03                                                          | 0.05  | 700           | 20,000~50,000     | 0.02                                            | 0.04  | 600           | 20,000~50,000     | 0.04         | 0.07  | 700           | 20,000~50,000     |
|               | 2                 | 4     | 0.02                                                          | 0.04  | 600           | 20,000~50,000     | 0.02                                            | 0.03  | 510           | 20,000~50,000     | 0.03         | 0.06  | 600           | 20,000~50,000     |
|               | 2.5               | 5     | 0.015                                                         | 0.04  | 600           | 20,000~50,000     | 0.01                                            | 0.03  | 510           | 20,000~50,000     | 0.02         | 0.06  | 600           | 20,000~50,000     |
|               | 3                 | 6     | 0.015                                                         | 0.035 | 500           | 20,000~50,000     | 0.01                                            | 0.025 | 420           | 20,000~50,000     | 0.02         | 0.05  | 500           | 20,000~50,000     |
| 3.5           | 7                 | 0.015 | 0.03                                                          | 400   | 20,000~50,000 | 0.01              | 0.02                                            | 340   | 20,000~50,000 | 0.02              | 0.045        | 400   | 20,000~50,000 |                   |

| Work Material |                   |       | Carbon Steels・Prehardened Steels<br>S50C・NAK・HPM1<br>(～45HRC) |       |               |                   | Hardened Steels<br>SKD・STAVAX・HPM38<br>(～55HRC) |       |               |                   | Copper       |       |               |                   |
|---------------|-------------------|-------|---------------------------------------------------------------|-------|---------------|-------------------|-------------------------------------------------|-------|---------------|-------------------|--------------|-------|---------------|-------------------|
| Radius        | Under Neck Length | L/D   | Depth of Cut                                                  |       | Feed          | Spindle Speed     | Depth of Cut                                    |       | Feed          | Spindle Speed     | Depth of Cut |       | Feed          | Spindle Speed     |
|               |                   |       | ap mm                                                         | ae mm | mm/min        | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min        | min <sup>-1</sup> | ap mm        | ae mm | mm/min        | min <sup>-1</sup> |
| 0.5           | 2                 | 2     | 0.25                                                          | 0.35  | 3,200         | 20,000～50,000     | 0.12                                            | 0.3   | 2,500         | 20,000～50,000     | 0.25         | 0.4   | 3,500         | 20,000～50,000     |
|               | 2.5               | 2.5   | 0.25                                                          | 0.3   | 3,000         | 20,000～50,000     | 0.12                                            | 0.3   | 2,500         | 20,000～50,000     | 0.25         | 0.4   | 3,200         | 20,000～50,000     |
|               | 3                 | 3     | 0.2                                                           | 0.3   | 3,000         | 20,000～50,000     | 0.12                                            | 0.3   | 2,500         | 20,000～50,000     | 0.25         | 0.4   | 3,000         | 20,000～50,000     |
|               | 4                 | 4     | 0.15                                                          | 0.25  | 2,500         | 20,000～50,000     | 0.1                                             | 0.2   | 2,100         | 20,000～50,000     | 0.2          | 0.4   | 2,500         | 20,000～50,000     |
|               | 5                 | 5     | 0.1                                                           | 0.25  | 2,000         | 20,000～50,000     | 0.08                                            | 0.17  | 1,700         | 20,000～50,000     | 0.15         | 0.35  | 2,000         | 20,000～50,000     |
|               | 6                 | 6     | 0.1                                                           | 0.2   | 1,500         | 20,000～50,000     | 0.07                                            | 0.12  | 1,200         | 20,000～50,000     | 0.15         | 0.3   | 1,500         | 20,000～50,000     |
|               | 7                 | 7     | 0.08                                                          | 0.2   | 1,300         | 20,000～30,000     | 0.06                                            | 0.1   | 1,100         | 20,000～30,000     | 0.12         | 0.3   | 1,300         | 20,000～30,000     |
|               | 8                 | 8     | 0.05                                                          | 0.1   | 1,200         | 20,000～30,000     | 0.05                                            | 0.08  | 1,000         | 20,000～30,000     | 0.08         | 0.15  | 1,200         | 20,000～30,000     |
|               | 9                 | 9     | 0.04                                                          | 0.06  | 1,000         | 20,000～30,000     | 0.05                                            | 0.05  | 850           | 20,000～30,000     | 0.06         | 0.1   | 1,000         | 20,000～30,000     |
|               | 10                | 10    | 0.03                                                          | 0.05  | 800           | 20,000～30,000     | 0.03                                            | 0.05  | 680           | 20,000～30,000     | 0.05         | 0.08  | 800           | 20,000～30,000     |
|               | 12                | 12    | 0.015                                                         | 0.025 | 600           | 16,000～20,000     | 0.01                                            | 0.03  | 510           | 16,000～20,000     | 0.02         | 0.04  | 600           | 16,000～20,000     |
|               | 13                | 13    | 0.012                                                         | 0.025 | 600           | 16,000～20,000     | 0.007                                           | 0.02  | 450           | 16,000～20,000     | 0.015        | 0.03  | 600           | 16,000～20,000     |
|               | 14                | 14    | 0.01                                                          | 0.02  | 500           | 16,000～20,000     | 0.005                                           | 0.01  | 420           | 16,000～20,000     | 0.015        | 0.03  | 500           | 16,000～20,000     |
|               | 16                | 16    | 0.005                                                         | 0.01  | 250           | 12,000～16,000     | 0.005                                           | 0.01  | 210           | 12,000～16,000     | 0.01         | 0.015 | 250           | 12,000～16,000     |
|               | 18                | 18    | 0.005                                                         | 0.005 | 150           | 12,000～16,000     | 0.003                                           | 0.003 | 120           | 12,000～16,000     | 0.008        | 0.01  | 150           | 12,000～16,000     |
|               | 20                | 20    | 0.005                                                         | 0.005 | 100           | 12,000～16,000     | 0.003                                           | 0.003 | 80            | 12,000～16,000     | 0.008        | 0.008 | 100           | 12,000～16,000     |
| 22            | 22                | 0.003 | 0.005                                                         | 80    | 12,000～16,000 | 0.002             | 0.003                                           | 60    | 12,000～16,000 | 0.005             | 0.008        | 80    | 12,000～16,000 |                   |
| 0.6           | 2.4               | 2     | 0.25                                                          | 0.35  | 3,400         | 20,000～30,000     | 0.12                                            | 0.3   | 2,500         | 20,000～30,000     | 0.3          | 0.45  | 3,400         | 20,000～30,000     |
|               | 4                 | 3.3   | 0.2                                                           | 0.3   | 3,000         | 20,000～30,000     | 0.12                                            | 0.3   | 2,500         | 20,000～30,000     | 0.28         | 0.45  | 3,000         | 20,000～30,000     |
|               | 6                 | 5     | 0.1                                                           | 0.25  | 2,000         | 20,000～30,000     | 0.08                                            | 0.17  | 1,700         | 20,000～30,000     | 0.15         | 0.4   | 2,000         | 20,000～30,000     |
|               | 8                 | 6.7   | 0.08                                                          | 0.2   | 1,300         | 20,000～30,000     | 0.06                                            | 0.15  | 1,100         | 20,000～30,000     | 0.12         | 0.3   | 1,300         | 20,000～30,000     |
|               | 10                | 8.3   | 0.05                                                          | 0.1   | 1,200         | 14,000～20,000     | 0.03                                            | 0.08  | 1,000         | 14,000～20,000     | 0.08         | 0.15  | 1,200         | 14,000～20,000     |
|               | 12                | 10    | 0.03                                                          | 0.05  | 800           | 14,000～20,000     | 0.02                                            | 0.04  | 680           | 14,000～20,000     | 0.05         | 0.08  | 800           | 14,000～20,000     |
|               | 14                | 11.7  | 0.015                                                         | 0.025 | 600           | 14,000～20,000     | 0.01                                            | 0.02  | 510           | 14,000～20,000     | 0.02         | 0.04  | 600           | 14,000～20,000     |
|               | 16                | 13.3  | 0.01                                                          | 0.02  | 400           | 14,000～20,000     | 0.01                                            | 0.01  | 340           | 14,000～20,000     | 0.015        | 0.03  | 400           | 14,000～20,000     |
|               | 18                | 15    | 0.005                                                         | 0.01  | 250           | 12,000～18,000     | 0.005                                           | 0.01  | 210           | 12,000～18,000     | 0.012        | 0.015 | 250           | 12,000～18,000     |
|               | 20                | 16.7  | 0.005                                                         | 0.007 | 200           | 12,000～18,000     | 0.005                                           | 0.005 | 170           | 12,000～18,000     | 0.01         | 0.01  | 200           | 12,000～18,000     |
| 24            | 20                | 0.005 | 0.005                                                         | 100   | 12,000～18,000 | 0.003             | 0.003                                           | 80    | 12,000～18,000 | 0.008             | 0.01         | 100   | 12,000～18,000 |                   |
| 0.7           | 8                 | 5.7   | 0.1                                                           | 0.3   | 2,500         | 20,000～30,000     | 0.1                                             | 0.2   | 2,100         | 20,000～30,000     | 0.15         | 0.45  | 2,500         | 20,000～30,000     |
|               | 12                | 8.6   | 0.07                                                          | 0.12  | 1,200         | 14,000～20,000     | 0.05                                            | 0.1   | 1,000         | 14,000～20,000     | 0.1          | 0.18  | 1,200         | 14,000～20,000     |
|               | 16                | 11.4  | 0.03                                                          | 0.05  | 600           | 14,000～20,000     | 0.015                                           | 0.03  | 510           | 14,000～20,000     | 0.05         | 0.08  | 600           | 14,000～20,000     |
| 0.75          | 3                 | 2     | 0.2                                                           | 0.35  | 4,000         | 20,000～30,000     | 0.15                                            | 0.3   | 3,400         | 20,000～30,000     | 0.3          | 0.5   | 4,000         | 20,000～30,000     |
|               | 4                 | 2.7   | 0.2                                                           | 0.3   | 4,000         | 20,000～30,000     | 0.15                                            | 0.25  | 3,400         | 20,000～30,000     | 0.3          | 0.45  | 4,000         | 20,000～30,000     |
|               | 6                 | 4     | 0.15                                                          | 0.3   | 3,000         | 20,000～30,000     | 0.12                                            | 0.2   | 2,500         | 20,000～30,000     | 0.2          | 0.45  | 3,000         | 20,000～30,000     |
|               | 8                 | 5.3   | 0.1                                                           | 0.25  | 2,400         | 20,000～30,000     | 0.08                                            | 0.18  | 2,000         | 20,000～30,000     | 0.15         | 0.4   | 2,400         | 20,000～30,000     |
|               | 10                | 6.7   | 0.08                                                          | 0.2   | 1,800         | 20,000～30,000     | 0.06                                            | 0.12  | 1,500         | 20,000～30,000     | 0.12         | 0.3   | 1,800         | 20,000～30,000     |
|               | 12                | 8     | 0.07                                                          | 0.13  | 1,200         | 18,000～24,000     | 0.05                                            | 0.09  | 1,000         | 18,000～24,000     | 0.1          | 0.2   | 1,200         | 18,000～24,000     |
|               | 14                | 9.3   | 0.06                                                          | 0.1   | 1,200         | 18,000～24,000     | 0.04                                            | 0.07  | 1,000         | 18,000～24,000     | 0.1          | 0.15  | 1,200         | 18,000～24,000     |
|               | 16                | 10.7  | 0.05                                                          | 0.08  | 800           | 12,000～18,000     | 0.035                                           | 0.06  | 680           | 12,000～18,000     | 0.07         | 0.12  | 800           | 12,000～18,000     |
|               | 18                | 12    | 0.03                                                          | 0.05  | 500           | 12,000～18,000     | 0.02                                            | 0.04  | 420           | 12,000～18,000     | 0.05         | 0.08  | 500           | 12,000～18,000     |
|               | 20                | 13.3  | 0.02                                                          | 0.04  | 400           | 12,000～18,000     | 0.015                                           | 0.03  | 340           | 12,000～18,000     | 0.03         | 0.06  | 400           | 12,000～18,000     |
|               | 22                | 14.7  | 0.01                                                          | 0.02  | 250           | 10,000～14,000     | 0.005                                           | 0.005 | 210           | 10,000～14,000     | 0.02         | 0.03  | 250           | 10,000～14,000     |
|               | 30                | 20    | 0.005                                                         | 0.005 | 100           | 10,000～14,000     | 0.003                                           | 0.005 | 80            | 10,000～14,000     | 0.01         | 0.008 | 100           | 10,000～14,000     |
| 0.8           | 4                 | 2.5   | 0.2                                                           | 0.3   | 4,000         | 18,000～24,000     | 0.17                                            | 0.25  | 3,400         | 18,000～24,000     | 0.3          | 0.45  | 4,000         | 18,000～24,000     |
|               | 8                 | 5     | 0.1                                                           | 0.3   | 3,000         | 18,000～24,000     | 0.09                                            | 0.2   | 2,500         | 18,000～24,000     | 0.15         | 0.45  | 3,000         | 18,000～24,000     |
|               | 12                | 7.5   | 0.07                                                          | 0.15  | 1,800         | 18,000～24,000     | 0.06                                            | 0.12  | 1,500         | 18,000～24,000     | 0.1          | 0.25  | 1,800         | 18,000～24,000     |
|               | 16                | 10    | 0.05                                                          | 0.1   | 650           | 12,000～18,000     | 0.035                                           | 0.07  | 550           | 12,000～18,000     | 0.08         | 0.15  | 650           | 12,000～18,000     |
|               | 20                | 12.5  | 0.03                                                          | 0.05  | 450           | 12,000～18,000     | 0.02                                            | 0.04  | 380           | 12,000～18,000     | 0.05         | 0.08  | 450           | 12,000～18,000     |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC

Hardened Steel

H

Coating

Long Neck  
Ball

MRB230

Recommended Milling Conditions

| Work Material |                   |      | Carbon Steels・Prehardened Steels<br>S50C・NAK・HPM1<br>(~45HRC) |       |              |                   | Hardened Steels<br>SKD・STAVAX・HPM38<br>(~55HRC) |       |              |                   | Copper        |       |               |                   |               |
|---------------|-------------------|------|---------------------------------------------------------------|-------|--------------|-------------------|-------------------------------------------------|-------|--------------|-------------------|---------------|-------|---------------|-------------------|---------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                                  |       | Feed         |                   | Spindle Speed                                   |       | Depth of Cut |                   | Feed          |       | Spindle Speed |                   |               |
|               |                   |      | ap mm                                                         | ae mm | mm/min       | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min       | min <sup>-1</sup> | ap mm         | ae mm | mm/min        | min <sup>-1</sup> |               |
| 0.9           | 8                 | 4.4  | 0.15                                                          | 0.3   | 2,500        | 16,000~20,000     | 0.12                                            | 0.2   | 2,100        | 16,000~20,000     | 0.2           | 0.45  | 2,500         | 16,000~20,000     |               |
|               | 12                | 6.7  | 0.1                                                           | 0.2   | 1,800        | 12,000~16,000     | 0.07                                            | 0.15  | 1,500        | 12,000~16,000     | 0.15          | 0.3   | 1,800         | 12,000~16,000     |               |
|               | 16                | 8.9  | 0.08                                                          | 0.13  | 1,600        | 10,000~14,000     | 0.06                                            | 0.1   | 1,400        | 10,000~14,000     | 0.12          | 0.2   | 1,600         | 10,000~14,000     |               |
|               | 20                | 11.1 | 0.05                                                          | 0.1   | 1,000        | 8,000~12,000      | 0.04                                            | 0.08  | 850          | 8,000~12,000      | 0.08          | 0.15  | 1,000         | 8,000~12,000      |               |
| 1             | 3                 | 1.5  | 0.3                                                           | 0.5   | 4,000        | 20,000~30,000     | 0.2                                             | 0.5   | 3,400        | 20,000~30,000     | 0.45          | 0.7   | 4,000         | 20,000~30,000     |               |
|               | 4                 | 2    | 0.3                                                           | 0.5   | 4,000        | 20,000~30,000     | 0.2                                             | 0.45  | 3,400        | 20,000~30,000     | 0.45          | 0.7   | 4,000         | 20,000~30,000     |               |
|               | 6                 | 3    | 0.25                                                          | 0.5   | 3,000        | 20,000~30,000     | 0.2                                             | 0.4   | 2,500        | 20,000~30,000     | 0.38          | 0.7   | 3,000         | 20,000~30,000     |               |
|               | 8                 | 4    | 0.2                                                           | 0.3   | 2,500        | 16,000~20,000     | 0.15                                            | 0.3   | 2,100        | 16,000~20,000     | 0.3           | 0.45  | 2,500         | 16,000~20,000     |               |
|               | 10                | 5    | 0.15                                                          | 0.3   | 2,500        | 16,000~20,000     | 0.1                                             | 0.2   | 2,100        | 16,000~20,000     | 0.23          | 0.45  | 2,500         | 16,000~20,000     |               |
|               | 12                | 6    | 0.13                                                          | 0.2   | 1,800        | 12,000~16,000     | 0.1                                             | 0.15  | 1,500        | 12,000~16,000     | 0.2           | 0.3   | 1,800         | 12,000~16,000     |               |
|               | 13                | 6.5  | 0.12                                                          | 0.2   | 1,800        | 12,000~16,000     | 0.08                                            | 0.13  | 1,500        | 12,000~16,000     | 0.2           | 0.3   | 1,800         | 12,000~16,000     |               |
|               | 14                | 7    | 0.1                                                           | 0.2   | 1,800        | 12,000~16,000     | 0.07                                            | 0.13  | 1,500        | 12,000~16,000     | 0.15          | 0.3   | 1,800         | 12,000~16,000     |               |
|               | 16                | 8    | 0.1                                                           | 0.15  | 1,600        | 10,000~14,000     | 0.06                                            | 0.11  | 1,400        | 10,000~14,000     | 0.15          | 0.25  | 1,600         | 10,000~14,000     |               |
|               | 18                | 9    | 0.07                                                          | 0.12  | 1,600        | 10,000~14,000     | 0.05                                            | 0.1   | 1,400        | 10,000~14,000     | 0.1           | 0.2   | 1,600         | 10,000~14,000     |               |
|               | 20                | 10   | 0.06                                                          | 0.1   | 1,000        | 8,000~12,000      | 0.05                                            | 0.07  | 850          | 8,000~12,000      | 0.1           | 0.15  | 1,000         | 8,000~12,000      |               |
|               | 22                | 11   | 0.05                                                          | 0.1   | 1,000        | 8,000~12,000      | 0.04                                            | 0.06  | 850          | 8,000~12,000      | 0.08          | 0.15  | 1,000         | 8,000~12,000      |               |
|               | 25                | 12.5 | 0.03                                                          | 0.05  | 800          | 8,000~12,000      | 0.03                                            | 0.04  | 680          | 8,000~12,000      | 0.05          | 0.08  | 800           | 8,000~12,000      |               |
|               | 30                | 15   | 0.02                                                          | 0.04  | 420          | 6,000~10,000      | 0.02                                            | 0.04  | 360          | 6,000~10,000      | 0.03          | 0.06  | 420           | 6,000~10,000      |               |
|               | 35                | 17.5 | 0.02                                                          | 0.03  | 140          | 6,000~10,000      | 0.015                                           | 0.02  | 120          | 6,000~10,000      | 0.03          | 0.04  | 140           | 6,000~10,000      |               |
|               | 40                | 20   | 0.007                                                         | 0.01  | 100          | 6,000~10,000      | 0.004                                           | 0.007 | 80           | 6,000~10,000      | 0.01          | 0.015 | 100           | 6,000~10,000      |               |
| 1.25          | 6                 | 2.4  | 0.35                                                          | 0.5   | 4,000        | 16,000~20,000     | 0.3                                             | 0.4   | 3,400        | 16,000~20,000     | 0.5           | 0.8   | 4,000         | 16,000~20,000     |               |
|               | 10                | 4    | 0.2                                                           | 0.5   | 3,000        | 16,000~20,000     | 0.25                                            | 0.35  | 2,500        | 16,000~20,000     | 0.3           | 0.8   | 3,000         | 16,000~20,000     |               |
|               | 15                | 6    | 0.15                                                          | 0.3   | 2,500        | 16,000~20,000     | 0.1                                             | 0.2   | 2,100        | 16,000~20,000     | 0.25          | 0.45  | 2,500         | 16,000~20,000     |               |
|               | 20                | 8    | 0.1                                                           | 0.2   | 1,800        | 12,000~16,000     | 0.08                                            | 0.15  | 1,500        | 12,000~16,000     | 0.15          | 0.3   | 1,800         | 12,000~16,000     |               |
|               | 25                | 10   | 0.075                                                         | 0.14  | 1,100        | 10,000~14,000     | 0.05                                            | 0.1   | 930          | 10,000~14,000     | 0.1           | 0.2   | 1,100         | 10,000~14,000     |               |
|               | 30                | 12   | 0.04                                                          | 0.08  | 800          | 8,000~12,000      | 0.02                                            | 0.06  | 680          | 8,000~12,000      | 0.06          | 0.15  | 800           | 8,000~12,000      |               |
|               | 35                | 14   | 0.03                                                          | 0.07  | 450          | 6,000~10,000      | 0.01                                            | 0.03  | 380          | 6,000~10,000      | 0.05          | 0.1   | 450           | 6,000~10,000      |               |
| 1.5           | 6                 | 2    | 0.35                                                          | 0.6   | 4,000        | 16,000~20,000     | 0.25                                            | 0.5   | 3,400        | 16,000~20,000     | 0.5           | 1     | 4,000         | 16,000~20,000     |               |
|               | 8                 | 2.7  | 0.3                                                           | 0.5   | 4,000        | 16,000~20,000     | 0.2                                             | 0.5   | 3,400        | 16,000~20,000     | 0.45          | 0.8   | 4,000         | 16,000~20,000     |               |
|               | 10                | 3.3  | 0.3                                                           | 0.5   | 4,000        | 16,000~20,000     | 0.2                                             | 0.45  | 3,400        | 16,000~20,000     | 0.45          | 0.8   | 4,000         | 16,000~20,000     |               |
|               | 12                | 4    | 0.2                                                           | 0.4   | 3,000        | 16,000~20,000     | 0.2                                             | 0.4   | 2,500        | 16,000~20,000     | 0.3           | 0.6   | 3,000         | 16,000~20,000     |               |
|               | 14                | 4.7  | 0.2                                                           | 0.4   | 3,000        | 16,000~20,000     | 0.15                                            | 0.35  | 2,500        | 16,000~20,000     | 0.3           | 0.6   | 3,000         | 16,000~20,000     |               |
|               | 15                | 5    | 0.15                                                          | 0.4   | 3,000        | 16,000~20,000     | 0.13                                            | 0.35  | 2,500        | 16,000~20,000     | 0.23          | 0.6   | 3,000         | 16,000~20,000     |               |
|               | 16                | 5.3  | 0.15                                                          | 0.35  | 3,000        | 16,000~20,000     | 0.13                                            | 0.35  | 2,500        | 16,000~20,000     | 0.23          | 0.5   | 3,000         | 16,000~20,000     |               |
|               | 20                | 6.7  | 0.15                                                          | 0.3   | 1,800        | 12,000~16,000     | 0.1                                             | 0.2   | 1,500        | 12,000~16,000     | 0.23          | 0.45  | 1,800         | 12,000~16,000     |               |
|               | 25                | 8.3  | 0.13                                                          | 0.27  | 1,200        | 12,000~16,000     | 0.1                                             | 0.16  | 1,000        | 12,000~16,000     | 0.2           | 0.4   | 1,200         | 12,000~16,000     |               |
|               | 30                | 10   | 0.1                                                           | 0.2   | 800          | 8,000~12,000      | 0.07                                            | 0.12  | 680          | 8,000~12,000      | 0.15          | 0.3   | 800           | 8,000~12,000      |               |
|               | 35                | 11.7 | 0.07                                                          | 0.15  | 600          | 8,000~12,000      | 0.05                                            | 0.1   | 510          | 8,000~12,000      | 0.1           | 0.2   | 600           | 8,000~12,000      |               |
|               | 40                | 13.3 | 0.05                                                          | 0.1   | 460          | 6,000~10,000      | 0.05                                            | 0.07  | 390          | 6,000~10,000      | 0.08          | 0.15  | 460           | 6,000~10,000      |               |
|               | 1.75              | 10   | 2.9                                                           | 0.35  | 0.6          | 4,000             | 16,000~20,000                                   | 0.25  | 0.5          | 3,400             | 16,000~20,000 | 0.5   | 1             | 4,000             | 16,000~20,000 |
|               |                   | 15   | 4.3                                                           | 0.3   | 0.4          | 4,000             | 16,000~20,000                                   | 0.2   | 0.45         | 3,400             | 16,000~20,000 | 0.45  | 0.6           | 4,000             | 16,000~20,000 |
| 20            |                   | 5.7  | 0.2                                                           | 0.3   | 2,400        | 14,000~18,000     | 0.13                                            | 0.35  | 2,000        | 14,000~18,000     | 0.3           | 0.45  | 2,400         | 14,000~18,000     |               |
| 25            |                   | 7.1  | 0.17                                                          | 0.3   | 2,000        | 14,000~18,000     | 0.1                                             | 0.3   | 1,800        | 14,000~18,000     | 0.25          | 0.42  | 2,000         | 14,000~18,000     |               |
| 30            |                   | 8.6  | 0.15                                                          | 0.27  | 1,600        | 8,000~12,000      | 0.1                                             | 0.2   | 1,400        | 8,000~12,000      | 0.23          | 0.4   | 1,600         | 8,000~12,000      |               |
| 35            |                   | 10   | 0.1                                                           | 0.2   | 1,200        | 8,000~12,000      | 0.07                                            | 0.15  | 1,000        | 8,000~12,000      | 0.15          | 0.3   | 1,200         | 8,000~12,000      |               |
| 40            |                   | 11.4 | 0.07                                                          | 0.13  | 800          | 6,000~10,000      | 0.05                                            | 0.1   | 680          | 6,000~10,000      | 0.1           | 0.2   | 800           | 6,000~10,000      |               |
| 45            | 12.9              | 0.05 | 0.1                                                           | 800   | 6,000~10,000 | 0.05              | 0.05                                            | 680   | 6,000~10,000 | 0.08              | 0.15          | 800   | 6,000~10,000  |                   |               |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC

Hardened Steel

H

Coating

Long Neck  
Ball

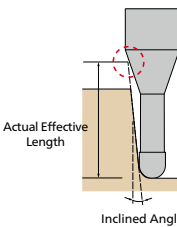
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Recommended Milling Conditions

| Work Material |                   |      | Carbon Steels・Prehardened Steels<br>S50C・NAK・HPM1<br>(~45HRC) |       |        |                   | Hardened Steels<br>SKD・STAVAX・HPM38<br>(~55HRC) |       |              |                   | Copper |       |               |                   |
|---------------|-------------------|------|---------------------------------------------------------------|-------|--------|-------------------|-------------------------------------------------|-------|--------------|-------------------|--------|-------|---------------|-------------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                                  |       | Feed   |                   | Spindle Speed                                   |       | Depth of Cut |                   | Feed   |       | Spindle Speed |                   |
|               |                   |      | ap mm                                                         | ae mm | mm/min | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min       | min <sup>-1</sup> | ap mm  | ae mm | mm/min        | min <sup>-1</sup> |
| 2             | 10                | 2.5  | 0.35                                                          | 0.8   | 4,000  | 16,000~20,000     | 0.25                                            | 0.7   | 3,400        | 16,000~20,000     | 0.55   | 1.2   | 4,000         | 16,000~20,000     |
|               | 12                | 3    | 0.35                                                          | 0.7   | 4,000  | 16,000~20,000     | 0.25                                            | 0.7   | 3,400        | 16,000~20,000     | 0.53   | 1     | 4,000         | 16,000~20,000     |
|               | 14                | 3.5  | 0.3                                                           | 0.6   | 4,000  | 16,000~20,000     | 0.2                                             | 0.5   | 3,400        | 16,000~20,000     | 0.45   | 1     | 4,000         | 16,000~20,000     |
|               | 15                | 3.8  | 0.25                                                          | 0.55  | 3,500  | 16,000~20,000     | 0.2                                             | 0.4   | 3,000        | 16,000~20,000     | 0.38   | 0.8   | 3,500         | 16,000~20,000     |
|               | 16                | 4    | 0.2                                                           | 0.5   | 3,500  | 16,000~20,000     | 0.2                                             | 0.3   | 3,000        | 16,000~20,000     | 0.3    | 0.8   | 3,500         | 16,000~20,000     |
|               | 20                | 5    | 0.2                                                           | 0.35  | 3,300  | 16,000~20,000     | 0.15                                            | 0.3   | 2,800        | 16,000~20,000     | 0.3    | 0.5   | 3,300         | 16,000~20,000     |
|               | 25                | 6.3  | 0.15                                                          | 0.3   | 2,600  | 12,000~16,000     | 0.12                                            | 0.25  | 2,200        | 12,000~16,000     | 0.23   | 0.45  | 2,600         | 12,000~16,000     |
|               | 30                | 7.5  | 0.12                                                          | 0.25  | 2,600  | 12,000~16,000     | 0.1                                             | 0.2   | 2,200        | 12,000~16,000     | 0.2    | 0.4   | 2,600         | 12,000~16,000     |
|               | 35                | 8.8  | 0.12                                                          | 0.2   | 1,800  | 10,000~14,000     | 0.07                                            | 0.15  | 1,500        | 10,000~14,000     | 0.18   | 0.3   | 1,800         | 10,000~14,000     |
|               | 40                | 10   | 0.1                                                           | 0.15  | 1,200  | 10,000~14,000     | 0.07                                            | 0.12  | 1,000        | 10,000~14,000     | 0.15   | 0.2   | 1,200         | 10,000~14,000     |
| 2.5           | 45                | 11.3 | 0.07                                                          | 0.12  | 800    | 10,000~14,000     | 0.05                                            | 0.1   | 700          | 10,000~14,000     | 0.1    | 0.17  | 800           | 10,000~14,000     |
|               | 50                | 12.5 | 0.07                                                          | 0.1   | 600    | 6,000~10,000      | 0.05                                            | 0.07  | 500          | 6,000~10,000      | 0.1    | 0.15  | 600           | 6,000~10,000      |
|               | 10                | 2    | 0.4                                                           | 1.2   | 4,000  | 16,000~20,000     | 0.3                                             | 1     | 3,400        | 16,000~20,000     | 0.6    | 1.8   | 4,000         | 16,000~20,000     |
|               | 15                | 3    | 0.35                                                          | 1     | 4,000  | 16,000~20,000     | 0.3                                             | 0.9   | 3,400        | 16,000~20,000     | 0.55   | 1.5   | 4,000         | 16,000~20,000     |
|               | 20                | 4    | 0.3                                                           | 0.7   | 4,000  | 16,000~20,000     | 0.25                                            | 0.7   | 3,400        | 16,000~20,000     | 0.45   | 1     | 4,000         | 16,000~20,000     |
|               | 25                | 5    | 0.25                                                          | 0.6   | 3,000  | 14,000~16,000     | 0.2                                             | 0.5   | 2,500        | 14,000~16,000     | 0.38   | 0.9   | 3,000         | 14,000~16,000     |
|               | 30                | 6    | 0.2                                                           | 0.5   | 2,400  | 14,000~16,000     | 0.15                                            | 0.4   | 2,000        | 14,000~16,000     | 0.3    | 0.8   | 2,400         | 14,000~16,000     |
|               | 35                | 7    | 0.15                                                          | 0.4   | 1,600  | 10,000~14,000     | 0.15                                            | 0.3   | 1,400        | 10,000~14,000     | 0.23   | 0.6   | 1,600         | 10,000~14,000     |
|               | 40                | 8    | 0.15                                                          | 0.3   | 1,200  | 8,000~12,000      | 0.12                                            | 0.2   | 1,000        | 8,000~12,000      | 0.23   | 0.45  | 1,200         | 8,000~12,000      |
|               | 45                | 9    | 0.12                                                          | 0.2   | 1,000  | 8,000~12,000      | 0.1                                             | 0.15  | 850          | 8,000~12,000      | 0.18   | 0.3   | 1,00          |                   |

# MRB230SF

## MUGEN COATING 2-Flute Long Neck Ball End Mill with Short Shank



- It fits for shrink chuck system.

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Shank Length (ℓ <sub>2</sub> ) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|----------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------------------|--------------------|------------------------------------------------------------------|------|-------|------|------|
|                |            |                                     |                   |          |                             |                      |                |                                |                    | 30°                                                              | 1°   | 1°30' | 2°   | 3°   |
| 08-00525-00103 | R0.1       | 0.5                                 | 0.15              | 0.2      | 0.18                        | 15°                  | 4              | 27.3                           | 35                 | 0.55                                                             | 0.56 | 0.58  | 0.60 | 0.64 |
| 08-00525-00105 |            | 0.75                                | 0.15              | 0.2      | 0.18                        | 15°                  | 4              | 27.1                           | 35                 | 0.81                                                             | 0.83 | 0.86  | 0.89 | 0.95 |
| 08-00525-00107 |            | 1                                   | 0.15              | 0.2      | 0.18                        | 15°                  | 4              | 26.8                           | 35                 | 1.06                                                             | 1.10 | 1.13  | 1.17 | 1.26 |
| 08-00525-00109 |            | 1.25                                | 0.15              | 0.2      | 0.18                        | 15°                  | 4              | 26.6                           | 35                 | 1.32                                                             | 1.37 | 1.41  | 1.46 | 1.57 |
| 08-00525-00151 | R0.15      | 0.5                                 | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 27.5                           | 35                 | 0.55                                                             | 0.56 | 0.57  | 0.59 | 0.63 |
| 08-00525-00152 |            | 0.6                                 | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 27.4                           | 35                 | 0.65                                                             | 0.67 | 0.69  | 0.71 | 0.75 |
| 08-00525-00153 |            | 0.75                                | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 27.3                           | 35                 | 0.80                                                             | 0.83 | 0.85  | 0.88 | 0.94 |
| 08-00525-00154 |            | 1                                   | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 27                             | 35                 | 1.06                                                             | 1.09 | 1.13  | 1.17 | 1.25 |
| 08-00525-00155 |            | 1.25                                | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 26.8                           | 35                 | 1.32                                                             | 1.36 | 1.41  | 1.45 | 1.56 |
| 08-00525-00156 |            | 1.5                                 | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 26.5                           | 35                 | 1.58                                                             | 1.63 | 1.68  | 1.74 | 1.87 |
| 08-00525-00157 |            | 1.75                                | 0.2               | 0.3      | 0.28                        | 15°                  | 4              | 26.3                           | 35                 | 1.84                                                             | 1.90 | 1.96  | 2.03 | 2.18 |
| 08-00525-00202 | R0.2       | 0.75                                | 0.3               | 0.4      | 0.37                        | 15°                  | 4              | 27.4                           | 35                 | 0.82                                                             | 0.84 | 0.87  | 0.89 | 0.95 |
| 08-00525-00203 |            | 1                                   | 0.3               | 0.4      | 0.37                        | 15°                  | 4              | 27.2                           | 35                 | 1.08                                                             | 1.11 | 1.14  | 1.18 | 1.26 |
| 08-00525-00204 |            | 1.5                                 | 0.3               | 0.4      | 0.37                        | 15°                  | 4              | 26.7                           | 35                 | 1.60                                                             | 1.65 | 1.70  | 1.75 | 1.88 |
| 08-00525-00205 |            | 2                                   | 0.3               | 0.4      | 0.37                        | 15°                  | 4              | 26.2                           | 35                 | 2.11                                                             | 2.18 | 2.25  | 2.33 | 2.50 |
| 08-00525-00206 |            | 2.5                                 | 0.3               | 0.4      | 0.37                        | 15°                  | 4              | 25.7                           | 35                 | 2.63                                                             | 2.72 | 2.81  | 2.90 | 3.13 |
| 08-00525-00251 | R0.25      | 1                                   | 0.35              | 0.5      | 0.46                        | 15°                  | 4              | 27.3                           | 35                 | 1.10                                                             | 1.13 | 1.16  | 1.19 | 1.27 |
| 08-00525-00252 |            | 1.5                                 | 0.35              | 0.5      | 0.46                        | 15°                  | 4              | 26.8                           | 35                 | 1.61                                                             | 1.66 | 1.71  | 1.77 | 1.89 |
| 08-00525-00253 |            | 2                                   | 0.35              | 0.5      | 0.46                        | 15°                  | 4              | 26.3                           | 35                 | 2.13                                                             | 2.20 | 2.27  | 2.34 | 2.51 |
| 08-00525-00254 |            | 2.5                                 | 0.35              | 0.5      | 0.46                        | 15°                  | 4              | 25.8                           | 35                 | 2.65                                                             | 2.73 | 2.82  | 2.92 | 3.14 |
| 08-00525-00255 |            | 3                                   | 0.35              | 0.5      | 0.46                        | 15°                  | 4              | 25.3                           | 35                 | 3.16                                                             | 3.27 | 3.38  | 3.49 | 3.76 |
| 08-00525-00301 | R0.3       | 1.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 27                             | 35                 | 1.61                                                             | 1.66 | 1.71  | 1.76 | 1.88 |
| 08-00525-00302 |            | 2                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 26.5                           | 35                 | 2.13                                                             | 2.19 | 2.26  | 2.34 | 2.50 |
| 08-00525-00303 |            | 2.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 26                             | 35                 | 2.65                                                             | 2.73 | 2.82  | 2.91 | 3.12 |
| 08-00525-00304 |            | 3                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 25.5                           | 35                 | 3.16                                                             | 3.26 | 3.37  | 3.49 | 3.75 |
| 08-00525-00305 |            | 3.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 25                             | 35                 | 3.68                                                             | 3.80 | 3.92  | 4.06 | 4.37 |
| 08-00525-00306 |            | 4                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 29.5                           | 40                 | 4.20                                                             | 4.33 | 4.48  | 4.64 | 4.99 |
| 08-00525-00307 |            | 4.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 29                             | 40                 | 4.71                                                             | 4.87 | 5.03  | 5.21 | 5.61 |
| 08-00525-00308 |            | 5                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 28.5                           | 40                 | 5.23                                                             | 5.40 | 5.59  | 5.79 | 6.23 |
| 08-00525-00309 |            | 5.5                                 | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 28                             | 40                 | 5.75                                                             | 5.94 | 6.14  | 6.36 | 6.85 |
| 08-00525-00310 |            | 6                                   | 0.45              | 0.6      | 0.56                        | 15°                  | 4              | 27.5                           | 40                 | 6.26                                                             | 6.47 | 6.70  | 6.94 | 7.48 |

When you order, indicate MRB230SF (R)×(Q1). ※(γ) is reference value.

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Shank Length (ℓ <sub>2</sub> ) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                                     |                   |          |                             |                      |                |                                |                    | 30°                                                              | 1°    | 1°30' | 2°    | 3°    |
| 08-00525-00401 | R0.4       | 2                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 26.9                           | 35                 | 2.13                                                             | 2.19  | 2.25  | 2.32  | 2.48  |
| 08-00525-00402 |            | 3                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 25.9                           | 35                 | 3.16                                                             | 3.26  | 3.36  | 3.47  | 3.72  |
| 08-00525-00403 |            | 4                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 29.9                           | 40                 | 4.19                                                             | 4.33  | 4.47  | 4.62  | 4.97  |
| 08-00525-00404 |            | 5                                   | 0.6               | 0.8      | 0.76                        | 15°                  | 4              | 28.9                           | 40                 | 5.23                                                             | 5.40  | 5.58  | 5.77  | 6.21  |
| 08-00525-00501 | R0.5       | 3                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 26.3                           | 35                 | 3.18                                                             | 3.27  | 3.37  | 3.48  | 3.72  |
| 08-00525-00502 |            | 4                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 25.3                           | 35                 | 4.21                                                             | 4.34  | 4.48  | 4.63  | 4.97  |
| 08-00525-00503 |            | 5                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 29.3                           | 40                 | 5.24                                                             | 5.41  | 5.59  | 5.78  | 6.21  |
| 08-00525-00504 |            | 6                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 28.3                           | 40                 | 6.28                                                             | 6.48  | 6.69  | 6.93  | 7.45  |
| 08-00525-00505 |            | 8                                   | 0.75              | 1        | 0.95                        | 15°                  | 4              | 26.3                           | 40                 | 8.34                                                             | 8.62  | 8.91  | 9.23  | 9.94  |
| 08-00525-00506 |            | 10                                  | 0.75              | 1        | 0.95                        | 15°                  | 4              | 24.3                           | 40                 | 10.41                                                            | 10.76 | 11.13 | 11.53 | 12.42 |
| 08-00525-00751 | R0.75      | 3                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 27.2                           | 35                 | 3.17                                                             | 3.25  | 3.34  | 3.44  | 3.66  |
| 08-00525-00752 |            | 4                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 26.2                           | 35                 | 4.20                                                             | 4.32  | 4.45  | 4.59  | 4.91  |
| 08-00525-00754 |            | 6                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 29.2                           | 40                 | 6.27                                                             | 6.46  | 6.67  | 6.89  | 7.39  |
| 08-00525-00755 |            | 8                                   | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 27.2                           | 40                 | 8.34                                                             | 8.60  | 8.88  | 9.19  | 9.88  |
| 08-00525-00756 |            | 10                                  | 1.1               | 1.5      | 1.45                        | 15°                  | 4              | 25.2                           | 40                 | 10.40                                                            | 10.74 | 11.10 | 11.49 | 12.36 |
| 08-00525-01001 | R1         | 3                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 28.1                           | 35                 | 3.18                                                             | 3.25  | 3.34  | 3.43  | 3.63  |
| 08-00525-01002 |            | 4                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 27.1                           | 35                 | 4.21                                                             | 4.32  | 4.45  | 4.58  | 4.87  |
| 08-00525-01003 |            | 6                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 25.1                           | 35                 | 6.28                                                             | 6.46  | 6.66  | 6.88  | 7.36  |
| 08-00525-01004 |            | 8                                   | 1.5               | 2        | 1.94                        | 15°                  | 4              | 28.1                           | 40                 | 8.35                                                             | 8.60  | 8.88  | 9.18  | 9.84  |
| 08-00525-01005 |            | 10                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 26.1                           | 40                 | 10.41                                                            | 10.74 | 11.10 | 11.48 | 12.33 |
| 08-00525-01006 |            | 12                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 29.1                           | 45                 | 12.48                                                            | 12.88 | 13.31 | 13.77 | 14.82 |
| 08-00525-01007 |            | 14                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 27.1                           | 45                 | 14.55                                                            | 15.02 | 15.53 | 16.07 | 17.30 |
| 08-00525-01008 |            | 16                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 25.1                           | 45                 | 16.62                                                            | 17.16 | 17.75 | 18.37 | 19.79 |
| 08-00525-01009 |            | 18                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 28.1                           | 50                 | 18.68                                                            | 19.30 | 19.96 | 20.67 | Free  |
| 08-00525-01010 |            | 20                                  | 1.5               | 2        | 1.94                        | 15°                  | 4              | 26.1                           | 50                 | 20.75                                                            | 21.44 | 22.18 | 22.97 | Free  |
| 08-00525-01501 | R1.5       | 6                                   | 2.5               | 3        | 2.85                        | 15°                  | 4              | 31.8                           | 40                 | 6.44                                                             | 6.61  | 6.79  | 7.00  | 7.45  |
| 08-00525-01502 |            | 8                                   | 2.5               | 3        | 2.85                        | 15°                  | 4              | 29.8                           | 40                 | 8.50                                                             | 8.75  | 9.01  | 9.29  | 9.93  |
| 08-00525-01503 |            | 10                                  | 2.5               | 3        | 2.85                        | 15°                  | 4              | 27.8                           | 40                 | 10.57                                                            | 10.89 | 11.23 | 11.59 | Free  |
| 08-00525-01504 |            | 12                                  | 2.5               | 3        | 2.85                        | 15°                  | 4              | 25.8                           | 40                 | 12.64                                                            | 13.03 | 13.44 | 13.89 | Free  |

1-039



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Coating

Long Neck Ball

P

P

P

M

N

N

N

H

| MRB230SF                       |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   | MRB230SF                                                                                                                                                                                                          |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|--------------------------------|-------------------|---------------------------------------------------------------|-------|--------|-------------------|-------------------------------------------------|-------|--------|-------------------|--------------|-------|--------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------|-------|--------|-------------------|-------------------------------------------------|-------|--------|-------------------|--------------|-------|--------|-------------------|
| Recommended Milling Conditions |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   | Recommended Milling Conditions                                                                                                                                                                                    |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
| Work Material                  |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK・HPM1<br>(~44HRC) |       |        |                   | Hardened Steels<br>SKD・STAVAX・HPM38<br>(~55HRC) |       |        |                   | Copper       |       |        |                   | Work Material                                                                                                                                                                                                     |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK・HPM1<br>(~44HRC) |       |        |                   | Hardened Steels<br>SKD・STAVAX・HPM38<br>(~55HRC) |       |        |                   | Copper       |       |        |                   |
| Radius                         | Under Neck Length | Depth of Cut                                                  |       | Feed   | Spindle Speed     | Depth of Cut                                    |       | Feed   | Spindle Speed     | Depth of Cut |       | Feed   | Spindle Speed     | Radius                                                                                                                                                                                                            | Under Neck Length | Depth of Cut                                                  |       | Feed   | Spindle Speed     | Depth of Cut                                    |       | Feed   | Spindle Speed     | Depth of Cut |       | Feed   | Spindle Speed     |
|                                |                   | ap mm                                                         | ae mm | mm/min | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min | min <sup>-1</sup> | ap mm        | ae mm | mm/min | min <sup>-1</sup> |                                                                                                                                                                                                                   |                   | ap mm                                                         | ae mm | mm/min | min <sup>-1</sup> | ap mm                                           | ae mm | mm/min | min <sup>-1</sup> | ap mm        | ae mm | mm/min | min <sup>-1</sup> |
| 0.1                            | 0.5               | 0.01                                                          | 0.02  | 250    | 20,000~50,000     | 0.01                                            | 0.01  | 210    | 20,000~50,000     | 0.01         | 0.02  | 250    | 20,000~50,000     | 0.5                                                                                                                                                                                                               | 3                 | 0.2                                                           | 0.3   | 3,000  | 20,000~50,000     | 0.12                                            | 0.3   | 2,500  | 20,000~50,000     | 0.25         | 0.4   | 3,000  | 20,000~50,000     |
|                                | 0.75              | 0.007                                                         | 0.01  | 250    | 20,000~50,000     | 0.005                                           | 0.01  | 210    | 20,000~50,000     | 0.01         | 0.015 | 250    | 20,000~50,000     |                                                                                                                                                                                                                   | 4                 | 0.15                                                          | 0.25  | 2,500  | 20,000~50,000     | 0.1                                             | 0.2   | 2,100  | 20,000~50,000     | 0.2          | 0.4   | 2,500  | 20,000~50,000     |
|                                | 1                 | 0.005                                                         | 0.01  | 250    | 20,000~50,000     | 0.003                                           | 0.005 | 210    | 20,000~50,000     | 0.008        | 0.015 | 250    | 20,000~50,000     |                                                                                                                                                                                                                   | 5                 | 0.1                                                           | 0.25  | 2,000  | 20,000~50,000     | 0.08                                            | 0.17  | 1,700  | 20,000~50,000     | 0.15         | 0.35  | 2,000  | 20,000~50,000     |
|                                | 1.25              | 0.003                                                         | 0.01  | 150    | 20,000~50,000     | 0.003                                           | 0.005 | 120    | 20,000~50,000     | 0.005        | 0.015 | 150    | 20,000~50,000     |                                                                                                                                                                                                                   | 6                 | 0.1                                                           | 0.2   | 1,500  | 20,000~50,000     | 0.07                                            | 0.12  | 1,200  | 20,000~50,000     | 0.15         | 0.3   | 1,500  | 20,000~50,000     |
| 0.15                           | 0.5               | 0.01                                                          | 0.02  | 250    | 20,000~50,000     | 0.01                                            | 0.015 | 210    | 20,000~50,000     | 0.012        | 0.025 | 250    | 20,000~50,000     |                                                                                                                                                                                                                   | 8                 | 0.05                                                          | 0.1   | 1,200  | 20,000~30,000     | 0.05                                            | 0.08  | 1,000  | 20,000~30,000     | 0.08         | 0.15  | 1,200  | 20,000~30,000     |
|                                | 0.6               | 0.01                                                          | 0.02  | 250    | 20,000~50,000     | 0.01                                            | 0.015 | 210    | 20,000~50,000     | 0.012        | 0.025 | 250    | 20,000~50,000     | 0.75                                                                                                                                                                                                              | 10                | 0.03                                                          | 0.05  | 800    | 20,000~30,000     | 0.03                                            | 0.05  | 680    | 20,000~30,000     | 0.05         | 0.08  | 800    | 20,000~30,000     |
|                                | 0.75              | 0.008                                                         | 0.02  | 250    | 20,000~50,000     | 0.007                                           | 0.012 | 210    | 20,000~50,000     | 0.011        | 0.02  | 250    | 20,000~50,000     |                                                                                                                                                                                                                   | 3                 | 0.2                                                           | 0.35  | 4,000  | 20,000~30,000     | 0.15                                            | 0.3   | 3,400  | 20,000~30,000     | 0.3          | 0.5   | 4,000  | 20,000~30,000     |
|                                | 1                 | 0.007                                                         | 0.01  | 250    | 20,000~50,000     | 0.005                                           | 0.01  | 210    | 20,000~50,000     | 0.01         | 0.02  | 250    | 20,000~50,000     |                                                                                                                                                                                                                   | 4                 | 0.2                                                           | 0.3   | 4,000  | 20,000~30,000     | 0.15                                            | 0.25  | 3,400  | 20,000~30,000     | 0.3          | 0.45  | 4,000  | 20,000~30,000     |
|                                | 1.25              | 0.005                                                         | 0.01  | 250    | 20,000~50,000     | 0.005                                           | 0.005 | 210    | 20,000~50,000     | 0.008        | 0.015 | 250    | 20,000~50,000     |                                                                                                                                                                                                                   | 6                 | 0.15                                                          | 0.3   | 3,000  | 20,000~30,000     | 0.12                                            | 0.2   | 2,500  | 20,000~30,000     | 0.2          | 0.45  | 3,000  | 20,000~30,000     |
|                                | 1.5               | 0.005                                                         | 0.01  | 200    | 20,000~50,000     | 0.005                                           | 0.005 | 170    | 20,000~50,000     | 0.008        | 0.015 | 200    | 20,000~50,000     |                                                                                                                                                                                                                   | 8                 | 0.1                                                           | 0.25  | 2,400  | 20,000~30,000     | 0.08                                            | 0.18  | 2,000  | 20,000~30,000     | 0.15         | 0.4   | 2,400  | 20,000~30,000     |
| 0.2                            | 0.75              | 0.02                                                          | 0.05  | 800    | 20,000~50,000     | 0.02                                            | 0.03  | 650    | 20,000~50,000     | 0.03         | 0.07  | 800    | 20,000~50,000     | 1                                                                                                                                                                                                                 | 10                | 0.08                                                          | 0.2   | 1,800  | 20,000~30,000     | 0.06                                            | 0.12  | 1,500  | 20,000~30,000     | 0.12         | 0.3   | 1,800  | 20,000~30,000     |
|                                | 1                 | 0.02                                                          | 0.05  | 800    | 20,000~50,000     | 0.02                                            | 0.03  | 650    | 20,000~50,000     | 0.03         | 0.07  | 800    | 20,000~50,000     |                                                                                                                                                                                                                   | 3                 | 0.3                                                           | 0.5   | 4,000  | 20,000~30,000     | 0.2                                             | 0.5   | 3,400  | 20,000~30,000     | 0.45         | 0.7   | 4,000  | 20,000~30,000     |
|                                | 1.5               | 0.02                                                          | 0.03  | 700    | 20,000~50,000     | 0.01                                            | 0.02  | 600    | 20,000~50,000     | 0.03         | 0.05  | 700    | 20,000~50,000     |                                                                                                                                                                                                                   | 4                 | 0.3                                                           | 0.5   | 4,000  | 20,000~30,000     | 0.2                                             | 0.45  | 3,400  | 20,000~30,000     | 0.45         | 0.7   | 4,000  | 20,000~30,000     |
|                                | 2                 | 0.015                                                         | 0.02  | 600    | 20,000~50,000     | 0.01                                            | 0.015 | 500    | 20,000~50,000     | 0.02         | 0.03  | 600    | 20,000~50,000     |                                                                                                                                                                                                                   | 6                 | 0.25                                                          | 0.5   | 3,000  | 20,000~30,000     | 0.2                                             | 0.4   | 2,500  | 20,000~30,000     | 0.38         | 0.7   | 3,000  | 20,000~30,000     |
|                                | 2.5               | 0.015                                                         | 0.02  | 450    | 20,000~50,000     | 0.01                                            | 0.015 | 380    | 20,000~50,000     | 0.02         | 0.03  | 450    | 20,000~50,000     |                                                                                                                                                                                                                   | 8                 | 0.2                                                           | 0.3   | 2,500  | 16,000~20,000     | 0.15                                            | 0.3   | 2,100  | 16,000~20,000     | 0.3          | 0.45  | 2,500  | 16,000~20,000     |
| 0.25                           | 1                 | 0.03                                                          | 0.05  | 800    | 20,000~50,000     | 0.02                                            | 0.05  | 680    | 20,000~50,000     | 0.045        | 0.07  | 800    | 20,000~50,000     |                                                                                                                                                                                                                   | 10                | 0.15                                                          | 0.3   | 2,500  | 16,000~20,000     | 0.1                                             | 0.2   | 2,100  | 16,000~20,000     | 0.23         | 0.45  | 2,500  | 16,000~20,000     |
|                                | 1.5               | 0.03                                                          | 0.05  | 700    | 20,000~50,000     | 0.02                                            | 0.04  | 600    | 20,000~50,000     | 0.04         | 0.07  | 700    | 20,000~50,000     |                                                                                                                                                                                                                   | 12                | 0.13                                                          | 0.2   | 1,800  | 12,000~16,000     | 0.1                                             | 0.15  | 1,500  | 12,000~16,000     | 0.2          | 0.3   | 1,800  | 12,000~16,000     |
|                                | 2                 | 0.02                                                          | 0.04  | 600    | 20,000~50,000     | 0.02                                            | 0.03  | 510    | 20,000~50,000     | 0.03         | 0.06  | 600    | 20,000~50,000     |                                                                                                                                                                                                                   | 14                | 0.1                                                           | 0.2   | 1,800  | 12,000~16,000     | 0.07                                            | 0.13  | 1,500  | 12,000~16,000     | 0.15         | 0.3   | 1,800  | 12,000~16,000     |
|                                | 2.5               | 0.015                                                         | 0.04  | 600    | 20,000~50,000     | 0.01                                            | 0.03  | 510    | 20,000~50,000     | 0.02         | 0.06  | 600    | 20,000~50,000     |                                                                                                                                                                                                                   | 16                | 0.1                                                           | 0.15  | 1,600  | 10,000~14,000     | 0.06                                            | 0.11  | 1,400  | 10,000~14,000     | 0.15         | 0.25  | 1,600  | 10,000~14,000     |
|                                | 3                 | 0.015                                                         | 0.035 | 500    | 20,000~50,000     | 0.01                                            | 0.025 | 420    | 20,000~50,000     | 0.02         | 0.05  | 500    | 20,000~50,000     |                                                                                                                                                                                                                   | 18                | 0.07                                                          | 0.12  | 1,600  | 10,000~14,000     | 0.05                                            | 0.1   | 1,400  | 10,000~14,000     | 0.1          | 0.2   | 1,600  | 10,000~14,000     |
| 0.3                            | 1.5               | 0.05                                                          | 0.1   | 1,200  | 20,000~50,000     | 0.05                                            | 0.07  | 1,000  | 20,000~50,000     | 0.07         | 0.12  | 1,200  | 20,000~50,000     | 1.5                                                                                                                                                                                                               | 6                 | 0.35                                                          | 0.6   | 4,000  | 16,000~20,000     | 0.25                                            | 0.5   | 3,400  | 16,000~20,000     | 0.5          | 1     | 4,000  | 16,000~20,000     |
|                                | 2                 | 0.05                                                          | 0.1   | 1,200  | 20,000~50,000     | 0.04                                            | 0.07  | 1,000  | 20,000~50,000     | 0.07         | 0.12  | 1,200  | 20,000~50,000     |                                                                                                                                                                                                                   | 8                 | 0.3                                                           | 0.5   | 4,000  | 16,000~20,000     | 0.2                                             | 0.5   | 3,400  | 16,000~20,000     | 0.45         | 0.8   | 4,000  | 16,000~20,000     |
|                                | 2.5               | 0.035                                                         | 0.1   | 1,200  | 20,000~50,000     | 0.03                                            | 0.06  | 1,000  | 20,000~50,000     | 0.05         | 0.12  | 1,200  | 20,000~50,000     |                                                                                                                                                                                                                   | 10                | 0.3                                                           | 0.5   | 4,000  | 16,000~20,000     | 0.2                                             | 0.45  | 3,400  | 16,000~20,000     | 0.45         | 0.8   | 4,000  | 16,000~20,000     |
|                                | 3                 | 0.025                                                         | 0.1   | 1,000  | 20,000~50,000     | 0.03                                            | 0.05  | 850    | 20,000~50,000     | 0.04         | 0.1   | 1,000  | 20,000~50,000     |                                                                                                                                                                                                                   | 12                | 0.2                                                           | 0.4   | 3,000  | 16,000~20,000     | 0.2                                             | 0.4   | 2,500  | 16,000~20,000     | 0.3          | 0.6   | 3,000  | 16,000~20,000     |
|                                | 3.5               | 0.025                                                         | 0.08  | 1,000  | 20,000~50,000     | 0.02                                            | 0.05  | 850    | 20,000~50,000     | 0.04         | 0.1   | 1,000  | 20,000~50,000     | Notes<br>※1 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Oil mist coolant is recommended for the machining of hardened steels. |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 4                 | 0.025                                                         | 0.05  | 800    | 20,000~50,000     | 0.02                                            | 0.04  | 680    | 20,000~50,000     | 0.035        | 0.08  | 800    | 20,000~50,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 4.5               | 0.025                                                         | 0.05  | 750    | 20,000~50,000     | 0.01                                            | 0.03  | 630    | 20,000~50,000     | 0.035        | 0.08  | 750    | 20,000~50,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 5                 | 0.02                                                          | 0.04  | 500    | 20,000~30,000     | 0.01                                            | 0.02  | 420    | 20,000~30,000     | 0.03         | 0.06  | 500    | 20,000~30,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
| 0.4                            | 5.5               | 0.013                                                         | 0.02  | 500    | 20,000~30,000     | 0.01                                            | 0.01  | 420    | 20,000~30,000     | 0.02         | 0.03  | 500    | 20,000~30,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 6                 | 0.01                                                          | 0.02  | 450    | 20,000~30,000     | 0.005                                           | 0.01  | 380    | 20,000~30,000     | 0.015        | 0.03  | 450    | 20,000~30,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 2                 | 0.1                                                           | 0.15  | 2,000  | 20,000~50,000     | 0.1                                             | 0.12  | 1,700  | 20,000~50,000     | 0.15         | 0.2   | 2,000  | 20,000~50,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 3                 | 0.08                                                          | 0.13  | 1,700  | 20,000~50,000     | 0.08                                            | 0.1   | 1,500  | 20,000~50,000     | 0.12         | 0.2   | 1,700  | 20,000~50,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 4                 | 0.05                                                          | 0.12  | 1,500  | 20,000~50,000     | 0.05                                            | 0.08  | 1,300  | 20,000~50,000     | 0.1          | 0.2   | 1,500  | 20,000~50,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |
|                                | 5                 | 0.05                                                          | 0.1   | 1,200  | 20,000~50,000     | 0.04                                            | 0.07  | 1,000  | 20,000~50,000     | 0.08         | 0.15  | 1,200  | 20,000~50,000     |                                                                                                                                                                                                                   |                   |                                                               |       |        |                   |                                                 |       |        |                   |              |       |        |                   |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Coating

Long Neck Ball

P

P

P

M

N

N

N

H



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

Hardened Steel  
~ 55 HRC  
H

Coating  
Long Neck  
Ball  
End Mill

# MRBLN230-6

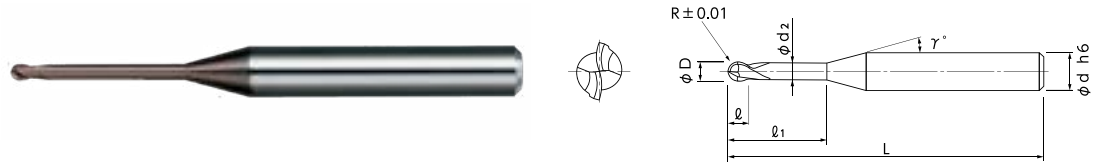
Size R0.15 ~ R1



## MRBLN230-6

MUGEN COATING 2-Flute Long Neck Ball End Mill (Shank Dia. 6)

2-flute long neck ball end mill. Shank Dia.6mm



● I : Semi-standard item, please inquire for price and delivery.

Unit : mm

| Code No.         | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| I 08-00522-01501 | R0.15      | 3                      | 0.3               | 0.3      | 0.28           | 15°                  | 6              | 60                 |
| I 08-00522-02001 | R0.2       | 4                      | 0.4               | 0.4      | 0.37           | 15°                  | 6              | 60                 |
| I 08-00522-02501 | R0.25      | 5                      | 0.8               | 0.5      | 0.46           | 15°                  | 6              | 60                 |
| I 08-00522-03001 | R0.3       | 3                      | 1                 | 0.6      | 0.56           | 15°                  | 6              | 60                 |
| I 08-00522-03005 |            | 5                      | 1                 | 0.6      | 0.56           | 15°                  | 6              | 60                 |
| I 08-00522-03006 |            | 6                      | 1                 | 0.6      | 0.56           | 15°                  | 6              | 60                 |
| I 08-00522-04008 | R0.4       | 8                      | 1.4               | 0.8      | 0.76           | 15°                  | 6              | 60                 |
| I 08-00522-05010 | R0.5       | 10                     | 1.5               | 1        | 0.95           | 15°                  | 6              | 60                 |
| I 08-00522-07515 | R0.75      | 15                     | 1.75              | 1.5      | 1.45           | 15°                  | 6              | 60                 |
| I 08-00522-10020 | R1         | 20                     | 2                 | 2        | 1.94           | 15°                  | 6              | 60                 |

### How to Order

When you order, indicate MRBLN230-6 (R)×(ℓ1). ※(γ) is reference value.



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

Hardened Steel  
~ 55 HRC  
H

Coating  
Long Neck  
Ball  
End Mill

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

MRBTN230

R0.1 × neck taper angle30° ~  
Size R2 × neck taper angle1°

MG

2

30°

R ± 0.005  
(R < 0.25)

3D

MUGEN COATING 2-Flute Long Taper Neck Ball End Mill

MUGEN COATING 2-Flute Long Taper Neck Ball End Mill

Taper neck to improve tool rigidity. L/D up to 36.  
Option of same taper angle as inclined working angle

R < 0.25  
R ≥ 0.25

R ± 0.005  
R ± 0.01

It is possible to increase rigidity with the neck taper.  
The volume of depth of cut will be more than conventional end mills.

Effective Inclined Angle α

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |    |    |
|----------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|----|----|
| 08-00570-01020 | R0.1       | 30°                  | 1                      | 0.21           | 0.2               | 0.4                      | 12°                    | 0°19′                        | 4              | 50                 |    |    |
| 08-00570-01021 |            |                      | 1.5                    | 0.22           | 0.2               | 0.4                      | 12°                    | 0°23′                        | 4              | 50                 |    |    |
| 08-00570-01022 |            |                      | 2                      | 0.23           | 0.2               | 0.4                      | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-01040 |            | 1°                   | 1                      | 0.22           | 0.2               | 0.4                      | 12°                    | 0°38′                        | 4              | 50                 |    |    |
| 08-00570-01041 |            |                      | 1.5                    | 0.24           | 0.2               | 0.4                      | 12°                    | 0°47′                        | 4              | 50                 |    |    |
| 08-00570-01042 |            |                      | 2                      | 0.26           | 0.2               | 0.4                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-01050 |            | 1°30′                | 1                      | 0.23           | 0.2               | 0.4                      | 12°                    | 0°57′                        | 4              | 50                 |    |    |
| 08-00570-01051 |            |                      | 1.5                    | 0.26           | 0.2               | 0.4                      | 12°                    | 1°11′                        | 4              | 50                 |    |    |
| 08-00570-01052 |            |                      | 2                      | 0.28           | 0.2               | 0.4                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-01060 |            | 2°                   | 1                      | 0.24           | 0.2               | 0.4                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-01061 |            |                      | 1.5                    | 0.28           | 0.2               | 0.4                      | 12°                    | 1°35′                        | 4              | 50                 |    |    |
| 08-00570-01062 |            |                      | 2                      | 0.31           | 0.2               | 0.4                      | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-01080 |            | 3°                   | 1                      | 0.26           | 0.2               | 0.4                      | 12°                    | 1°54′                        | 4              | 50                 |    |    |
| 08-00570-01081 |            |                      | 1.5                    | 0.32           | 0.2               | 0.4                      | 12°                    | 2°21′                        | 4              | 50                 |    |    |
| 08-00570-01082 |            |                      | 2                      | 0.37           | 0.2               | 0.4                      | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-01092 |            | 5°                   | 2                      | 0.48           | 0.2               | 0.4                      | 12°                    | 4°13′                        | 4              | 50                 |    |    |
| 08-00570-01521 | R0.15      | 30°                  | 3                      | 0.34           | 0.3               | 0.6                      | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-01540 |            |                      | 2                      | 0.35           | 0.3               | 0.6                      | 12°                    | 0°45′                        | 4              | 50                 |    |    |
| 08-00570-01541 |            | 1°                   | 3                      | 0.38           | 0.3               | 0.6                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-01550 |            |                      | 2                      | 0.37           | 0.3               | 0.6                      | 12°                    | 1°08′                        | 4              | 50                 |    |    |
| 08-00570-01551 |            | 1°30′                | 3                      | 0.43           | 0.3               | 0.6                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-01561 |            |                      | 3                      | 0.47           | 0.3               | 0.6                      | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-01581 |            | 3°                   | 3                      | 0.55           | 0.3               | 0.6                      | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-01591 |            |                      | 3                      | 0.72           | 0.3               | 0.6                      | 12°                    | 4°13′                        | 4              | 50                 |    |    |
| 08-00570-02021 | R0.2       | 30°                  | 2                      | 0.42           | 0.4               | 0.8                      | 12°                    | 0°20′                        | 4              | 50                 |    |    |
| 08-00570-02023 |            |                      | 3                      | 0.44           | 0.4               | 0.8                      | 12°                    | 0°24′                        | 4              | 50                 |    |    |
| 08-00570-02022 |            |                      | 4                      | 0.46           | 0.4               | 0.8                      | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-02041 |            | 1°                   | 2                      | 0.44           | 0.4               | 0.8                      | 12°                    | 0°40′                        | 4              | 50                 |    |    |
| 08-00570-02043 |            |                      | 3                      | 0.48           | 0.4               | 0.8                      | 12°                    | 0°47′                        | 4              | 50                 |    |    |
| 08-00570-02042 |            |                      | 4                      | 0.51           | 0.4               | 0.8                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-02051 |            |                      | R0.2                   | 1°30′          | 2                 | 0.46                     | 0.4                    | 0.8                          | 12°            | 1°00′              | 4  | 50 |
| 08-00570-02053 |            |                      |                        |                | 3                 | 0.52                     | 0.4                    | 0.8                          | 12°            | 1°11′              | 4  | 50 |
| 08-00570-02052 | 4          | 0.57                 |                        |                | 0.4               | 0.8                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-02061 | 2°         | 2                    |                        | 0.48           | 0.4               | 0.8                      | 12°                    | 1°20′                        | 4              | 50                 |    |    |
| 08-00570-02063 |            | 3                    |                        | 0.55           | 0.4               | 0.8                      | 12°                    | 1°34′                        | 4              | 50                 |    |    |
| 08-00570-02062 | 4°         | 4                    | 0.62                   | 0.4            | 0.8               | 12°                      | 1°41′                  | 4                            | 50             |                    |    |    |
| 08-00570-02081 |            | 3°                   | 2                      | 0.53           | 0.4               | 0.8                      | 12°                    | 2°00′                        | 4              | 50                 |    |    |
| 08-00570-02082 | 4          |                      | 0.74                   | 0.4            | 0.8               | 12°                      | 2°31′                  | 4                            | 50             |                    |    |    |
| 08-00570-02092 | 5°         | 4                    | 0.96                   | 0.4            | 0.8               | 12°                      | 4°13′                  | 4                            | 50             |                    |    |    |
| 08-00570-02521 |            | R0.25                | 30′                    | 3              | 0.53              | 0.5                      | 1                      | 12°                          | 0°22′          | 4                  | 50 |    |
| 08-00570-02522 | 5          |                      |                        | 0.57           | 0.5               | 1                        | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-02541 | 1°         |                      | 3                      | 0.57           | 0.5               | 1                        | 12°                    | 0°44′                        | 4              | 50                 |    |    |
| 08-00570-02542 |            |                      | 5                      | 0.64           | 0.5               | 1                        | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-02551 | 1°30′      |                      | 3                      | 0.6            | 0.5               | 1                        | 12°                    | 1°06′                        | 4              | 50                 |    |    |
| 08-00570-02552 |            |                      | 5                      | 0.71           | 0.5               | 1                        | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-02561 | 2°         |                      | 3                      | 0.64           | 0.5               | 1                        | 12°                    | 1°27′                        | 4              | 50                 |    |    |
| 08-00570-02562 |            |                      | 5                      | 0.78           | 0.5               | 1                        | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-02581 | 3°         |                      | 3                      | 0.71           | 0.5               | 1                        | 12°                    | 2°11′                        | 4              | 50                 |    |    |
| 08-00570-02582 |            |                      | 5                      | 0.92           | 0.5               | 1                        | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-02592 | 5°         | 5                    | 1.2                    | 0.5            | 1                 | 12°                      | 4°13′                  | 4                            | 50             |                    |    |    |
| 08-00570-03021 |            | R0.3                 | 30′                    | 5              | 0.67              | 0.6                      | 1.2                    | 12°                          | 0°24′          | 4                  | 50 |    |
| 08-00570-03022 | 8          |                      |                        | 0.72           | 0.6               | 1.2                      | 12°                    | 0°27′                        | 4              | 50                 |    |    |
| 08-00570-03040 | 1°         |                      | 4                      | 0.7            | 0.6               | 1.2                      | 12°                    | 0°45′                        | 4              | 50                 |    |    |
| 08-00570-03041 |            |                      | 5                      | 0.73           | 0.6               | 1.2                      | 12°                    | 0°49′                        | 4              | 50                 |    |    |
| 08-00570-03043 |            |                      | 6                      | 0.77           | 0.6               | 1.2                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-03042 |            |                      | 8                      | 0.84           | 0.6               | 1.2                      | 12°                    | 0°53′                        | 4              | 50                 |    |    |
| 08-00570-03051 | 1°30′      |                      | 5                      | 0.8            | 0.6               | 1.2                      | 12°                    | 1°13′                        | 4              | 50                 |    |    |
| 08-00570-03052 |            |                      | 8                      | 0.96           | 0.6               | 1.2                      | 12°                    | 1°19′                        | 4              | 50                 |    |    |
| 08-00570-03061 | 2°         |                      | 6                      | 0.94           | 0.6               | 1.2                      | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-03062 |            |                      | 8                      | 1.07           | 0.6               | 1.2                      | 12°                    | 1°46′                        | 4              | 50                 |    |    |
| 08-00570-03081 | 3°         |                      | 6                      | 1.1            | 0.6               | 1.2                      | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-03082 |            |                      | 8                      | 1.31           | 0.6               | 1.2                      | 12°                    | 2°39′                        | 4              | 50                 |    |    |
| 08-00570-03092 | 5°         |                      | 8                      | 1.79           | 0.6               | 1.2                      | 12°                    | 4°25′                        | 4              | 50                 |    |    |
| 08-00570-04021 |            |                      | R0.4                   | 30′            | 8                 | 0.91                     | 0.8                    | 1.6                          | 12°            | 0°25′              | 4  | 50 |
| 08-00570-04022 | 12         |                      |                        |                | 0.98              | 0.8                      | 1.6                    | 12°                          | 0°27′          | 4                  | 60 |    |
| 08-00570-04041 | 1°         |                      |                        | 8              | 1.02              | 0.8                      | 1.6                    | 12°                          | 0°50′          | 4                  | 50 |    |
| 08-00570-04042 |            | 12                   |                        | 1.16           | 0.8               | 1.6                      | 12°                    | 0°54′                        | 4              | 60                 |    |    |
| 08-00570-04051 | 1°30′      | 8                    |                        | 1.14           | 0.8               | 1.6                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-04052 |            | 12                   |                        | 1.34           | 0.8               | 1.6                      | 12°                    | 1°21′                        | 4              | 60                 |    |    |
| 08-00570-04061 | 2°         | 8                    |                        | 1.25           | 0.8               | 1.6                      | 12°                    | 1°42′                        | 4              | 50                 |    |    |
| 08-00570-04062 |            | 12                   |                        | 1.53           | 0.8               | 1.6                      | 12°                    | 1°48′                        | 4              | 60                 |    |    |

How to Order

When you order, indicate MRBTN230 (R)×(θ)×(ℓ1). ※(γ) is reference value.

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

Hardened Steel

MRBTN230

R0.1 × neck taper angle30° ~  
Size R2 × neck taper angle1°

MG

2

30°

R ± 0.005  
(R < 0.25)

3D

MUGEN COATING 2-Flute Long Taper Neck Ball End Mill

MUGEN COATING 2-Flute Long Taper Neck Ball End Mill

Taper neck to improve tool rigidity. L/D up to 36.  
Option of same taper angle as inclined working angle

R < 0.25  
R ≥ 0.25

R ± 0.005  
R ± 0.01

It is possible to increase rigidity with the neck taper.  
The volume of depth of cut will be more than conventional end mills.

Effective Inclined Angle α

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |    |    |
|----------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|----|----|
| 08-00570-01020 | R0.1       | 30°                  | 1                      | 0.21           | 0.2               | 0.4                      | 12°                    | 0°19′                        | 4              | 50                 |    |    |
| 08-00570-01021 |            |                      | 1.5                    | 0.22           | 0.2               | 0.4                      | 12°                    | 0°23′                        | 4              | 50                 |    |    |
| 08-00570-01022 |            |                      | 2                      | 0.23           | 0.2               | 0.4                      | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-01040 |            | 1°                   | 1                      | 0.22           | 0.2               | 0.4                      | 12°                    | 0°38′                        | 4              | 50                 |    |    |
| 08-00570-01041 |            |                      | 1.5                    | 0.24           | 0.2               | 0.4                      | 12°                    | 0°47′                        | 4              | 50                 |    |    |
| 08-00570-01042 |            |                      | 2                      | 0.26           | 0.2               | 0.4                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-01050 |            | 1°30′                | 1                      | 0.23           | 0.2               | 0.4                      | 12°                    | 0°57′                        | 4              | 50                 |    |    |
| 08-00570-01051 |            |                      | 1.5                    | 0.26           | 0.2               | 0.4                      | 12°                    | 1°11′                        | 4              | 50                 |    |    |
| 08-00570-01052 |            |                      | 2                      | 0.28           | 0.2               | 0.4                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-01060 |            | 2°                   | 1                      | 0.24           | 0.2               | 0.4                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-01061 |            |                      | 1.5                    | 0.28           | 0.2               | 0.4                      | 12°                    | 1°35′                        | 4              | 50                 |    |    |
| 08-00570-01062 |            |                      | 2                      | 0.31           | 0.2               | 0.4                      | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-01080 |            | 3°                   | 1                      | 0.26           | 0.2               | 0.4                      | 12°                    | 1°54′                        | 4              | 50                 |    |    |
| 08-00570-01081 |            |                      | 1.5                    | 0.32           | 0.2               | 0.4                      | 12°                    | 2°21′                        | 4              | 50                 |    |    |
| 08-00570-01082 |            |                      | 2                      | 0.37           | 0.2               | 0.4                      | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-01092 |            | 5°                   | 2                      | 0.48           | 0.2               | 0.4                      | 12°                    | 4°13′                        | 4              | 50                 |    |    |
| 08-00570-01521 | R0.15      | 30°                  | 3                      | 0.34           | 0.3               | 0.6                      | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-01540 |            |                      | 2                      | 0.35           | 0.3               | 0.6                      | 12°                    | 0°45′                        | 4              | 50                 |    |    |
| 08-00570-01541 |            | 1°                   | 3                      | 0.38           | 0.3               | 0.6                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-01550 |            |                      | 2                      | 0.37           | 0.3               | 0.6                      | 12°                    | 1°08′                        | 4              | 50                 |    |    |
| 08-00570-01551 |            | 1°30′                | 3                      | 0.43           | 0.3               | 0.6                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-01561 |            |                      | 3                      | 0.47           | 0.3               | 0.6                      | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-01581 |            | 3°                   | 3                      | 0.55           | 0.3               | 0.6                      | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-01591 |            |                      | 3                      | 0.72           | 0.3               | 0.6                      | 12°                    | 4°13′                        | 4              | 50                 |    |    |
| 08-00570-02021 | R0.2       | 30°                  | 2                      | 0.42           | 0.4               | 0.8                      | 12°                    | 0°20′                        | 4              | 50                 |    |    |
| 08-00570-02023 |            |                      | 3                      | 0.44           | 0.4               | 0.8                      | 12°                    | 0°24′                        | 4              | 50                 |    |    |
| 08-00570-02022 |            |                      | 4                      | 0.46           | 0.4               | 0.8                      | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-02041 |            | 1°                   | 2                      | 0.44           | 0.4               | 0.8                      | 12°                    | 0°40′                        | 4              | 50                 |    |    |
| 08-00570-02043 |            |                      | 3                      | 0.48           | 0.4               | 0.8                      | 12°                    | 0°47′                        | 4              | 50                 |    |    |
| 08-00570-02042 |            |                      | 4                      | 0.51           | 0.4               | 0.8                      | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-02051 |            |                      | R0.2                   | 1°30′          | 2                 | 0.46                     | 0.4                    | 0.8                          | 12°            | 1°00′              | 4  | 50 |
| 08-00570-02053 |            |                      |                        |                | 3                 | 0.52                     | 0.4                    | 0.8                          | 12°            | 1°11′              | 4  | 50 |
| 08-00570-02052 | 4          | 0.57                 |                        |                | 0.4               | 0.8                      | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-02061 | 2°         | 2                    |                        | 0.48           | 0.4               | 0.8                      | 12°                    | 1°20′                        | 4              | 50                 |    |    |
| 08-00570-02063 |            | 3                    |                        | 0.55           | 0.4               | 0.8                      | 12°                    | 1°34′                        | 4              | 50                 |    |    |
| 08-00570-02062 | 4°         | 4                    | 0.62                   | 0.4            | 0.8               | 12°                      | 1°41′                  | 4                            | 50             |                    |    |    |
| 08-00570-02081 |            | 3°                   | 2                      | 0.53           | 0.4               | 0.8                      | 12°                    | 2°00′                        | 4              | 50                 |    |    |
| 08-00570-02082 | 4          |                      | 0.74                   | 0.4            | 0.8               | 12°                      | 2°31′                  | 4                            | 50             |                    |    |    |
| 08-00570-02092 | 5°         | 4                    | 0.96                   | 0.4            | 0.8               | 12°                      | 4°13′                  | 4                            | 50             |                    |    |    |
| 08-00570-02521 |            | R0.25                | 30′                    | 3              | 0.53              | 0.5                      | 1                      | 12°                          | 0°22′          | 4                  | 50 |    |
| 08-00570-02522 | 5          |                      |                        | 0.57           | 0.5               | 1                        | 12°                    | 0°25′                        | 4              | 50                 |    |    |
| 08-00570-02541 | 1°         |                      | 3                      | 0.57           | 0.5               | 1                        | 12°                    | 0°44′                        | 4              | 50                 |    |    |
| 08-00570-02542 |            |                      | 5                      | 0.64           | 0.5               | 1                        | 12°                    | 0°51′                        | 4              | 50                 |    |    |
| 08-00570-02551 | 1°30′      |                      | 3                      | 0.6            | 0.5               | 1                        | 12°                    | 1°06′                        | 4              | 50                 |    |    |
| 08-00570-02552 |            |                      | 5                      | 0.71           | 0.5               | 1                        | 12°                    | 1°16′                        | 4              | 50                 |    |    |
| 08-00570-02561 | 2°         |                      | 3                      | 0.64           | 0.5               | 1                        | 12°                    | 1°27′                        | 4              | 50                 |    |    |
| 08-00570-02562 |            |                      | 5                      | 0.78           | 0.5               | 1                        | 12°                    | 1°41′                        | 4              | 50                 |    |    |
| 08-00570-02581 | 3°         |                      | 3                      | 0.71           | 0.5               | 1                        | 12°                    | 2°11′                        | 4              | 50                 |    |    |
| 08-00570-02582 |            |                      | 5                      | 0.92           | 0.5               | 1                        | 12°                    | 2°32′                        | 4              | 50                 |    |    |
| 08-00570-02592 | 5°         | 5                    | 1.2                    | 0.5            | 1                 | 12°                      | 4°13′                  | 4                            | 50             |                    |    |    |
| 08-00570-03021 |            | R0.3                 | 30′                    | 5              | 0.67              | 0.6                      | 1.2                    | 12°                          | 0°24′          | 4                  | 50 |    |
| 08-00570-03022 | 8          |                      |                        | 0.72           | 0.6               | 1.2                      | 12°</                  |                              |                |                    |    |    |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

P

Alloy Steel

P

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

N

Copper

N

Resin

N

~ 55  
HRC

Hardened Steel

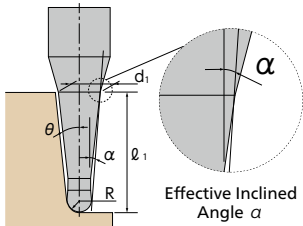
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Coating

Long Neck  
Tapered Ball

MRBTN230

MUGEN COATING 2-Flute Long Taper Neck Ball End Mill



Unit : mm

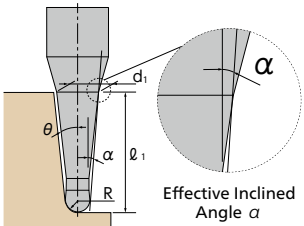
| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|
| 08-00570-04081 | R0.4       | 3°                   | 8                      | 1.47           | 0.8               | 1.6                      | 12°                    | 2°31′                        | 4              | 50                 |
| 08-00570-04082 |            |                      | 12                     | 1.89           | 0.8               | 1.6                      | 12°                    | 2°41′                        | 4              | 60                 |
| 08-00570-05021 |            | 30′                  | 10                     | 1.14           | 1                 | 2                        | 12°                    | 0°25′                        | 4              | 60                 |
| 08-00570-05022 |            |                      | 15                     | 1.23           | 1                 | 2                        | 12°                    | 0°27′                        | 4              | 60                 |
| 08-00570-05023 |            |                      | 20                     | 1.31           | 1                 | 2                        | 12°                    | 0°28′                        | 4              | 70                 |
| 08-00570-05024 |            |                      | 25                     | 1.41           | 1                 | 2                        | 12°                    | 0°29′                        | 4              | 70                 |
| 08-00570-05039 | R0.5       | 1°                   | 6                      | 1.14           | 1                 | 2                        | 12°                    | 0°43′                        | 4              | 60                 |
| 08-00570-05040 |            |                      | 8                      | 1.21           | 1                 | 2                        | 12°                    | 0°48′                        | 4              | 60                 |
| 08-00570-05041 |            |                      | 10                     | 1.28           | 1                 | 2                        | 12°                    | 0°50′                        | 4              | 60                 |
| 08-00570-05044 |            |                      | 12                     | 1.35           | 1                 | 2                        | 12°                    | 0°52′                        | 4              | 60                 |
| 08-00570-05042 |            |                      | 15                     | 1.45           | 1                 | 2                        | 12°                    | 0°54′                        | 4              | 60                 |
| 08-00570-05045 |            |                      | 16                     | 1.49           | 1                 | 2                        | 12°                    | 0°54′                        | 4              | 60                 |
| 08-00570-05043 |            | 1°30′                | 20                     | 1.63           | 1                 | 2                        | 12°                    | 0°55′                        | 4              | 70                 |
| 08-00570-05046 |            |                      | 22                     | 1.7            | 1                 | 2                        | 12°                    | 0°56′                        | 4              | 70                 |
| 08-00570-05047 |            |                      | 25                     | 1.8            | 1                 | 2                        | 12°                    | 0°56′                        | 4              | 70                 |
| 08-00570-05049 |            |                      | 6                      | 1.21           | 1                 | 2                        | 12°                    | 1°05′                        | 4              | 60                 |
| 08-00570-05050 |            |                      | 8                      | 1.31           | 1                 | 2                        | 12°                    | 1°12′                        | 4              | 60                 |
| 08-00570-05051 |            |                      | 10                     | 1.42           | 1                 | 2                        | 12°                    | 1°16′                        | 4              | 60                 |
| 08-00570-05054 |            |                      | 12                     | 1.52           | 1                 | 2                        | 12°                    | 1°18′                        | 4              | 60                 |
| 08-00570-05052 |            |                      | 15                     | 1.68           | 1                 | 2                        | 12°                    | 1°21′                        | 4              | 60                 |
| 08-00570-05055 |            |                      | 16                     | 1.73           | 1                 | 2                        | 12°                    | 1°21′                        | 4              | 60                 |
| 08-00570-05053 |            | 2°                   | 20                     | 1.94           | 1                 | 2                        | 12°                    | 1°23′                        | 4              | 70                 |
| 08-00570-05056 |            |                      | 22                     | 2.05           | 1                 | 2                        | 12°                    | 1°24′                        | 4              | 70                 |
| 08-00570-05057 |            |                      | 25                     | 2.2            | 1                 | 2                        | 12°                    | 1°24′                        | 4              | 70                 |
| 08-00570-05059 |            |                      | 36                     | 2.78           | 1                 | 2                        | 12°                    | 1°26′                        | 4              | 70                 |
| 08-00570-05061 |            |                      | 10                     | 1.56           | 1                 | 2                        | 12°                    | 1°41′                        | 4              | 60                 |
| 08-00570-05062 |            |                      | 15                     | 1.91           | 1                 | 2                        | 12°                    | 1°48′                        | 4              | 60                 |
| 08-00570-05063 |            | 3°                   | 20                     | 2.26           | 1                 | 2                        | 12°                    | 1°51′                        | 4              | 70                 |
| 08-00570-05081 |            |                      | 10                     | 1.84           | 1                 | 2                        | 12°                    | 2°31′                        | 4              | 60                 |
| 08-00570-05082 |            |                      | 15                     | 2.36           | 1                 | 2                        | 12°                    | 2°41′                        | 4              | 60                 |
| 08-00570-05083 |            | 5°                   | 20                     | 2.89           | 1                 | 2                        | 12°                    | 2°46′                        | 4              | 70                 |
| 08-00570-05092 |            |                      | 15                     | 3.27           | 1                 | 2                        | 12°                    | 4°28′                        | 6              | 60                 |
| 08-00570-05093 |            |                      | 20                     | 4.15           | 1                 | 2                        | 12°                    | 4°37′                        | 6              | 70                 |
| 08-00570-06021 | R0.6       | 30′                  | 12                     | 1.37           | 1.2               | 2.4                      | 12°                    | 0°25′                        | 4              | 60                 |
| 08-00570-06022 |            |                      | 24                     | 1.58           | 1.2               | 2.4                      | 12°                    | 0°28′                        | 4              | 70                 |
| 08-00570-06041 |            | 1°                   | 12                     | 1.54           | 1.2               | 2.4                      | 12°                    | 0°51′                        | 4              | 60                 |
| 08-00570-06042 |            |                      | 24                     | 1.95           | 1.2               | 2.4                      | 12°                    | 0°55′                        | 4              | 70                 |
| 08-00570-06051 |            | 1°30′                | 12                     | 1.7            | 1.2               | 2.4                      | 12°                    | 1°16′                        | 4              | 60                 |
| 08-00570-06052 |            |                      | 24                     | 2.33           | 1.2               | 2.4                      | 12°                    | 1°23′                        | 4              | 70                 |
| 08-00570-06061 |            | 2°                   | 12                     | 1.87           | 1.2               | 2.4                      | 12°                    | 1°41′                        | 4              | 60                 |
| 08-00570-06062 |            |                      | 24                     | 2.71           | 1.2               | 2.4                      | 12°                    | 1°51′                        | 4              | 70                 |

How to Order

When you order, indicate MRBTN230 (R)×(θ)×(ℓ1). ※(γ) is reference value.

MRBTN230

MUGEN COATING 2-Flute Long Taper Neck Ball End Mill



Unit : mm

| Code No.       | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Effective Inclined Angle (α) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|------------------------------|----------------|--------------------|
| 08-00570-06081 | R0.6       | 3°                   | 12                     | 2.21           | 1.2               | 2.4                      | 12°                    | 2°32′                        | 4              | 60                 |
| 08-00570-06082 |            |                      | 24                     | 3.46           | 1.2               | 2.4                      | 12°                    | 2°46′                        | 6              | 70                 |
| 08-00570-06091 |            | 5°                   | 12                     | 2.88           | 1.2               | 2.4                      | 12°                    | 4°13′                        | 4              | 60                 |
| 08-00570-06092 |            |                      | 24                     | 4.98           | 1.2               | 2.4                      | 12°                    | 4°37′                        | 6              | 70                 |
| 08-00570-07520 | R0.75      | 30′                  | 10                     | 1.62           | 1.5               | 3                        | 12°                    | 0°23′                        | 4              | 60                 |
| 08-00570-07521 |            |                      | 15                     | 1.71           | 1.5               | 3                        | 12°                    | 0°25′                        | 4              | 60                 |
| 08-00570-07522 |            | 1°                   | 30                     | 1.97           | 1.5               | 3                        | 12°                    | 0°28′                        | 4              | 70                 |
| 08-00570-07540 |            |                      | 10                     | 1.74           | 1.5               | 3                        | 12°                    | 0°45′                        | 4              | 60                 |
| 08-00570-07541 |            |                      | 15                     | 1.92           | 1.5               | 3                        | 12°                    | 0°51′                        | 4              | 60                 |
| 08-00570-07543 |            |                      | 20                     | 2.09           | 1.5               | 3                        | 12°                    | 0°53′                        | 4              | 60                 |
| 08-00570-07544 |            |                      | 30                     | 2.44           | 1.5               | 3                        | 12°                    | 0°55′                        | 4              | 70                 |
| 08-00570-07550 |            | 1°30′                | 10                     | 1.87           | 1.5               | 3                        | 12°                    | 1°08′                        | 4              | 60                 |
| 08-00570-07551 |            |                      | 15                     | 2.13           | 1.5               | 3                        | 12°                    | 1°16′                        | 4              | 60                 |
| 08-00570-07552 |            |                      | 30                     | 2.91           | 1.5               | 3                        | 12°                    | 1°23′                        | 4              | 70                 |
| 08-00570-07560 |            | 2°                   | 10                     | 1.99           | 1.5               | 3                        | 12°                    | 1°31′                        | 4              | 60                 |
| 08-00570-07561 |            |                      | 15                     | 2.34           | 1.5               | 3                        | 12°                    | 1°41′                        | 4              | 60                 |
| 08-00570-07563 |            |                      | 20                     | 2.69           | 1.5               | 3                        | 12°                    | 1°46′                        | 4              | 60                 |
| 08-00570-07562 |            |                      | 30                     | 3.39           | 1.5               | 3                        | 12°                    | 1°51′                        | 6              | 70                 |
| 08-00570-07581 |            | 3°                   | 15                     | 2.76           | 1.5               | 3                        | 12°                    | 2°32′                        | 4              | 60                 |
| 08-00570-07583 |            |                      | 20                     | 3.28           | 1.5               | 3                        | 12°                    | 2°39′                        | 4              | 60                 |
| 08-00570-07582 |            |                      | 30                     | 4.33           | 1.5               | 3                        | 12°                    | 2°46′                        | 6              | 70                 |
| 08-00570-07591 |            | 5°                   | 15                     | 3.6            | 1.5               | 3                        | 12°                    | 4°13′                        | 6              | 60                 |
| 08-00570-07592 |            |                      | 28.7                   | 6              | 1.5               | 3                        | —                      | 4°36′                        | 6              | 70                 |
| 08-00570-10019 |            | 30′                  | 12                     | 2.14           | 2                 | 4                        | 12°                    | 0°21′                        | 4              | 60                 |
| 08-00570-10020 |            |                      | 16                     | 2.21           | 2                 | 4                        | 12°                    | 0°24′                        | 4              | 60                 |
| 08-00570-10021 |            |                      | 20                     | 2.28           | 2                 | 4                        | 12°                    | 0°25′                        | 4              | 60                 |
| 08-00570-10022 |            |                      | 30                     | 2.45           | 2                 | 4                        | 12°                    | 0°27′                        | 4              | 70                 |
| 08-00570-10023 |            | 1°                   | 40                     | 2.63           | 2                 | 4                        | 12°                    | 0°28′                        | 4              | 80                 |
| 08-00570-10039 |            |                      | 12                     | 2.28           | 2                 | 4                        | 12°                    | 0°43′                        | 4              | 60                 |
| 08-00570-10040 |            |                      | 16                     | 2.42           | 2                 | 4                        | 12°                    | 0°48′                        | 4              | 60                 |
| 08-00570-10041 |            |                      | 20                     | 2.56           | 2                 | 4                        | 12°                    | 0°51′                        | 4              | 60                 |
| 08-00570-10044 |            |                      | 25                     | 2.73           | 2                 | 4                        | 12°                    | 0°53′                        | 4              | 60                 |
| 08-00570-10042 |            |                      | 30                     | 2.91           | 2                 | 4                        | 12°                    | 0°54′                        | 4              | 70                 |
| 08-00570-10045 |            | 1°30′                | 35                     | 3.08           | 2                 | 4                        | 12°                    | 0°55′                        | 4              | 80                 |
| 08-00570-10043 |            |                      | 40                     | 3.26           | 2                 | 4                        | 12°                    | 0°55′                        | 6              | 80                 |
| 08-00570-10049 |            |                      | 12                     | 2.42           | 2                 | 4                        | 12°                    | 1°05′                        | 4              | 60                 |
| 08-00570-10050 |            |                      | 16                     | 2.63           | 2                 | 4                        | 12°                    | 1°12′                        | 4              | 60                 |
| 08-00570-10051 |            |                      | 20                     | 2.84           | 2                 | 4                        | 12°                    | 1°16′                        | 4              | 60                 |
| 08-00570-10054 |            |                      | 25                     | 3.1            | 2                 | 4                        | 12°                    | 1°19′                        | 4              | 60                 |
| 08-00570-10052 |            |                      | 30                     | 3.36           | 2                 | 4                        | 12°                    | 1°21′                        | 6              | 70                 |
| 08-00570-10055 |            |                      | 35                     | 3.62           | 2                 | 4                        | 12°                    | 1°22′                        | 6              | 80                 |
| 08-00570-10053 |            |                      | 40                     | 3.89           | 2                 | 4                        | 12°                    | 1°23′                        | 6              | 80                 |

~ 55  
HRC

Hardened Steel

H

Coating

Long Neck  
Tapered Ball





Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

Copper

Resin

N

~ 55  
HRC

Hardened Steel

H



MRBTN230

Recommended Milling Conditions

| Work Material |                  |                   | Carbon Steels・Alloy Steels・Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK |       |        |                   |
|---------------|------------------|-------------------|---------------------------------------------------------------------------|-------|--------|-------------------|
| Radius        | Neck Taper Angle | Under Neck Length | Depth of Cut                                                              |       | Feed   | Spindle Speed     |
|               |                  |                   | ap mm                                                                     | ae mm | mm/min | min <sup>-1</sup> |
| 0.4           | 30′              | 8                 | 0.01                                                                      | 0.02  | ~1,000 | 20,000            |
|               |                  | 12                | 0.01                                                                      | 0.02  |        |                   |
|               | 1°               | 8                 | 0.01                                                                      | 0.02  |        |                   |
|               |                  | 12                | 0.01                                                                      | 0.02  |        |                   |
|               | 1°30′            | 8                 | 0.02                                                                      | 0.03  |        |                   |
|               |                  | 12                | 0.02                                                                      | 0.03  |        |                   |
|               | 2°               | 8                 | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 12                | 0.03                                                                      | 0.05  |        |                   |
|               | 3°               | 8                 | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 12                | 0.03                                                                      | 0.05  |        |                   |
|               | 30′              | 10                | 0.01                                                                      | 0.03  |        |                   |
|               |                  | 15                | 0.01                                                                      | 0.02  |        |                   |
| 0.5           | 1°               | 20                | 0.01                                                                      | 0.01  | ~1,200 | 16,000~20,000     |
|               |                  | 25                | 0.005                                                                     | 0.005 |        |                   |
|               |                  | 6                 | 0.05                                                                      | 0.07  |        |                   |
|               |                  | 8                 | 0.03                                                                      | 0.06  |        |                   |
|               |                  | 10                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 12                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 15                | 0.02                                                                      | 0.03  |        |                   |
|               |                  | 16                | 0.01                                                                      | 0.03  |        |                   |
|               |                  | 20                | 0.01                                                                      | 0.02  |        |                   |
|               |                  | 22                | 0.01                                                                      | 0.01  |        |                   |
|               |                  | 25                | 0.005                                                                     | 0.01  |        |                   |
|               | 1°30′            | 6                 | 0.07                                                                      | 0.15  |        |                   |
|               |                  | 8                 | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 10                | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 12                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 15                | 0.02                                                                      | 0.03  |        |                   |
|               |                  | 16                | 0.02                                                                      | 0.03  |        |                   |
|               |                  | 20                | 0.01                                                                      | 0.05  |        |                   |
|               |                  | 22                | 0.01                                                                      | 0.01  |        |                   |
|               | 2°               | 25                | 0.005                                                                     | 0.01  |        |                   |
|               |                  | 36                | 0.003                                                                     | 0.005 |        |                   |
|               |                  | 10                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 15                | 0.02                                                                      | 0.05  |        |                   |
|               | 3°               | 20                | 0.01                                                                      | 0.03  |        |                   |
|               |                  | 10                | 0.07                                                                      | 0.15  |        |                   |
|               |                  | 15                | 0.03                                                                      | 0.05  |        |                   |
|               | 5°               | 20                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 15                | 0.07                                                                      | 0.2   |        |                   |
| 0.6           | 30′              | 20                | 0.03                                                                      | 0.05  | ~1,200 | 16,000~20,000     |
|               |                  | 24                | 0.01                                                                      | 0.01  |        |                   |
|               | 1°               | 12                | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 24                | 0.01                                                                      | 0.02  |        |                   |
|               | 1°30′            | 12                | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 24                | 0.02                                                                      | 0.02  |        |                   |
|               | 2°               | 12                | 0.04                                                                      | 0.05  |        |                   |
|               |                  | 24                | 0.02                                                                      | 0.03  |        |                   |
|               | 3°               | 12                | 0.04                                                                      | 0.07  |        |                   |
|               |                  | 24                | 0.03                                                                      | 0.03  |        |                   |
|               | 5°               | 12                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 24                | 0.03                                                                      | 0.05  |        |                   |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

Copper

Resin

N

~ 55  
HRC

Hardened Steel

H



| Work Material |                  |                   | Carbon Steels・Alloy Steels・Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK |       |        |                   |
|---------------|------------------|-------------------|---------------------------------------------------------------------------|-------|--------|-------------------|
| Radius        | Neck Taper Angle | Under Neck Length | Depth of Cut                                                              |       | Feed   | Spindle Speed     |
|               |                  |                   | ap mm                                                                     | ae mm | mm/min | min <sup>-1</sup> |
| 0.75          | 30′              | 10                | 0.1                                                                       | 0.2   | ~1,200 | 16,000~20,000     |
|               |                  | 15                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 30                | 0.01                                                                      | 0.01  |        |                   |
|               | 1°               | 10                | 0.1                                                                       | 0.2   |        |                   |
|               |                  | 15                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 20                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 30                | 0.01                                                                      | 0.01  |        |                   |
|               | 1°30′            | 10                | 0.1                                                                       | 0.2   |        |                   |
|               |                  | 15                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 30                | 0.01                                                                      | 0.02  |        |                   |
|               | 2°               | 10                | 0.1                                                                       | 0.3   |        |                   |
|               |                  | 15                | 0.05                                                                      | 0.12  |        |                   |
|               |                  | 20                | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 30                | 0.02                                                                      | 0.03  |        |                   |
|               | 3°               | 15                | 0.1                                                                       | 0.15  |        |                   |
|               |                  | 20                | 0.05                                                                      | 0.07  |        |                   |
|               |                  | 30                | 0.03                                                                      | 0.05  |        |                   |
|               | 5°               | 15                | 0.1                                                                       | 0.2   |        |                   |
|               |                  | 28.7              | 0.05                                                                      | 0.07  |        |                   |
| 1             | 30′              | 12                | 0.1                                                                       | 0.2   | ~1,600 | 16,000~20,000     |
|               |                  | 16                | 0.07                                                                      | 0.15  |        |                   |
|               |                  | 20                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 30                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 40                | 0.01                                                                      | 0.015 |        |                   |
|               | 1°               | 12                | 0.1                                                                       | 0.25  |        |                   |
|               |                  | 16                | 0.08                                                                      | 0.15  |        |                   |
|               |                  | 20                | 0.05                                                                      | 0.1   |        |                   |
|               |                  | 25                | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 30                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 35                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 40                | 0.01                                                                      | 0.02  |        |                   |
|               | 1°30′            | 12                | 0.15                                                                      | 0.3   |        |                   |
|               |                  | 16                | 0.1                                                                       | 0.15  |        |                   |
|               |                  | 20                | 0.05                                                                      | 0.12  |        |                   |
|               |                  | 25                | 0.03                                                                      | 0.07  |        |                   |
|               |                  | 30                | 0.03                                                                      | 0.05  |        |                   |
|               |                  | 35                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 40                | 0.01                                                                      | 0.02  |        |                   |
|               | 2°               | 12                | 0.2                                                                       | 0.3   |        |                   |
|               |                  | 16                | 0.1                                                                       | 0.2   |        |                   |
|               |                  | 20                | 0.07                                                                      | 0.15  |        |                   |
|               |                  | 30                | 0.03                                                                      | 0.1   |        |                   |
|               |                  | 40                | 0.02                                                                      | 0.03  |        |                   |
|               | 3°               | 12                | 0.2                                                                       | 0.5   |        |                   |
|               |                  | 16                | 0.1                                                                       | 0.3   |        |                   |
|               |                  | 20                | 0.07                                                                      | 0.2   |        |                   |
|               |                  | 30                | 0.05                                                                      | 0.1   |        |                   |
|               | 5°               | 40                | 0.02                                                                      | 0.05  |        |                   |
|               |                  | 20                | 0.1                                                                       | 0.3   |        |                   |
|               |                  | 26.8              | 0.08                                                                      | 0.2   |        |                   |
|               |                  | 38.2              | 0.05                                                                      | 0.12  |        |                   |



Regular Line  
MUGEN COATING  
Long Neck Type

☒ Carbon Steel **P**

☐ Alloy Steel **P**

☐ Prehardened Steel **P**

☒ Stainless Steel **M**

☐ Aluminium Alloy **N**

☐ Copper **N**

☐ Resin **N**

☐ ~ 55 HRC  
Hardened Steel **H**

Coating  
Long Neck  
Tapered Ball

MRBTN230

Recommended Milling Conditions

| Work Material |                                                                                                                                                                                                                                                                                                                                                                                                                      |                   | Carbon Steels・Alloy Steels・Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK |       |        |                   |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------|-------|--------|-------------------|
| Radius        | Neck Taper Angle                                                                                                                                                                                                                                                                                                                                                                                                     | Under Neck Length | Depth of Cut                                                              |       | Feed   | Spindle Speed     |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      |                   | ap mm                                                                     | ae mm | mm/min | min <sup>-1</sup> |
| 1.5           | 30′                                                                                                                                                                                                                                                                                                                                                                                                                  | 15                | 0.15                                                                      | 0.3   | ~1,600 | 16,000            |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 20                | 0.08                                                                      | 0.1   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 30                | 0.03                                                                      | 0.05  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 40                | 0.02                                                                      | 0.03  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 50                | 0.01                                                                      | 0.01  |        |                   |
|               | 1°                                                                                                                                                                                                                                                                                                                                                                                                                   | 15                | 0.15                                                                      | 0.3   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 20                | 0.1                                                                       | 0.15  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 30                | 0.05                                                                      | 0.07  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 40                | 0.02                                                                      | 0.05  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 50                | 0.01                                                                      | 0.02  |        |                   |
|               | 1°30′                                                                                                                                                                                                                                                                                                                                                                                                                | 15                | 0.2                                                                       | 0.3   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 20                | 0.15                                                                      | 0.2   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 30                | 0.07                                                                      | 0.1   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 40                | 0.03                                                                      | 0.05  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 50                | 0.02                                                                      | 0.03  |        |                   |
|               | 2°                                                                                                                                                                                                                                                                                                                                                                                                                   | 15                | 0.2                                                                       | 0.3   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 20                | 0.15                                                                      | 0.2   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 30                | 0.1                                                                       | 0.1   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 48.9              | 0.03                                                                      | 0.05  |        |                   |
|               | 3°                                                                                                                                                                                                                                                                                                                                                                                                                   | 20                | 0.2                                                                       | 0.3   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 30                | 0.1                                                                       | 0.15  |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 50                | 0.05                                                                      | 0.1   |        |                   |
|               | 5°                                                                                                                                                                                                                                                                                                                                                                                                                   | 23.1              | 0.2                                                                       | 0.3   |        |                   |
| 2             | 30′                                                                                                                                                                                                                                                                                                                                                                                                                  | 20                | 0.2                                                                       | 0.3   | ~1,400 | 14,000            |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 40                | 0.05                                                                      | 0.1   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 60                | 0.01                                                                      | 0.02  |        |                   |
|               | 1°                                                                                                                                                                                                                                                                                                                                                                                                                   | 20                | 0.2                                                                       | 0.5   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 40                | 0.07                                                                      | 0.2   |        |                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                      | 60                | 0.01                                                                      | 0.03  |        |                   |
| Notes         | ※1 When deciding milling condition in case the effective length is long and/or the neck taper angle is small, it is recommended both axial depth of cut and radial depth of cut values are chosen at lower level within the specified range.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Use cutting fluid with smoke retardant.<br>※4 We recommend using oil mist coolant for hardened steels. |                   |                                                                           |       |        |                   |



Regular Line  
MUGEN COATING  
Long Neck Type

**P** Carbon Steel ☒

**P** Alloy Steel ☐

**P** Prehardened Steel ☐

**M** Stainless Steel ☐

**N** Aluminium Alloy ☐

**N** Copper ☐

**N** Resin ☐

**H** ~ 55 HRC  
Hardened Steel

Coating  
Long Neck  
Tapered Ball

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55 HRC

Hardened Steel

H

Long Neck  
Tapered Ball

Coating

MRBTN230L

R0.1 × neck taper angle30' ~  
Size R5 × neck taper angle1° 30'

∞

≤55  
HRC

MUGEN COATING 2-Flute Extra Long Taper Neck Ball End Mill

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55 HRC

Hardened Steel

H

Long Neck  
Tapered Ball

Coating

Taper neck to improve tool rigidity.  
L/D up to 80. Option of same taper angle as inclined working angle

MG

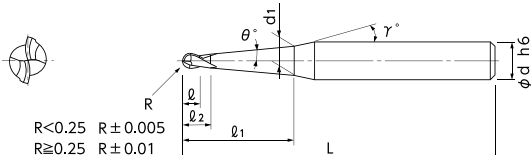
2

30°

R ± 0.005  
(R < 0.25)

3D





● ■ : Semi-standard item, please inquire for price and delivery.

| Code No.         | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|----------------|--------------------|
| ■ 08-00580-01021 | R0.1       | 30′                  | 2.5                    | 0.24           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01022 |            |                      | 3                      | 0.25           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01041 |            | 1°                   | 2.5                    | 0.27           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01042 |            |                      | 3                      | 0.29           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01051 |            | 1°30′                | 2.5                    | 0.31           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01052 |            |                      | 3                      | 0.34           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01061 |            | 2°                   | 2.5                    | 0.35           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01062 |            |                      | 3                      | 0.38           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01081 |            | 3°                   | 2.5                    | 0.42           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01082 |            |                      | 3                      | 0.47           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01092 |            | 5°                   | 3                      | 0.65           | 0.2               | 0.4                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01521 |            | R0.15                | 30′                    | 4              | 0.36              | 0.3                      | 0.5                    | 12°            | 4                  |
| ■ 08-00580-01541 | 1°         |                      | 4                      | 0.42           | 0.3               | 0.5                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01551 | 1°30′      |                      | 4                      | 0.48           | 0.3               | 0.5                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01561 | 2°         |                      | 4                      | 0.54           | 0.3               | 0.5                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01581 | 3°         |                      | 4                      | 0.67           | 0.3               | 0.5                      | 12°                    | 4              | 50                 |
| ■ 08-00580-01591 | 5°         |                      | 4                      | 0.91           | 0.3               | 0.5                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02021 | R0.2       | 30′                  | 5                      | 0.47           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02022 |            |                      | 6                      | 0.49           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02041 |            | 1°                   | 5                      | 0.55           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02042 |            |                      | 6                      | 0.58           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02051 |            | 1°30′                | 5                      | 0.62           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02052 |            |                      | 6                      | 0.67           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02061 |            | 2°                   | 5                      | 0.69           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02062 |            |                      | 6                      | 0.76           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02081 |            | 3°                   | 5                      | 0.84           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02082 |            |                      | 6                      | 0.95           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02092 |            | 5°                   | 6                      | 1.31           | 0.4               | 0.8                      | 12°                    | 4              | 50                 |
| ■ 08-00580-02521 |            | R0.25                | 30′                    | 6              | 0.59              | 0.5                      | 1                      | 12°            | 4                  |
| ■ 08-00580-02522 | 7          |                      |                        | 0.6            | 0.5               | 1                        | 12°                    | 4              | 50                 |
| ■ 08-00580-02541 | 1°         |                      | 6                      | 0.67           | 0.5               | 1                        | 12°                    | 4              | 50                 |
| ■ 08-00580-02542 |            |                      | 7                      | 0.71           | 0.5               | 1                        | 12°                    | 4              | 50                 |

How to Order

When you order, indicate MRBTN230L (R)×(θ)×(ℓ1).    ※(γ) is reference value.

MUGEN COATING 2-Flute Extra Long Taper Neck Ball End Mill

Unit : mm

| Code No.         | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Shank Dia. (d) | Overall Length (L) |    |
|------------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|----------------|--------------------|----|
| ■ 08-00580-02551 | R0.25      | 1°30′                | 6                      | 0.76           | 0.5               | 1                        | 12°                    | 4              | 50                 |    |
| ■ 08-00580-02552 |            |                      | 7                      | 0.81           | 0.5               | 1                        | 12°                    | 4              | 50                 |    |
| ■ 08-00580-02561 |            | 2°                   | 6                      | 0.85           | 0.5               | 1                        | 12°                    | 4              | 50                 |    |
| ■ 08-00580-02562 |            |                      | 7                      | 0.92           | 0.5               | 1                        | 12°                    | 4              | 50                 |    |
| ■ 08-00580-02581 |            | 3°                   | 6                      | 1.02           | 0.5               | 1                        | 12°                    | 4              | 50                 |    |
| ■ 08-00580-02582 |            |                      | 7                      | 1.13           | 0.5               | 1                        | 12°                    | 4              | 50                 |    |
| ■ 08-00580-02592 | 5°         | 7                    | 1.55                   | 0.5            | 1                 | 12°                      | 4                      | 50             |                    |    |
| ■ 08-00580-03021 | R0.3       | 30′                  | 10                     | 0.75           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03022 |            |                      | 12                     | 0.79           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03023 |            |                      | 20                     | 0.93           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03041 |            | 1°                   | 10                     | 0.91           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03042 |            |                      | 12                     | 0.98           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03043 |            |                      | 20                     | 1.26           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03051 |            | 1°30′                | 10                     | 1.06           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03052 |            |                      | 12                     | 1.17           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03053 |            |                      | 20                     | 1.58           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03061 |            | 2°                   | 10                     | 1.21           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03062 |            |                      | 12                     | 1.35           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03063 |            |                      | 20                     | 1.91           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03081 |            | 3°                   | 10                     | 1.52           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03082 |            |                      | 12                     | 1.73           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03083 |            |                      | 20                     | 2.57           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03091 |            | 5°                   | 10                     | 2.14           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03092 |            |                      | 12                     | 2.49           | 0.6               | 1.2                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-03093 |            |                      | 20                     | 4              | 0.6               | 1.2                      | —                      | 4              | 60                 |    |
| ■ 08-00580-04021 |            | R0.4                 | 30′                    | 16             | 1.05              | 0.8                      | 1.6                    | 12°            | 4                  | 60 |
| ■ 08-00580-04022 |            |                      |                        | 20             | 1.12              | 0.8                      | 1.6                    | 12°            | 4                  | 60 |
| ■ 08-00580-04041 |            |                      | 1°                     | 16             | 1.3               | 0.8                      | 1.6                    | 12°            | 4                  | 60 |
| ■ 08-00580-04042 |            |                      |                        | 20             | 1.44              | 0.8                      | 1.6                    | 12°            | 4                  | 60 |
| ■ 08-00580-04051 |            |                      | 1°30′                  | 16             | 1.55              | 0.8                      | 1.6                    | 12°            | 4                  | 60 |
| ■ 08-00580-04052 |            |                      |                        | 20             | 1.76              | 0.8                      | 1.6                    | 12°            | 4                  | 60 |
| ■ 08-00580-04061 | 2°         |                      | 16                     | 1.81           | 0.8               | 1.6                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-04062 |            |                      | 20                     | 2.09           | 0.8               | 1.6                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-04081 | 3°         |                      | 16                     | 2.31           | 0.8               | 1.6                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-04082 |            |                      | 20                     | 2.73           | 0.8               | 1.6                      | 12°                    | 4              | 60                 |    |
| ■ 08-00580-04092 | 5°         |                      | 19.8                   | 4              | 0.8               | 1.6                      | —                      | 4              | 60                 |    |
| ■ 08-00580-05021 | R0.5       |                      | 30′                    | 30             | 1.49              | 1                        | 2                      | 12°            | 4                  | 70 |
| ■ 08-00580-05022 |            | 50                   |                        | 1.84           | 1                 | 2                        | 12°                    | 4              | 90                 |    |
| ■ 08-00580-05023 |            | 80                   |                        | 2.36           | 1                 | 2                        | 12°                    | 4              | 130                |    |
| ■ 08-00580-05041 |            | 1°                   | 30                     | 1.98           | 1                 | 2                        | 12°                    | 4              | 70                 |    |
| ■ 08-00580-05042 |            |                      | 50                     | 2.68           | 1                 | 2                        | 12°                    | 4              | 90                 |    |
| ■ 08-00580-05043 |            |                      | 80                     | 3.72           | 1                 | 2                        | 12°                    | 4              | 130                |    |

I-054

I-055

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Coating  
Long Neck  
Tapered Ball

| MRBTN230L                                                                   |            |                      |                        |                |                   |                          |                        |                |                    | MRBTN230L                                                 |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
|-----------------------------------------------------------------------------|------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|----------------|--------------------|-----------------------------------------------------------|------------------|----------------------|------------------------|----------------|-------------------|--------------------------|------------------------|----------------|--------------------|--|--|--|
| MUGEN COATING 2-Flute Extra Long Taper Neck Ball End Mill                   |            |                      |                        |                |                   |                          |                        |                |                    | MUGEN COATING 2-Flute Extra Long Taper Neck Ball End Mill |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ● ■ : Semi-standard item, please inquire for price and delivery.            |            |                      |                        |                |                   |                          |                        |                |                    |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| Unit : mm                                                                   |            |                      |                        |                |                   |                          |                        |                |                    | Unit : mm                                                 |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| Code No.                                                                    | Radius (R) | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Shank Dia. (d) | Overall Length (L) | Code No.                                                  | Radius (R)       | Neck Taper Angle (θ) | Under Neck Length (ℓ1) | Neck Dia. (d1) | Length of Cut (ℓ) | Under Neck Length 2 (ℓ2) | Neck Taper Angle 2 (γ) | Shank Dia. (d) | Overall Length (L) |  |  |  |
| ■ 08-00580-05051                                                            | R0.5       | 1°30′                | 30                     | 2.47           | 1                 | 2                        | 12°                    | 4              | 70                 | ■ 08-00580-10081                                          | R1               | 3°                   | 50                     | 6.82           | 2                 | 4                        | 12°                    | 8              | 100                |  |  |  |
| ■ 08-00580-05052                                                            |            |                      | 50                     | 3.51           | 1                 | 2                        | 12°                    | 4              | 90                 | ■ 08-00580-10082                                          |                  |                      | 80.3                   | 10             | 2                 | 4                        | —                      | 10             | 130                |  |  |  |
| ■ 08-00580-05053                                                            |            |                      | 80                     | 5.09           | 1                 | 2                        | 12°                    | 6              | 130                | ■ 08-00580-10091                                          |                  | 5°                   | 49.7                   | 10             | 2                 | 4                        | —                      | 10             | 100                |  |  |  |
| ■ 08-00580-05061                                                            |            | 2°                   | 30                     | 2.96           | 1                 | 2                        | 12°                    | 4              | 70                 | ■ 08-00580-15021                                          | R1.5             | 30′                  | 80                     | 4.29           | 3                 | 6                        | 12°                    | 6              | 130                |  |  |  |
| ■ 08-00580-05062                                                            |            |                      | 50                     | 4.35           | 1                 | 2                        | 12°                    | 6              | 90                 | ■ 08-00580-15041                                          |                  | 1°                   | 80                     | 5.58           | 3                 | 6                        | 12°                    | 6              | 130                |  |  |  |
| ■ 08-00580-05063                                                            |            |                      | 73.5                   | 6              | 1                 | 2                        | —                      | 6              | 130                | ■ 08-00580-15051                                          |                  | 1°30′                | 80                     | 6.88           | 3                 | 6                        | 12°                    | 8              | 130                |  |  |  |
| ■ 08-00580-05081                                                            |            | 3°                   | 30.6                   | 4              | 1                 | 2                        | —                      | 4              | 70                 | ■ 08-00580-15061                                          |                  | 2°                   | 77.5                   | 8              | 3                 | 6                        | —                      | 8              | 130                |  |  |  |
| ■ 08-00580-05082                                                            |            |                      | 49.7                   | 6              | 1                 | 2                        | —                      | 6              | 90                 | ■ 08-00580-15081                                          |                  | 3°                   | 72.7                   | 10             | 3                 | 6                        | —                      | 10             | 130                |  |  |  |
| ■ 08-00580-05083                                                            |            |                      | 80                     | 9.18           | 1                 | 2                        | 12°                    | 10             | 130                | ■ 08-00580-20021                                          | R2               | 30′                  | 80                     | 5.26           | 4                 | 8                        | 12°                    | 6              | 130                |  |  |  |
| ■ 08-00580-05091                                                            |            | 5°                   | 30.5                   | 6              | 1                 | 2                        | —                      | 6              | 70                 | ■ 08-00580-20041                                          |                  | 1°                   | 80                     | 6.51           | 4                 | 8                        | 12°                    | 8              | 130                |  |  |  |
| ■ 08-00580-05092                                                            |            |                      | 53.4                   | 10             | 1                 | 2                        | —                      | 10             | 90                 | ■ 08-00580-20051                                          |                  | 1°30′                | 60                     | 6.72           | 4                 | 8                        | 12°                    | 8              | 110                |  |  |  |
| ■ 08-00580-06021                                                            | R0.6       |                      | 36                     | 1.79           | 1.2               | 2.4                      | 12°                    | 4              | 80                 | ■ 08-00580-20052                                          |                  |                      | 84.3                   | 8              | 4                 | 8                        | —                      | 8              | 130                |  |  |  |
| ■ 08-00580-06022                                                            | 1°         | 48                   | 2                      | 1.2            | 2.4               | 12°                      | 4                      | 90             | ■ 08-00580-20061   | 2°                                                        |                  | 60                   | 7.63                   | 4              | 8                 | 12°                      | 8                      | 110            |                    |  |  |  |
| ■ 08-00580-06041                                                            |            | 36                   | 2.37                   | 1.2            | 2.4               | 12°                      | 4                      | 80             | ■ 08-00580-20062   |                                                           |                  | 80                   | 9.03                   | 4              | 8                 | 12°                      | 10                     | 130            |                    |  |  |  |
| ■ 08-00580-06042                                                            |            | 48                   | 2.79                   | 1.2            | 2.4               | 12°                      | 4                      | 90             | ■ 08-00580-20081   | 3°                                                        |                  | 60                   | 9.45                   | 4              | 8                 | 12°                      | 10                     | 110            |                    |  |  |  |
| ■ 08-00580-06051                                                            | 1°30′      | 36                   | 2.96                   | 1.2            | 2.4               | 12°                      | 4                      | 80             | ■ 08-00580-20082   |                                                           |                  | 84.3                 | 12                     | 4              | 8                 | —                        | 12                     | 130            |                    |  |  |  |
| ■ 08-00580-06052                                                            |            | 48                   | 3.59                   | 1.2            | 2.4               | 12°                      | 4                      | 90             | ■ 08-00580-25021   | R2.5                                                      | 30′              | 50                   | 5.7                    | 5              | 10                | 12°                      | 6                      | 100            |                    |  |  |  |
| ■ 08-00580-06061                                                            | 2°         | 36                   | 3.55                   | 1.2            | 2.4               | 12°                      | 4                      | 80             | ■ 08-00580-25022   |                                                           |                  | 80                   | 6.22                   | 5              | 10                | 12°                      | 8                      | 130            |                    |  |  |  |
| ■ 08-00580-06062                                                            |            | 48                   | 4.38                   | 1.2            | 2.4               | 12°                      | 6                      | 90             | ■ 08-00580-25041   |                                                           | 1°               | 50                   | 6.4                    | 5              | 10                | 12°                      | 8                      | 100            |                    |  |  |  |
| ■ 08-00580-06081                                                            |            | 36                   | 4.72                   | 1.2            | 2.4               | 12°                      | 6                      | 80             | ■ 08-00580-25042   |                                                           |                  | 80                   | 7.44                   | 5              | 10                | 12°                      | 8                      | 130            |                    |  |  |  |
| ■ 08-00580-06082                                                            | 3°         | 48                   | 6                      | 1.2            | 2.4               | —                        | 6                      | 90             | ■ 08-00580-25051   |                                                           | 1°30′            | 50                   | 7.09                   | 5              | 10                | 12°                      | 8                      | 100            |                    |  |  |  |
| ■ 08-00580-06092                                                            |            | 41.2                 | 8                      | 1.2            | 2.4               | —                        | 8                      | 90             | ■ 08-00580-25052   |                                                           |                  | 80                   | 8.67                   | 5              | 10                | 12°                      | 10                     | 130            |                    |  |  |  |
| ■ 08-00580-07521                                                            | R0.75      | 30′                  | 45                     | 2.23           | 1.5               | 3                        | 12°                    | 4              | 90                 |                                                           | ■ 08-00580-25061 | 2°                   | 52.9                   | 8              | 5                 | 10                       | —                      | 8              | 100                |  |  |  |
| ■ 08-00580-07522                                                            |            |                      | 60                     | 2.49           | 1.5               | 3                        | 12°                    | 4              | 110                |                                                           | ■ 08-00580-25062 |                      | 81.5                   | 10             | 5                 | 10                       | —                      | 10             | 130                |  |  |  |
| ■ 08-00580-07541                                                            |            | 1°                   | 45                     | 2.97           | 1.5               | 3                        | 12°                    | 4              | 90                 |                                                           | ■ 08-00580-25081 | 3°                   | 57.7                   | 10             | 5                 | 10                       | —                      | 10             | 110                |  |  |  |
| ■ 08-00580-07542                                                            |            |                      | 60                     | 3.49           | 1.5               | 3                        | 12°                    | 4              | 110                | ■ 08-00580-30041                                          | R3               | 1°                   | 69.2                   | 8              | 6                 | 12                       | —                      | 8              | 130                |  |  |  |
| ■ 08-00580-07551                                                            |            | 1°30′                | 45                     | 3.7            | 1.5               | 3                        | 12°                    | 4              | 90                 | ■ 08-00580-30051                                          |                  | 1°30′                | 88.3                   | 10             | 6                 | 12                       | —                      | 10             | 140                |  |  |  |
| ■ 08-00580-07552                                                            |            |                      | 60                     | 4.49           | 1.5               | 3                        | 12°                    | 6              | 110                | ■ 08-00580-30061                                          |                  | 2°                   | 69.3                   | 10             | 6                 | 12                       | —                      | 10             | 130                |  |  |  |
| ■ 08-00580-07561                                                            |            | 2°                   | 45                     | 4.43           | 1.5               | 3                        | 12°                    | 6              | 90                 | ■ 08-00580-30081                                          |                  | 3°                   | 69.2                   | 12             | 6                 | 12                       | —                      | 12             | 130                |  |  |  |
| ■ 08-00580-07562                                                            |            |                      | 60                     | 5.48           | 1.5               | 3                        | 12°                    | 6              | 110                | ■ 08-00580-40041                                          | R4               | 1°                   | 73.2                   | 10             | 8                 | 16                       | —                      | 10             | 130                |  |  |  |
| ■ 08-00580-07581                                                            |            | 3°                   | 45.9                   | 6              | 1.5               | 3                        | —                      | 6              | 90                 | ■ 08-00580-40051                                          |                  | 1°30′                | 80                     | 11.35          | 8                 | 16                       | 12°                    | 12             | 130                |  |  |  |
| ■ 08-00580-07582                                                            |            |                      | 60                     | 7.47           | 1.5               | 3                        | 12°                    | 8              | 110                | ■ 08-00580-40061                                          |                  | 2°                   | 73.2                   | 12             | 8                 | 16                       | —                      | 12             | 130                |  |  |  |
| ■ 08-00580-07591                                                            |            | 5°                   | 45                     | 8.85           | 1.5               | 3                        | 12°                    | 10             | 90                 | ■ 08-00580-50041                                          | R5               | 1°                   | 77.2                   | 12             | 10                | 20                       | —                      | 12             | 130                |  |  |  |
| ■ 08-00580-07592                                                            |            |                      | 60                     | 11.47          | 1.5               | 3                        | 12°                    | 12             | 110                | ■ 08-00580-50051                                          |                  | 1°30′                | 58.2                   | 12             | 10                | 20                       | —                      | 12             | 110                |  |  |  |
| ■ 08-00580-10021                                                            | R1         | 30′                  | 50                     | 2.8            | 2                 | 4                        | 12°                    | 4              | 100                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10022                                                            |            |                      | 80                     | 3.33           | 2                 | 4                        | 12°                    | 4              | 130                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10041                                                            |            | 1°                   | 50                     | 3.61           | 2                 | 4                        | 12°                    | 4              | 100                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10042                                                            |            |                      | 80                     | 4.65           | 2                 | 4                        | 12°                    | 6              | 130                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10051                                                            |            | 1°30′                | 50                     | 4.41           | 2                 | 4                        | 12°                    | 6              | 100                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10052                                                            |            |                      | 80.3                   | 6              | 2                 | 4                        | —                      | 6              | 130                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10061                                                            |            | 2°                   | 50                     | 5.21           | 2                 | 4                        | 12°                    | 6              | 100                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| ■ 08-00580-10062                                                            |            |                      | 80                     | 7.31           | 2                 | 4                        | 12°                    | 8              | 130                |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| How to Order                                                                |            |                      |                        |                |                   |                          |                        |                |                    |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |
| When you order, indicate MRBTN230 (R)×(θ)×(ℓ1).    ※(γ) is reference value. |            |                      |                        |                |                   |                          |                        |                |                    |                                                           |                  |                      |                        |                |                   |                          |                        |                |                    |  |  |  |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC  
Hardened Steel

Coating  
Long Neck  
Tapered Ball

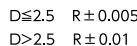
I-057



# MHR230R

## MUGEN COATING 2-Flute Long Neck Radius End Mill

The MG logo is shown in a black square. To its right are three icons: a square with a circular arrow and the number 2, a square with '30°' and a cross-section of a fillet, and a square with 'Corner R', a fillet symbol, and the text '±0.005 (0 ≤ z, 5)'. Below these are three icons for 'Side', 'Slot', and 'Face' features, each with a corresponding 3D model of a part.

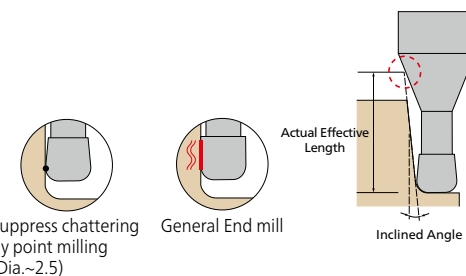


- $D > 2.5$   $R \pm 0.01$
- 
- Suppress chattering by point milling (Dia. ~2.5)
- General End mill
- Actual Effective Length
- Inclined Angle

Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |      |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°   | 1°30′ | 2°   | 3°   |
| 08-00221-02050 | 0.2         | R0.05                   | 0.5                                       | 0.15                    | 0.18                              | 12°                        | 4                    | 45                       | 0.57                                                                | 0.59 | 0.62  | 0.65 | 0.71 |
| 08-00220-02001 |             |                         | 0.5                                       |                         |                                   |                            | 6                    | 50                       | 0.57                                                                | 0.59 | 0.62  | 0.65 | 0.71 |
| 08-00221-02051 |             |                         | 1                                         |                         |                                   |                            | 4                    | 45                       | 1.09                                                                | 1.14 | 1.19  | 1.24 | 1.38 |
| 08-00220-02002 |             |                         | 1                                         |                         |                                   |                            | 6                    | 50                       | 1.09                                                                | 1.14 | 1.19  | 1.24 | 1.38 |
| 08-00221-02052 |             |                         | 1.5                                       |                         |                                   |                            | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| 08-00221-02053 |             |                         | 2                                         |                         |                                   |                            | 4                    | 45                       | 2.13                                                                | 2.23 | 2.33  | 2.44 | 2.71 |
| 08-00221-03050 | 0.3         | R0.05                   | 1                                         | 0.25                    | 0.28                              | 12°                        | 4                    | 45                       | 1.09                                                                | 1.14 | 1.19  | 1.24 | 1.38 |
| 08-00220-03001 |             |                         | 1                                         |                         |                                   |                            | 6                    | 50                       | 1.09                                                                | 1.14 | 1.19  | 1.24 | 1.38 |
| 08-00221-03051 |             |                         | 1.5                                       |                         |                                   |                            | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| 08-00221-03052 |             |                         | 2                                         |                         |                                   |                            | 4                    | 45                       | 2.13                                                                | 2.23 | 2.33  | 2.44 | 2.71 |
| 08-00220-03002 |             |                         | 2                                         |                         |                                   |                            | 6                    | 50                       | 2.13                                                                | 2.23 | 2.33  | 2.44 | 2.71 |
| 08-00221-03053 |             |                         | 2.5                                       |                         |                                   |                            | 4                    | 45                       | 2.65                                                                | 2.77 | 2.90  | 3.04 | 3.37 |
| 08-00221-03054 |             |                         | 3                                         |                         |                                   |                            | 4                    | 45                       | 3.18                                                                | 3.32 | 3.47  | 3.64 | 4.04 |
| 08-00221-04050 | 0.4         | R0.05                   | 1                                         | 0.3                     | 0.37                              | 12°                        | 4                    | 45                       | 1.11                                                                | 1.16 | 1.22  | 1.27 | 1.41 |
| 08-00221-04051 |             |                         | 1.5                                       |                         |                                   |                            | 4                    | 45                       | 1.64                                                                | 1.71 | 1.79  | 1.87 | 2.07 |
| 08-00221-04052 |             |                         | 2                                         |                         |                                   |                            | 4                    | 45                       | 2.16                                                                | 2.25 | 2.36  | 2.47 | 2.74 |
| 08-00220-04005 |             |                         | 2                                         |                         |                                   |                            | 6                    | 50                       | 2.16                                                                | 2.25 | 2.36  | 2.47 | 2.74 |
| 08-00221-04053 |             |                         | 3                                         |                         |                                   |                            | 4                    | 45                       | 3.20                                                                | 3.34 | 3.50  | 3.67 | 4.07 |
| 08-00220-04006 |             |                         | 3                                         |                         |                                   |                            | 6                    | 50                       | 3.20                                                                | 3.34 | 3.50  | 3.67 | 4.07 |
| 08-00221-04054 |             |                         | 4                                         |                         |                                   |                            | 4                    | 45                       | 4.24                                                                | 4.43 | 4.64  | 4.87 | 5.40 |
| 08-00220-04007 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.24                                                                | 4.43 | 4.64  | 4.87 | 5.40 |
| 08-00221-04100 |             | R0.1                    | 1                                         |                         |                                   |                            | 4                    | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.26 | 1.39 |
| 08-00221-04101 |             |                         | 1.5                                       |                         |                                   |                            | 4                    | 45                       | 1.63                                                                | 1.70 | 1.78  | 1.86 | 2.06 |
| 08-00221-04102 |             |                         | 2                                         |                         |                                   |                            | 4                    | 45                       | 2.16                                                                | 2.25 | 2.35  | 2.46 | 2.72 |
| 08-00220-04011 |             |                         | 2                                         |                         |                                   |                            | 6                    | 50                       | 2.16                                                                | 2.25 | 2.35  | 2.46 | 2.72 |
| 08-00221-04103 |             |                         | 3                                         |                         |                                   |                            | 4                    | 45                       | 3.20                                                                | 3.34 | 3.49  | 3.66 | 4.05 |
| 08-00220-04013 |             |                         | 3                                         |                         |                                   |                            | 6                    | 50                       | 3.20                                                                | 3.34 | 3.49  | 3.66 | 4.05 |
| 08-00221-04104 |             |                         | 4                                         |                         |                                   |                            | 4                    | 45                       | 4.24                                                                | 4.43 | 4.63  | 4.86 | 5.39 |
| 08-00220-04012 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.24                                                                | 4.43 | 4.63  | 4.86 | 5.39 |

$\otimes(\gamma)$  is reference value.



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |       |      |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|-------|------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°   | 1°30′ | 2°   | 3°    |      |
| 08-00221-05050 | 0.5         | R0.05                   | 1                                         | 0.4                     | 0.46                              | 12°                        | 4                    | 45                       | 1.14                                                                | 1.19 | 1.24  | 1.30 | 1.44  |      |
| 08-00221-05051 |             |                         | 2                                         |                         |                                   |                            | 4                    | 45                       | 2.18                                                                | 2.28 | 2.38  | 2.50 | 2.77  |      |
| 08-00220-05005 |             |                         | 2                                         |                         |                                   |                            | 6                    | 50                       | 2.18                                                                | 2.28 | 2.38  | 2.50 | 2.77  |      |
| 08-00221-05052 |             |                         | 3                                         |                         |                                   |                            | 4                    | 45                       | 3.22                                                                | 3.37 | 3.52  | 3.70 | 4.10  |      |
| 08-00220-05006 |             |                         | 3                                         |                         |                                   |                            | 6                    | 50                       | 3.22                                                                | 3.37 | 3.52  | 3.70 | 4.10  |      |
| 08-00221-05053 |             |                         | 4                                         |                         |                                   |                            | 4                    | 45                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |      |
| 08-00220-05007 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |      |
| 08-00221-05054 |             |                         | 5                                         |                         |                                   |                            | 4                    | 45                       | 5.31                                                                | 5.55 | 5.81  | 6.09 | 6.76  |      |
| 08-00220-05008 |             |                         | 5                                         |                         |                                   |                            | 6                    | 50                       | 5.31                                                                | 5.55 | 5.81  | 6.09 | 6.76  |      |
| 08-00221-05055 |             |                         | 6                                         |                         |                                   |                            | 4                    | 45                       | 6.35                                                                | 6.64 | 6.95  | 7.29 | 8.10  |      |
| 08-00221-05100 |             | R0.1                    | 1                                         |                         |                                   |                            | 4                    | 45                       | 1.14                                                                | 1.18 | 1.24  | 1.29 | 1.42  |      |
| 08-00221-05101 |             |                         | 2                                         |                         |                                   |                            | 4                    | 45                       | 2.18                                                                | 2.27 | 2.38  | 2.49 | 2.75  |      |
| 08-00220-05011 |             |                         | 2                                         |                         |                                   |                            | 6                    | 50                       | 2.18                                                                | 2.27 | 2.38  | 2.49 | 2.75  |      |
| 08-00221-05102 |             |                         | 3                                         |                         |                                   |                            | 4                    | 45                       | 3.22                                                                | 3.36 | 3.52  | 3.69 | 4.09  |      |
| 08-00220-05013 |             |                         | 3                                         |                         |                                   |                            | 6                    | 50                       | 3.22                                                                | 3.36 | 3.52  | 3.69 | 4.09  |      |
| 08-00221-05103 |             |                         | 4                                         |                         |                                   |                            | 4                    | 45                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |      |
| 08-00220-05012 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |      |
| 08-00221-05104 |             |                         | 5                                         |                         |                                   |                            | 4                    | 45                       | 5.31                                                                | 5.54 | 5.80  | 6.08 | 6.75  |      |
| 08-00220-05014 |             |                         | 5                                         |                         |                                   |                            | 6                    | 50                       | 5.31                                                                | 5.54 | 5.80  | 6.08 | 6.75  |      |
| 08-00221-05105 |             |                         | 6                                         |                         |                                   |                            | 4                    | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.08  |      |
| 08-00221-06050 | 0.6         | R0.05                   | 2                                         | 0.5                     | 0.56                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.28 | 2.38  | 2.50 | 2.77  |      |
| 08-00220-06005 |             |                         | 2                                         |                         |                                   |                            | 6                    | 50                       | 2.18                                                                | 2.28 | 2.38  | 2.50 | 2.77  |      |
| 08-00221-06051 |             |                         | 3                                         |                         |                                   |                            | 4                    | 45                       | 3.22                                                                | 3.37 | 3.52  | 3.70 | 4.10  |      |
| 08-00221-06052 |             |                         | 4                                         |                         |                                   |                            | 4                    | 45                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |      |
| 08-00220-06007 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |      |
| 08-00221-06053 |             |                         | 6                                         |                         |                                   |                            | 4                    | 45                       | 6.35                                                                | 6.64 | 6.95  | 7.29 | 8.10  |      |
| 08-00220-06009 |             |                         | 6                                         |                         |                                   |                            | 6                    | 50                       | 6.35                                                                | 6.64 | 6.95  | 7.29 | 8.10  |      |
| 08-00221-06054 |             |                         | 8                                         |                         |                                   |                            | 4                    | 50                       | 8.44                                                                | 8.82 | 9.23  | 9.69 | 10.76 |      |
| 08-00221-06100 |             |                         | R0.1                                      |                         |                                   |                            | 2                    | 4                        | 45                                                                  | 2.18 | 2.27  | 2.38 | 2.49  | 2.75 |
| 08-00221-06101 |             |                         |                                           |                         |                                   |                            | 3                    | 4                        | 45                                                                  | 3.22 | 3.36  | 3.52 | 3.69  | 4.09 |
| 08-00221-06102 |             | 4                       |                                           |                         |                                   |                            | 4                    | 45                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |      |
| 08-00220-06011 |             | 4                       |                                           |                         |                                   |                            | 6                    | 50                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |      |
| 08-00221-06103 |             | 6                       |                                           |                         |                                   |                            | 4                    | 45                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.08  |      |
| 08-00220-06012 |             | 6                       |                                           |                         |                                   |                            | 6                    | 50                       | 6.35                                                                | 6.63 | 6.94  | 7.28 | 8.08  |      |
| 08-00221-06104 |             | 8                       |                                           |                         |                                   |                            | 4                    | 50                       | 8.44                                                                | 8.81 | 9.22  | 9.68 | 10.74 |      |
| 08-00221-06200 |             | R0.2                    |                                           |                         |                                   |                            | 2                    | 4                        | 45                                                                  | 2.18 | 2.26  | 2.36 | 2.47  | 2.72 |
| 08-00221-06201 |             |                         |                                           |                         |                                   |                            | 3                    | 4                        | 45                                                                  | 3.22 | 3.35  | 3.50 | 3.67  | 4.05 |



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

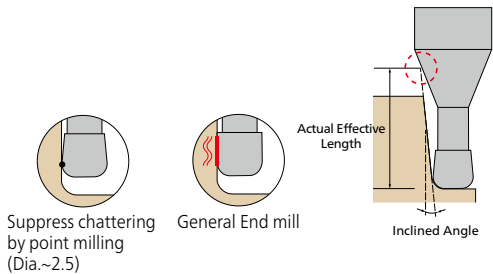
Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Corner Radius

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

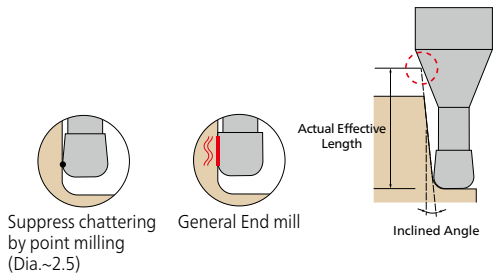
| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°   | 1°30′ | 2°   | 3°    |
| 08-00221-06202 | 0.6         | R0.2                    | 4                                         | 0.5                     | 0.56                              | 12°                        | 4                    | 45                       | 4.26                                                                | 4.44 | 4.64  | 4.87 | 5.38  |
| 08-00221-06203 |             |                         | 6                                         |                         |                                   |                            | 4                    | 45                       | 6.35                                                                | 6.62 | 6.93  | 7.26 | 8.05  |
| 08-00221-06204 |             |                         | 8                                         |                         |                                   |                            | 4                    | 50                       | 8.43                                                                | 8.80 | 9.21  | 9.66 | 10.71 |
| 08-00221-07050 | 0.7         | R0.05                   | 4                                         | 0.55                    | 0.66                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |
| 08-00220-07005 |             |                         | 6                                         |                         |                                   |                            | 50                   | 4.27                     | 4.46                                                                | 4.67 | 4.90  | 5.43 |       |
| 08-00221-07051 |             |                         | 4                                         |                         |                                   |                            | 45                   | 6.35                     | 6.64                                                                | 6.95 | 7.29  | 8.10 |       |
| 08-00220-07006 |             |                         | 6                                         |                         |                                   |                            | 50                   | 6.35                     | 6.64                                                                | 6.95 | 7.29  | 8.10 |       |
| 08-00221-07100 |             | R0.1                    | 4                                         |                         |                                   |                            | 45                   | 4.27                     | 4.45                                                                | 4.66 | 4.89  | 5.42 |       |
| 08-00220-07011 |             |                         | 6                                         |                         |                                   |                            | 50                   | 4.27                     | 4.45                                                                | 4.66 | 4.89  | 5.42 |       |
| 08-00221-07101 |             |                         | 4                                         |                         |                                   |                            | 45                   | 6.35                     | 6.63                                                                | 6.94 | 7.28  | 8.08 |       |
| 08-00220-07012 |             |                         | 6                                         |                         |                                   |                            | 50                   | 6.35                     | 6.63                                                                | 6.94 | 7.28  | 8.08 |       |
| 08-00221-08050 |             |                         | R0.05                                     |                         |                                   |                            | 4                    | 45                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |
| 08-00220-08005 |             |                         |                                           |                         |                                   |                            | 6                    | 50                       | 4.27                                                                | 4.46 | 4.67  | 4.90 | 5.43  |
| 08-00221-08051 | 4           | 45                      |                                           | 6.35                    | 6.64                              | 6.95                       | 7.29                 | 8.10                     |                                                                     |      |       |      |       |
| 08-00220-08006 | 6           | 50                      |                                           | 6.35                    | 6.64                              | 6.95                       | 7.29                 | 8.10                     |                                                                     |      |       |      |       |
| 08-00221-08052 | 8           | 4                       |                                           | 50                      | 8.44                              | 8.82                       | 9.23                 | 9.69                     | 10.76                                                               |      |       |      |       |
| 08-00220-08007 | 8           | 6                       |                                           | 50                      | 8.44                              | 8.82                       | 9.23                 | 9.69                     | 10.76                                                               |      |       |      |       |
| 08-00221-08100 | 0.8         | R0.1                    | 4                                         | 0.65                    | 0.76                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |
| 08-00220-08011 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |
| 08-00221-08101 |             |                         | 6                                         |                         |                                   |                            | 45                   | 6.35                     | 6.63                                                                | 6.94 | 7.28  | 8.08 |       |
| 08-00220-08012 |             |                         | 6                                         |                         |                                   |                            | 50                   | 6.35                     | 6.63                                                                | 6.94 | 7.28  | 8.08 |       |
| 08-00221-08102 |             |                         | 8                                         |                         |                                   |                            | 4                    | 50                       | 8.44                                                                | 8.81 | 9.22  | 9.68 | 10.74 |
| 08-00220-08013 |             |                         | 8                                         |                         |                                   |                            | 6                    | 50                       | 8.44                                                                | 8.81 | 9.22  | 9.68 | 10.74 |
| 08-00221-08200 |             | R0.2                    | 4                                         |                         |                                   |                            | 4                    | 45                       | 4.26                                                                | 4.44 | 4.64  | 4.87 | 5.38  |
| 08-00220-08021 |             |                         | 4                                         |                         |                                   |                            | 6                    | 50                       | 4.26                                                                | 4.44 | 4.64  | 4.87 | 5.38  |
| 08-00221-08201 |             |                         | 6                                         |                         |                                   |                            | 4                    | 45                       | 6.35                                                                | 6.62 | 6.93  | 7.26 | 8.05  |
| 08-00220-08022 |             |                         | 6                                         |                         |                                   |                            | 50                   | 6.35                     | 6.62                                                                | 6.93 | 7.26  | 8.05 |       |
| 08-00221-08202 | 8           | 4                       | 50                                        | 8.43                    | 8.80                              | 9.21                       | 9.66                 | 10.71                    |                                                                     |      |       |      |       |
| 08-00220-08023 | 8           | 6                       | 50                                        | 8.43                    | 8.80                              | 9.21                       | 9.66                 | 10.71                    |                                                                     |      |       |      |       |
| 08-00221-09100 | 0.9         | R0.1                    | 4                                         | 0.7                     | 0.85                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.45 | 4.66  | 4.89 | 5.42  |
| 08-00220-09011 |             |                         | 6                                         |                         |                                   |                            | 50                   | 4.27                     | 4.45                                                                | 4.66 | 4.89  | 5.42 |       |
| 08-00221-09101 |             |                         | 8                                         |                         |                                   |                            | 4                    | 50                       | 8.44                                                                | 8.81 | 9.22  | 9.68 | 10.74 |
| 08-00220-09012 |             |                         | 8                                         |                         |                                   |                            | 6                    | 50                       | 8.44                                                                | 8.81 | 9.22  | 9.68 | 10.74 |
| 08-00221-10050 | 1           | R0.05                   | 2                                         | 0.8                     | 0.95                              | 12°                        | 4                    | 50                       | 2.21                                                                | 2.30 | 2.41  | 2.53 | 2.80  |
| 08-00221-10051 |             |                         | 3                                         |                         |                                   |                            | 4                    | 50                       | 3.25                                                                | 3.39 | 3.55  | 3.73 | 4.13  |
| 08-00220-10001 |             |                         | 3                                         |                         |                                   |                            | 6                    | 50                       | 3.25                                                                | 3.39 | 3.55  | 3.73 | 4.13  |
| 08-00221-10052 |             |                         | 4                                         |                         |                                   |                            | 4                    | 50                       | 4.29                                                                | 4.48 | 4.69  | 4.92 | 5.46  |

How to Order

When you order, indicate MHR230R (D)×(R)×(ℓ1)×(d). ※(γ) is reference value.

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 08-00220-10002 | 1           | R0.05                   | 4                            | 0.8                     | 0.95                 | 12°                        | 6                    | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 08-00221-10053 |             |                         | 5                            |                         |                      |                            | 4                    | 50                       | 5.34                                                                | 5.57  | 5.83  | 6.12  | 6.80  |
| 08-00220-10003 |             |                         | 5                            |                         |                      |                            | 6                    | 50                       | 5.34                                                                | 5.57  | 5.83  | 6.12  | 6.80  |
| 08-00221-10054 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.38                                                                | 6.66  | 6.98  | 7.32  | 8.13  |
| 08-00220-10004 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.38                                                                | 6.66  | 6.98  | 7.32  | 8.13  |
| 08-00221-10055 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.84  | 9.26  | 9.72  | 10.79 |
| 08-00220-10006 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.46                                                                | 8.84  | 9.26  | 9.72  | 10.79 |
| 08-00221-10056 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.55                                                               | 11.02 | 11.54 | 12.11 | 13.45 |
| 08-00220-10008 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.55                                                               | 11.02 | 11.54 | 12.11 | 13.45 |
| 08-00221-10057 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.64                                                               | 13.20 | 13.82 | 14.51 | 16.11 |
| 08-00220-10009 |             | R0.1                    | 12                           |                         |                      |                            | 6                    | 50                       | 12.64                                                               | 13.20 | 13.82 | 14.51 | 16.11 |
| 08-00221-10058 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.81                                                               | 17.56 | 18.39 | 19.30 | 21.44 |
| 08-00221-10059 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.98                                                               | 21.92 | 22.95 | 24.09 | 26.76 |
| 08-00221-10100 |             |                         | 2                            |                         |                      |                            | 4                    | 50                       | 2.20                                                                | 2.30  | 2.40  | 2.52  | 2.79  |
| 08-00221-10101 |             |                         | 3                            |                         |                      |                            | 4                    | 50                       | 3.25                                                                | 3.39  | 3.54  | 3.72  | 4.12  |
| 08-00220-10010 |             |                         | 3                            |                         |                      |                            | 6                    | 50                       | 3.25                                                                | 3.39  | 3.54  | 3.72  | 4.12  |
| 08-00221-10102 |             |                         | 4                            |                         |                      |                            | 4                    | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.91  | 5.45  |
| 08-00220-10011 |             |                         | 4                            |                         |                      |                            | 6                    | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.91  | 5.45  |
| 08-00221-10103 |             |                         | 5                            |                         |                      |                            | 4                    | 50                       | 5.33                                                                | 5.57  | 5.83  | 6.11  | 6.78  |
| 08-00220-10014 |             |                         | 5                            |                         |                      |                            | 6                    | 50                       | 5.33                                                                | 5.57  | 5.83  | 6.11  | 6.78  |
| 08-00221-10104 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00220-10015 |             | R0.2                    | 6                            |                         |                      |                            | 6                    | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00221-10105 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00220-10012 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00221-10106 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00220-10016 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00221-10107 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00220-10013 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00221-10108 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.56 | 18.38 | 19.29 | 21.42 |
| 08-00221-10109 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.98                                                               | 21.92 | 22.95 | 24.08 | 26.74 |
| 08-00221-10200 |             | R0.2                    | 2                            |                         |                      |                            | 4                    | 50                       | 2.20                                                                | 2.29  | 2.39  | 2.50  | 2.75  |
| 08-00221-10201 |             |                         | 3                            |                         |                      |                            | 4                    | 50                       | 3.24                                                                | 3.38  | 3.53  | 3.70  | 4.08  |
| 08-00220-10024 |             |                         | 3                            |                         |                      |                            | 6                    | 50                       | 3.24                                                                | 3.38  | 3.53  | 3.70  | 4.08  |
| 08-00221-10202 |             |                         | 4                            |                         |                      |                            | 4                    | 50                       | 4.29                                                                | 4.47  | 4.67  | 4.89  | 5.42  |
| 08-00220-10021 |             |                         | 4                            |                         |                      |                            | 6                    | 50                       | 4.29                                                                | 4.47  | 4.67  | 4.89  | 5.42  |
| 08-00221-10203 |             |                         | 5                            |                         |                      |                            | 4                    | 50                       | 5.33                                                                | 5.56  | 5.81  | 6.09  | 6.75  |
| 08-00220-10025 |             |                         | 5                            |                         |                      |                            | 6                    | 50                       | 5.33                                                                | 5.56  | 5.81  | 6.09  | 6.75  |

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Corner Radius

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

Resin **N**



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

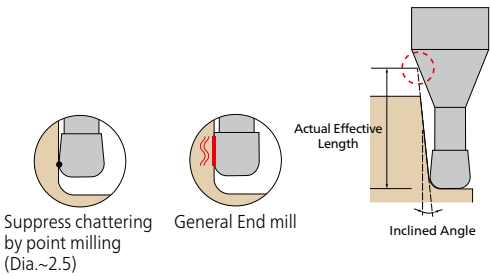
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00221-10204 | 1           | R0.2                    | 6                            | 0.8                     | 0.95                 | 12°                        | 4                    | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00220-10026 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00221-10205 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.83  | 9.24  | 9.69  | 10.74 |
| 08-00220-10022 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.46                                                                | 8.83  | 9.24  | 9.69  | 10.74 |
| 08-00221-10206 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00220-10027 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00221-10207 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00220-10023 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00221-10208 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.55 | 18.37 | 19.27 | 21.39 |
| 08-00221-10209 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.97                                                               | 21.91 | 22.93 | 24.06 | 26.71 |
| 08-00221-10300 |             | R0.3                    | 2                            |                         |                      |                            | 4                    | 50                       | 2.20                                                                | 2.28  | 2.38  | 2.48  | 2.72  |
| 08-00221-10301 |             |                         | 3                            |                         |                      |                            | 4                    | 50                       | 3.24                                                                | 3.37  | 3.52  | 3.68  | 4.05  |
| 08-00220-10034 |             |                         | 3                            |                         |                      |                            | 6                    | 50                       | 3.24                                                                | 3.37  | 3.52  | 3.68  | 4.05  |
| 08-00221-10302 |             |                         | 4                            |                         |                      |                            | 4                    | 50                       | 4.28                                                                | 4.46  | 4.66  | 4.87  | 5.38  |
| 08-00220-10031 |             |                         | 4                            |                         |                      |                            | 6                    | 50                       | 4.28                                                                | 4.46  | 4.66  | 4.87  | 5.38  |
| 08-00221-10303 |             |                         | 5                            |                         |                      |                            | 4                    | 50                       | 5.32                                                                | 5.55  | 5.80  | 6.07  | 6.71  |
| 08-00220-10035 |             |                         | 5                            |                         |                      |                            | 6                    | 50                       | 5.32                                                                | 5.55  | 5.80  | 6.07  | 6.71  |
| 08-00221-10304 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00220-10036 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00221-10305 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.45                                                                | 8.82  | 9.22  | 9.67  | 10.71 |
| 08-00220-10032 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.45                                                                | 8.82  | 9.22  | 9.67  | 10.71 |
| 08-00221-10306 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00220-10037 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00221-10307 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00220-10033 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00221-10308 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.54 | 18.35 | 19.25 | 21.35 |
| 08-00221-10309 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.97                                                               | 21.90 | 22.92 | 24.04 | 26.68 |
| 08-00220-12011 | 1.2         | R0.1                    | 5                            | 1                       | 1.14                 | 12°                        | 6                    | 50                       | 5.33                                                                | 5.56  | 5.82  | 6.10  | 6.76  |
| 08-00221-12100 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00221-12101 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00221-12102 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00220-12013 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00221-12103 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00220-12015 |             |                         | 15                           |                         |                      |                            | 6                    | 60                       | 15.76                                                               | 16.46 | 17.22 | 18.07 | 20.03 |
| 08-00221-12104 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.56 | 18.38 | 19.29 | 21.42 |
| 08-00221-12105 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.98                                                               | 21.92 | 22.95 | 24.08 | 26.74 |
| 08-00220-12021 |             | R0.2                    | 5                            |                         |                      |                            | 6                    | 50                       | 5.32                                                                | 5.55  | 5.80  | 6.08  | 6.72  |

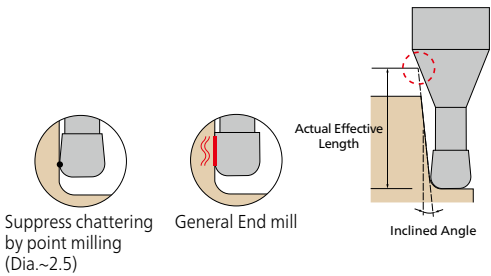
How to Order

When you order, indicate MHR230R (D)×(R)×(ℓ1)×(d).

※(γ) is reference value.

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00221-12200 | 1.2         | R0.2                    | 6                            | 1                       | 1.14                 | 12°                        | 4                    | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00221-12201 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.83  | 9.24  | 9.69  | 10.74 |
| 08-00221-12202 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00220-12022 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00221-12203 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00220-12023 |             |                         | 15                           |                         |                      |                            | 6                    | 60                       | 15.75                                                               | 16.45 | 17.21 | 18.05 | 20.00 |
| 08-00221-12204 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.55 | 18.37 | 19.27 | 21.39 |
| 08-00221-12205 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.97                                                               | 21.91 | 22.93 | 24.06 | 26.71 |
| 08-00220-12031 |             | R0.3                    | 5                            |                         |                      |                            | 6                    | 50                       | 5.32                                                                | 5.54  | 5.79  | 6.06  | 6.69  |
| 08-00221-12300 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00221-12301 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.45                                                                | 8.82  | 9.22  | 9.67  | 10.71 |
| 08-00221-12302 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00220-12032 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00221-12303 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00220-12033 |             |                         | 15                           |                         |                      |                            | 6                    | 60                       | 15.75                                                               | 16.44 | 17.20 | 18.03 | 19.96 |
| 08-00221-12304 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.54 | 18.35 | 19.25 | 21.35 |
| 08-00221-12305 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.97                                                               | 21.90 | 22.92 | 24.04 | 26.68 |
| 08-00221-15100 | 1.5         | R0.1                    | 4                            | 1.2                     | 1.45                 | 12°                        | 4                    | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.91  | 5.45  |
| 08-00221-15101 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00220-15011 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00221-15102 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00221-15103 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00221-15104 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00220-15013 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00221-15105 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.56 | 18.38 | 19.29 | 21.42 |
| 08-00221-15106 |             |                         | 18                           |                         |                      |                            | 4                    | 60                       | 18.89                                                               | 19.74 | 20.66 | 21.69 | 24.08 |
| 08-00220-15015 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 18.89                                                               | 19.74 | 20.66 | 21.69 | 24.08 |
| 08-00221-15107 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.98                                                               | 21.92 | 22.95 | 24.08 | 26.74 |
| 08-00221-15200 |             | R0.2                    | 4                            |                         |                      |                            | 4                    | 50                       | 4.29                                                                | 4.47  | 4.67  | 4.89  | 5.42  |
| 08-00221-15201 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00220-15021 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00221-15202 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.46                                                                | 8.83  | 9.24  | 9.69  | 10.74 |
| 08-00221-15203 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00221-15204 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00220-15023 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00221-15205 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.55 | 18.37 | 19.27 | 21.39 |
| 08-00221-15206 |             |                         | 18                           |                         |                      |                            | 4                    | 60                       | 18.89                                                               | 19.73 | 20.65 | 21.67 | 24.05 |

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

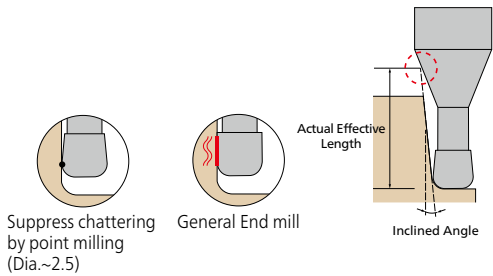
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

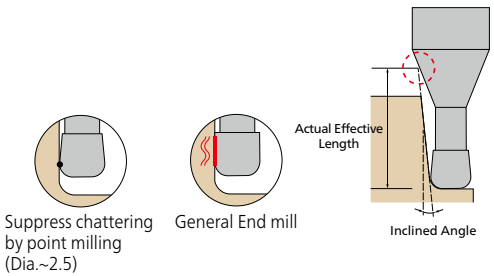
| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00220-15025 | 1.5         | R0.2                    | 18                           | 1.2                     | 1.45                 | 12°                        | 6                    | 60                       | 18.89                                                               | 19.73 | 20.65 | 21.67 | 24.05 |
| 08-00221-15207 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.97                                                               | 21.91 | 22.93 | 24.06 | 26.71 |
| 08-00221-15300 |             | R0.3                    | 4                            |                         |                      |                            | 4                    | 50                       | 4.28                                                                | 4.46  | 4.66  | 4.87  | 5.38  |
| 08-00221-15301 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00220-15031 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00221-15302 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.45                                                                | 8.82  | 9.22  | 9.67  | 10.71 |
| 08-00221-15303 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00221-15304 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00220-15032 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00221-15305 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.80                                                               | 17.54 | 18.35 | 19.25 | 21.35 |
| 08-00221-15306 |             |                         | 18                           |                         |                      |                            | 4                    | 60                       | 18.88                                                               | 19.72 | 20.64 | 21.65 | 24.01 |
| 08-00220-15033 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 18.88                                                               | 19.72 | 20.64 | 21.65 | 24.01 |
| 08-00221-15307 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.97                                                               | 21.90 | 22.92 | 24.04 | 26.68 |
| 08-00221-15500 |             | R0.5                    | 4                            |                         |                      |                            | 4                    | 50                       | 4.27                                                                | 4.44  | 4.63  | 4.83  | 5.32  |
| 08-00221-15501 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.36                                                                | 6.62  | 6.91  | 7.23  | 7.98  |
| 08-00220-15051 |             |                         | 6                            |                         |                      |                            | 6                    | 50                       | 6.36                                                                | 6.62  | 6.91  | 7.23  | 7.98  |
| 08-00221-15502 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.44                                                                | 8.80  | 9.19  | 9.63  | 10.64 |
| 08-00221-15503 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.53                                                               | 10.98 | 11.48 | 12.02 | 13.30 |
| 08-00221-15504 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.62                                                               | 13.16 | 13.76 | 14.42 | 15.96 |
| 08-00220-15052 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.62                                                               | 13.16 | 13.76 | 14.42 | 15.96 |
| 08-00221-15505 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.79                                                               | 17.52 | 18.32 | 19.21 | 21.29 |
| 08-00221-15506 |             |                         | 18                           |                         |                      |                            | 4                    | 60                       | 18.87                                                               | 19.70 | 20.61 | 21.61 | 23.95 |
| 08-00220-15053 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 18.87                                                               | 19.70 | 20.61 | 21.61 | 23.95 |
| 08-00221-15507 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.96                                                               | 21.88 | 22.89 | 24.00 | 26.61 |
| 08-00221-20100 | 2           | R0.1                    | 4                            | 1.6                     | 1.91                 | 12°                        | 4                    | 50                       | 4.31                                                                | 4.50  | 4.71  | 4.94  | 5.48  |
| 08-00221-20101 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.40                                                                | 6.68  | 7.00  | 7.34  | 8.14  |
| 08-00221-20102 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.49                                                                | 8.86  | 9.28  | 9.73  | 10.80 |
| 08-00220-20011 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.49                                                                | 8.86  | 9.28  | 9.73  | 10.80 |
| 08-00221-20103 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.57                                                               | 11.04 | 11.56 | 12.13 | 13.47 |
| 08-00221-20104 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.66                                                               | 13.22 | 13.84 | 14.53 | 16.13 |
| 08-00220-20014 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.66                                                               | 13.22 | 13.84 | 14.53 | 16.13 |
| 08-00221-20105 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.83                                                               | 17.58 | 18.41 | 19.32 | 21.45 |
| 08-00220-20012 |             |                         | 16                           |                         |                      |                            | 6                    | 60                       | 16.83                                                               | 17.58 | 18.41 | 19.32 | 21.45 |
| 08-00221-20106 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 21.00                                                               | 21.94 | 22.97 | 24.11 | 26.77 |
| 08-00220-20015 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 21.00                                                               | 21.94 | 22.97 | 24.11 | 26.77 |
| 08-00221-20107 |             |                         | 24                           |                         |                      |                            | 4                    | 70                       | 25.17                                                               | 26.30 | 27.54 | 28.90 | 32.10 |
| 08-00220-20013 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.17                                                               | 26.30 | 27.54 | 28.90 | 32.10 |

How to Order

When you order, indicate MHR230R (D)×(R)×(ℓ1)×(d). ※(γ) is reference value.

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 08-00221-20108 | 2           | R0.1                    | 26                           | 1.6                     | 1.91                 | 12°                        | 4                    | 70                       | 27.26                                                               | 28.48 | 29.82 | 31.30 | 34.76 |
| 08-00221-20109 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.43                                                               | 32.84 | 34.39 | 36.09 | 40.08 |
| 08-00221-20200 |             | R0.2                    | 4                            |                         |                      |                            | 4                    | 50                       | 4.31                                                                | 4.50  | 4.70  | 4.92  | 5.45  |
| 08-00221-20201 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.40                                                                | 6.68  | 6.98  | 7.32  | 8.11  |
| 08-00221-20202 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.48                                                                | 8.85  | 9.26  | 9.71  | 10.77 |
| 08-00220-20021 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.48                                                                | 8.85  | 9.26  | 9.71  | 10.77 |
| 08-00221-20203 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.57                                                               | 11.03 | 11.55 | 12.11 | 13.43 |
| 08-00221-20204 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.65                                                               | 13.21 | 13.83 | 14.51 | 16.09 |
| 08-00220-20023 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.65                                                               | 13.21 | 13.83 | 14.51 | 16.09 |
| 08-00221-20205 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.83                                                               | 17.57 | 18.39 | 19.30 | 21.42 |
| 08-00220-20025 |             |                         | 16                           |                         |                      |                            | 6                    | 60                       | 16.83                                                               | 17.57 | 18.39 | 19.30 | 21.42 |
| 08-00221-20206 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 21.00                                                               | 21.93 | 22.96 | 24.09 | 26.74 |
| 08-00220-20027 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 21.00                                                               | 21.93 | 22.96 | 24.09 | 26.74 |
| 08-00221-20207 |             |                         | 24                           |                         |                      |                            | 4                    | 70                       | 25.17                                                               | 26.29 | 27.52 | 28.88 | 32.06 |
| 08-00220-20029 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.17                                                               | 26.29 | 27.52 | 28.88 | 32.06 |
| 08-00221-20208 |             |                         | 26                           |                         |                      |                            | 4                    | 70                       | 27.25                                                               | 28.47 | 29.81 | 31.28 | 34.73 |
| 08-00221-20209 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.43                                                               | 32.83 | 34.37 | 36.07 | 40.05 |
| 08-00221-20300 |             | R0.3                    | 4                            |                         |                      |                            | 4                    | 50                       | 4.31                                                                | 4.49  | 4.68  | 4.90  | 5.41  |
| 08-00221-20301 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.39                                                                | 6.67  | 6.97  | 7.30  | 8.08  |
| 08-00221-20302 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.48                                                                | 8.85  | 9.25  | 9.70  | 10.74 |
| 08-00220-20031 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.48                                                                | 8.85  | 9.25  | 9.70  | 10.74 |
| 08-00221-20303 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.56                                                               | 11.03 | 11.53 | 12.09 | 13.40 |
| 08-00221-20304 |             |                         | 12                           |                         |                      |                            | 4                    | 50                       | 12.65                                                               | 13.20 | 13.81 | 14.49 | 16.06 |
| 08-00220-20034 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.65                                                               | 13.20 | 13.81 | 14.49 | 16.06 |
| 08-00221-20305 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.82                                                               | 17.56 | 18.38 | 19.28 | 21.38 |
| 08-00220-20032 |             |                         | 16                           |                         |                      |                            | 6                    | 60                       | 16.82                                                               | 17.56 | 18.38 | 19.28 | 21.38 |
| 08-00221-20306 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.99                                                               | 21.92 | 22.95 | 24.07 | 26.71 |
| 08-00220-20035 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 20.99                                                               | 21.92 | 22.95 | 24.07 | 26.71 |
| 08-00221-20307 |             |                         | 24                           |                         |                      |                            | 4                    | 70                       | 25.16                                                               | 26.28 | 27.51 | 28.86 | 32.03 |
| 08-00220-20033 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.16                                                               | 26.28 | 27.51 | 28.86 | 32.03 |
| 08-00221-20308 |             |                         | 26                           |                         |                      |                            | 4                    | 70                       | 27.25                                                               | 28.46 | 29.79 | 31.26 | 34.69 |
| 08-00221-20309 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.42                                                               | 32.82 | 34.36 | 36.05 | 40.02 |
| 08-00221-20500 |             | R0.5                    | 4                            |                         |                      |                            | 4                    | 50                       | 4.30                                                                | 4.47  | 4.66  | 4.86  | 5.35  |
| 08-00221-20501 |             |                         | 6                            |                         |                      |                            | 4                    | 50                       | 6.38                                                                | 6.65  | 6.94  | 7.26  | 8.01  |
| 08-00221-20502 |             |                         | 8                            |                         |                      |                            | 4                    | 50                       | 8.47                                                                | 8.83  | 9.22  | 9.66  | 10.67 |
| 08-00220-20051 |             |                         | 8                            |                         |                      |                            | 6                    | 50                       | 8.47                                                                | 8.83  | 9.22  | 9.66  | 10.67 |
| 08-00221-20503 |             |                         | 10                           |                         |                      |                            | 4                    | 50                       | 10.55                                                               | 11.01 | 11.50 | 12.05 | 13.33 |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

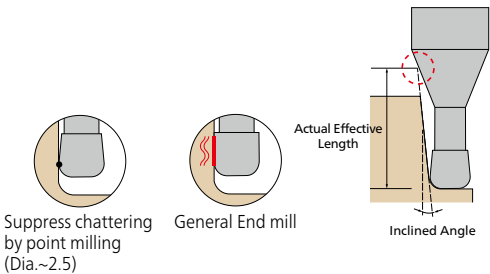
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

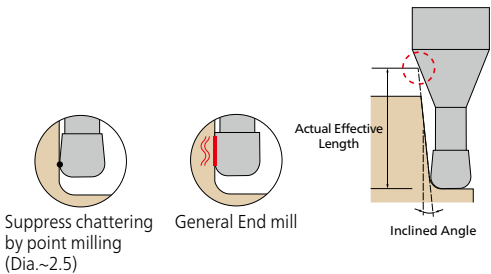
| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30° | 2°    | 3°    |
| 08-00221-20504 | 2           | R0.5                    | 12                           | 1.6                     | 1.91                 | 12°                        | 4                    | 50                       | 12.64                                                               | 13.19 | 13.79 | 14.45 | 15.99 |
| 08-00220-20054 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.64                                                               | 13.19 | 13.79 | 14.45 | 15.99 |
| 08-00221-20505 |             |                         | 16                           |                         |                      |                            | 4                    | 60                       | 16.81                                                               | 17.55 | 18.35 | 19.24 | 21.32 |
| 08-00220-20052 |             |                         | 16                           |                         |                      |                            | 6                    | 60                       | 16.81                                                               | 17.55 | 18.35 | 19.24 | 21.32 |
| 08-00221-20506 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 20.98                                                               | 21.91 | 22.92 | 24.03 | 26.64 |
| 08-00220-20055 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 20.98                                                               | 21.91 | 22.92 | 24.03 | 26.64 |
| 08-00221-20507 |             |                         | 24                           |                         |                      |                            | 4                    | 70                       | 25.16                                                               | 26.26 | 27.48 | 28.82 | 31.97 |
| 08-00220-20053 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.16                                                               | 26.26 | 27.48 | 28.82 | 31.97 |
| 08-00221-20508 |             |                         | 26                           |                         |                      |                            | 4                    | 70                       | 27.24                                                               | 28.44 | 29.76 | 31.22 | 34.63 |
| 08-00221-20509 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.41                                                               | 32.80 | 34.33 | 36.01 | 39.95 |
| 08-00221-25100 | 2.5         | R0.1                    | 10                           | 2                       | 2.39                 | 12°                        | 4                    | 50                       | 10.67                                                               | 11.15 | 11.67 | 12.24 | 13.59 |
| 08-00220-25011 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.67                                                               | 11.15 | 11.67 | 12.24 | 13.59 |
| 08-00221-25101 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 21.10                                                               | 22.04 | 23.08 | 24.22 | 26.90 |
| 08-00220-25013 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 21.10                                                               | 22.04 | 23.08 | 24.22 | 26.90 |
| 08-00221-25102 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.53                                                               | 32.94 | 34.49 | 36.21 | 40.21 |
| 08-00220-25015 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.53                                                               | 32.94 | 34.49 | 36.21 | 40.21 |
| 08-00221-25200 |             | R0.2                    | 10                           |                         |                      |                            | 4                    | 50                       | 10.67                                                               | 11.14 | 11.65 | 12.22 | 13.56 |
| 08-00220-25021 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.67                                                               | 11.14 | 11.65 | 12.22 | 13.56 |
| 08-00221-25201 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 21.10                                                               | 22.04 | 23.07 | 24.20 | 26.87 |
| 08-00220-25023 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 21.10                                                               | 22.04 | 23.07 | 24.20 | 26.87 |
| 08-00221-25202 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.52                                                               | 32.93 | 34.48 | 36.19 | 40.18 |
| 08-00220-25025 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.52                                                               | 32.93 | 34.48 | 36.19 | 40.18 |
| 08-00221-25300 |             | R0.3                    | 10                           |                         |                      |                            | 4                    | 50                       | 10.66                                                               | 11.13 | 11.64 | 12.20 | 13.53 |
| 08-00220-25031 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.66                                                               | 11.13 | 11.64 | 12.20 | 13.53 |
| 08-00221-25301 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 21.09                                                               | 22.03 | 23.05 | 24.19 | 26.83 |
| 08-00220-25032 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 21.09                                                               | 22.03 | 23.05 | 24.19 | 26.83 |
| 08-00221-25302 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.52                                                               | 32.92 | 34.47 | 36.17 | 40.14 |
| 08-00220-25033 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.52                                                               | 32.92 | 34.47 | 36.17 | 40.14 |
| 08-00221-25500 |             | R0.5                    | 10                           |                         |                      |                            | 4                    | 50                       | 10.65                                                               | 11.11 | 11.61 | 12.16 | 13.46 |
| 08-00220-25051 |             |                         | 10                           |                         |                      |                            | 6                    | 50                       | 10.65                                                               | 11.11 | 11.61 | 12.16 | 13.46 |
| 08-00221-25501 |             |                         | 20                           |                         |                      |                            | 4                    | 60                       | 21.08                                                               | 22.01 | 23.02 | 24.15 | 26.77 |
| 08-00220-25052 |             |                         | 20                           |                         |                      |                            | 6                    | 60                       | 21.08                                                               | 22.01 | 23.02 | 24.15 | 26.77 |
| 08-00221-25502 |             |                         | 30                           |                         |                      |                            | 4                    | 70                       | 31.51                                                               | 32.91 | 34.44 | 36.13 | 40.08 |
| 08-00220-25053 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.51                                                               | 32.91 | 34.44 | 36.13 | 40.08 |

How to Order

When you order, indicate MHR230R (D)×(R)×(ℓ1)×(d). ※(γ) is reference value.

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30° | 2°    | 3°    |
| 08-00220-30011 | 3           | R0.1                    | 12                           | 4.5                     | 2.85                 | 12°                        | 6                    | 50                       | 12.87                                                               | 13.44 | 14.07 | 14.76 | 16.36 |
| 08-00220-30013 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 19.13                                                               | 19.98 | 20.91 | 21.94 | 24.32 |
| 08-00220-30015 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.39                                                               | 26.52 | 27.76 | 29.12 | Free  |
| 08-00220-30017 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.64                                                               | 33.05 | 34.60 | 36.30 | Free  |
| 08-00220-30019 |             |                         | 36                           |                         |                      |                            | 6                    | 80                       | 37.90                                                               | 39.59 | 41.44 | 43.48 | Free  |
| 08-00220-30021 |             | R0.2                    | 12                           |                         |                      |                            | 6                    | 50                       | 12.87                                                               | 13.44 | 14.06 | 14.74 | 16.33 |
| 08-00220-30023 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 19.13                                                               | 19.97 | 20.90 | 21.92 | 24.29 |
| 08-00220-30025 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.38                                                               | 26.51 | 27.74 | 29.10 | Free  |
| 08-00220-30027 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.64                                                               | 33.05 | 34.58 | 36.28 | Free  |
| 08-00220-30029 |             | R0.3                    | 36                           |                         |                      |                            | 6                    | 80                       | 37.90                                                               | 39.58 | 41.43 | 43.46 | Free  |
| 08-00220-30031 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.86                                                               | 13.43 | 14.04 | 14.72 | 16.29 |
| 08-00220-30034 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 19.12                                                               | 19.96 | 20.88 | 21.90 | 24.26 |
| 08-00220-30032 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.38                                                               | 26.50 | 27.73 | 29.08 | Free  |
| 08-00220-30035 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.63                                                               | 33.04 | 34.57 | 36.26 | Free  |
| 08-00220-30033 |             | R0.5                    | 36                           |                         |                      |                            | 6                    | 80                       | 37.89                                                               | 39.57 | 41.41 | 43.44 | Free  |
| 08-00220-30051 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.86                                                               | 13.41 | 14.01 | 14.68 | 16.23 |
| 08-00220-30054 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 19.11                                                               | 19.95 | 20.86 | 21.86 | 24.19 |
| 08-00220-30052 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.37                                                               | 26.48 | 27.70 | 29.04 | Free  |
| 08-00220-30055 |             |                         | 30                           |                         |                      |                            | 6                    | 70                       | 31.63                                                               | 33.02 | 34.54 | 36.22 | Free  |
| 08-00220-30053 |             | R1                      | 36                           |                         |                      |                            | 6                    | 80                       | 37.88                                                               | 39.56 | 41.39 | 43.40 | Free  |
| 08-00220-30101 |             |                         | 12                           |                         |                      |                            | 6                    | 50                       | 12.83                                                               | 13.36 | 13.94 | 14.58 | 16.07 |
| 08-00220-30104 |             |                         | 18                           |                         |                      |                            | 6                    | 60                       | 19.09                                                               | 19.90 | 20.79 | 21.76 | 24.04 |
| 08-00220-30102 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.35                                                               | 26.44 | 27.63 | 28.94 | Free  |
| 08-00220-30105 |             | R1                      | 30                           |                         |                      |                            | 6                    | 70                       | 31.60                                                               | 32.97 | 34.47 | 36.12 | Free  |
| 08-00220-30103 |             |                         | 36                           |                         |                      |                            | 6                    | 80                       | 37.86                                                               | 39.51 | 41.32 | 43.30 | Free  |
| 08-00220-40011 | 4           | R0.1                    | 16                           |                         | 3.8                  | 12°                        | 6                    | 60                       | 17.17                                                               | 17.93 | 18.77 | 19.68 | Free  |
| 08-00220-40013 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.51                                                               | 26.65 | 27.89 | 29.26 | Free  |
| 08-00220-40015 |             |                         | 32                           |                         |                      |                            | 6                    | 70                       | 33.85                                                               | 35.36 | 37.01 | Free  | Free  |
| 08-00220-40017 |             |                         | 48                           |                         |                      |                            | 6                    | 100                      | 50.54                                                               | 52.79 | Free  | Free  | Free  |
| 08-00220-40021 |             | R0.2                    | 16                           |                         |                      |                            | 6                    | 60                       | 17.16                                                               | 17.92 | 18.75 | 19.66 | Free  |
| 08-00220-40023 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.50                                                               | 26.64 | 27.88 | 29.24 | Free  |
| 08-00220-40025 |             |                         | 32                           |                         |                      |                            | 6                    | 70                       | 33.85                                                               | 35.35 | 37.00 | Free  | Free  |
| 08-00220-40027 |             |                         | 48                           |                         |                      |                            | 6                    | 100                      | 50.53                                                               | 52.78 | Free  | Free  | Free  |
| 08-00220-40031 |             | R0.3                    | 16                           |                         |                      |                            | 6                    | 60                       | 17.16                                                               | 17.91 | 18.74 | 19.65 | Free  |
| 08-00220-40034 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.50                                                               | 26.63 | 27.86 | 29.22 | Free  |
| 08-00220-40032 |             |                         | 32                           |                         |                      |                            | 6                    | 70                       | 33.84                                                               | 35.34 | 36.99 | Free  | Free  |
| 08-00220-40033 |             |                         | 48                           |                         |                      |                            | 6                    | 100                      | 50.53                                                               | 52.78 | Free  | Free  | Free  |

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

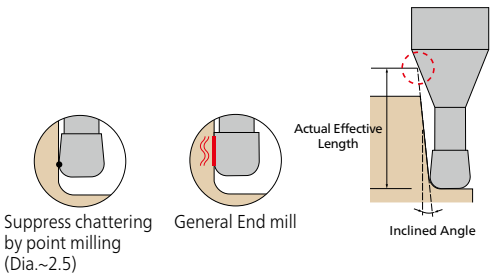
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

MHR230R

MUGEN COATING 2-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |      |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°   |
| 08-00220-40051 | 4           | R0.5                    | 16                           | 6                       | 3.8                  | 12°                        | 6                    | 60                       | 17.15                                                               | 17.89 | 18.71 | 19.61 | Free |
| 08-00220-40054 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.49                                                               | 26.61 | 27.83 | 29.18 | Free |
| 08-00220-40052 |             |                         | 32                           |                         |                      |                            | 6                    | 70                       | 33.83                                                               | 35.33 | 36.96 | Free  | Free |
| 08-00220-40053 |             |                         | 48                           |                         |                      |                            | 6                    | 100                      | 50.52                                                               | 52.76 | Free  | Free  | Free |
| 08-00220-40101 |             | R1                      | 16                           |                         |                      |                            | 6                    | 60                       | 17.13                                                               | 17.85 | 18.64 | 19.51 | Free |
| 08-00220-40104 |             |                         | 24                           |                         |                      |                            | 6                    | 70                       | 25.47                                                               | 26.57 | 27.77 | 29.08 | Free |
| 08-00220-40102 |             |                         | 32                           |                         |                      |                            | 6                    | 70                       | 33.81                                                               | 35.28 | 36.89 | Free  | Free |
| 08-00220-40103 |             |                         | 48                           |                         |                      |                            | 6                    | 100                      | 50.50                                                               | 52.71 | Free  | Free  | Free |
| 08-00220-50011 | 5           | R0.1                    | 20                           | 7.5                     | 4.8                  | 12°                        | 6                    | 70                       | 21.34                                                               | 22.29 | Free  | Free  | Free |
| 08-00220-50013 |             |                         | 40                           |                         |                      |                            | 6                    | 90                       | 42.19                                                               | Free  | Free  | Free  | Free |
| 08-00220-50021 |             | R0.2                    | 20                           |                         |                      |                            | 6                    | 70                       | 21.33                                                               | 22.28 | Free  | Free  | Free |
| 08-00220-50023 |             |                         | 40                           |                         |                      |                            | 6                    | 90                       | 42.19                                                               | Free  | Free  | Free  | Free |
| 08-00220-50031 |             | R0.3                    | 20                           |                         |                      |                            | 6                    | 70                       | 21.33                                                               | 22.27 | Free  | Free  | Free |
| 08-00220-50032 |             |                         | 40                           |                         |                      |                            | 6                    | 90                       | 42.19                                                               | Free  | Free  | Free  | Free |
| 08-00220-50051 |             | R0.5                    | 20                           |                         |                      |                            | 6                    | 70                       | 21.32                                                               | 22.25 | Free  | Free  | Free |
| 08-00220-50052 |             |                         | 40                           |                         |                      |                            | 6                    | 90                       | 42.18                                                               | Free  | Free  | Free  | Free |
| 08-00220-50101 |             | R1                      | 20                           |                         |                      |                            | 6                    | 70                       | 21.30                                                               | 22.21 | Free  | Free  | Free |
| 08-00220-50102 |             |                         | 40                           |                         |                      |                            | 6                    | 90                       | 42.16                                                               | Free  | Free  | Free  | Free |
| 08-00220-60011 | 6           | R0.1                    | 24                           | 9                       | 5.8                  | -                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60013 |             |                         | 48                           |                         |                      |                            | 6                    | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60021 |             | R0.2                    | 24                           |                         |                      |                            | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60023 |             |                         | 48                           |                         |                      |                            | 6                    | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60031 |             | R0.3                    | 24                           |                         |                      |                            | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60032 |             |                         | 48                           |                         |                      |                            | 6                    | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60051 |             | R0.5                    | 24                           |                         |                      |                            | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60052 |             |                         | 48                           |                         |                      |                            | 6                    | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60101 |             | R1                      | 24                           |                         |                      |                            | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00220-60102 |             |                         | 48                           |                         |                      |                            | 6                    | 110                      | Free                                                                | Free  | Free  | Free  | Free |

How to Order

When you order, indicate MHR230R (D)×(R)×(ℓ1)×(d). ※(γ) is reference value.

MHR230R

Recommended Milling Conditions

| Work Material |                           |                         | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Aluminium Alloy・Copper |        |              |       |
|---------------|---------------------------|-------------------------|-----------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|------------------------|--------|--------------|-------|
| Dia.          | Corner<br>Radius          | Under<br>Neck<br>Length | Spindle<br>Speed                                                      | Feed   | Depth of Cut |       | Spindle<br>Speed                                  | Feed   | Depth of Cut |       | Spindle<br>Speed       | Feed   | Depth of Cut |       |
|               |                           |                         | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>      | mm/min | ap mm        | ae mm |
| 0.2           | 0.05                      | 0.5                     | 30,000                                                                | 200    | 0.01         | 0.05  | 30,000                                            | 150    | 0.003        | 0.04  | 30,000                 | 250    | 0.012        | 0.05  |
|               |                           | 1                       | 30,000                                                                | 150    | 0.007        | 0.05  | 30,000                                            | 100    | 0.003        | 0.04  | 30,000                 | 200    | 0.008        | 0.05  |
|               |                           | 1.5                     | 30,000                                                                | 100    | 0.005        | 0.05  | 30,000                                            | 80     | 0.002        | 0.04  | 30,000                 | 135    | 0.006        | 0.05  |
|               |                           | 2                       | 30,000                                                                | 50     | 0.003        | 0.05  | 30,000                                            | 50     | 0.002        | 0.04  | 30,000                 | 75     | 0.004        | 0.05  |
| 0.3           | 0.05                      | 1                       | 30,000                                                                | 200    | 0.02         | 0.1   | 30,000                                            | 180    | 0.003        | 0.08  | 30,000                 | 300    | 0.024        | 0.1   |
|               |                           | 1.5                     | 30,000                                                                | 180    | 0.015        | 0.1   | 30,000                                            | 130    | 0.003        | 0.08  | 30,000                 | 260    | 0.018        | 0.1   |
|               |                           | 2                       | 30,000                                                                | 150    | 0.01         | 0.1   | 30,000                                            | 100    | 0.003        | 0.08  | 30,000                 | 250    | 0.012        | 0.1   |
|               |                           | 2.5                     | 30,000                                                                | 120    | 0.007        | 0.1   | 25,000                                            | 80     | 0.002        | 0.08  | 30,000                 | 240    | 0.008        | 0.1   |
| 0.4           | 0.05<br>0.1               | 3                       | 30,000                                                                | 100    | 0.005        | 0.1   | 25,000                                            | 50     | 0.002        | 0.08  | 30,000                 | 220    | 0.006        | 0.1   |
|               |                           | 1                       | 30,000                                                                | 350    | 0.025        | 0.12  | 30,000                                            | 300    | 0.005        | 0.1   | 30,000                 | 450    | 0.03         | 0.12  |
|               |                           | 1.5                     | 30,000                                                                | 300    | 0.022        | 0.12  | 30,000                                            | 270    | 0.005        | 0.1   | 30,000                 | 400    | 0.027        | 0.12  |
|               |                           | 2                       | 30,000                                                                | 250    | 0.02         | 0.12  | 25,000                                            | 180    | 0.005        | 0.1   | 30,000                 | 360    | 0.024        | 0.12  |
| 0.5           | 0.05<br>0.1               | 3                       | 30,000                                                                | 220    | 0.015        | 0.12  | 25,000                                            | 150    | 0.004        | 0.1   | 30,000                 | 300    | 0.018        | 0.12  |
|               |                           | 4                       | 25,000                                                                | 160    | 0.01         | 0.12  | 20,000                                            | 100    | 0.003        | 0.1   | 30,000                 | 240    | 0.012        | 0.12  |
|               |                           | 1                       | 30,000                                                                | 500    | 0.03         | 0.14  | 25,000                                            | 400    | 0.01         | 0.12  | 30,000                 | 650    | 0.036        | 0.14  |
|               |                           | 2                       | 30,000                                                                | 400    | 0.025        | 0.14  | 25,000                                            | 300    | 0.01         | 0.12  | 30,000                 | 600    | 0.03         | 0.14  |
| 0.6           | 0.05<br>0.1<br>0.2        | 3                       | 30,000                                                                | 340    | 0.02         | 0.14  | 25,000                                            | 250    | 0.008        | 0.12  | 30,000                 | 480    | 0.024        | 0.14  |
|               |                           | 4                       | 25,000                                                                | 280    | 0.015        | 0.14  | 20,000                                            | 180    | 0.005        | 0.12  | 30,000                 | 430    | 0.018        | 0.14  |
|               |                           | 5                       | 25,000                                                                | 230    | 0.01         | 0.14  | 20,000                                            | 150    | 0.004        | 0.12  | 30,000                 | 360    | 0.012        | 0.14  |
|               |                           | 6                       | 20,000                                                                | 180    | 0.008        | 0.14  | 16,000                                            | 100    | 0.003        | 0.12  | 25,000                 | 270    | 0.01         | 0.14  |
| 0.7           | 0.05<br>0.1               | 2                       | 30,000                                                                | 600    | 0.035        | 0.16  | 25,000                                            | 400    | 0.02         | 0.13  | 30,000                 | 800    | 0.04         | 0.16  |
|               |                           | 3                       | 30,000                                                                | 500    | 0.03         | 0.16  | 25,000                                            | 350    | 0.015        | 0.13  | 30,000                 | 750    | 0.035        | 0.16  |
|               |                           | 4                       | 25,000                                                                | 400    | 0.025        | 0.16  | 20,000                                            | 250    | 0.015        | 0.13  | 30,000                 | 650    | 0.03         | 0.16  |
|               |                           | 6                       | 20,000                                                                | 250    | 0.015        | 0.16  | 16,000                                            | 150    | 0.008        | 0.13  | 25,000                 | 400    | 0.018        | 0.16  |
| 0.8           | 0.05<br>0.1<br>0.2        | 8                       | 18,000                                                                | 180    | 0.01         | 0.16  | 14,000                                            | 100    | 0.005        | 0.13  | 20,000                 | 300    | 0.012        | 0.16  |
|               |                           | 4                       | 25,000                                                                | 600    | 0.03         | 0.2   | 20,000                                            | 400    | 0.02         | 0.16  | 30,000                 | 1,000  | 0.04         | 0.2   |
|               |                           | 6                       | 20,000                                                                | 450    | 0.02         | 0.2   | 16,000                                            | 250    | 0.01         | 0.16  | 25,000                 | 700    | 0.025        | 0.2   |
|               |                           | 4                       | 25,000                                                                | 1,000  | 0.045        | 0.25  | 20,000                                            | 600    | 0.025        | 0.2   | 30,000                 | 1,400  | 0.055        | 0.25  |
| 0.9           | 0.1                       | 6                       | 20,000                                                                | 700    | 0.03         | 0.25  | 16,000                                            | 400    | 0.02         | 0.2   | 25,000                 | 1,000  | 0.04         | 0.25  |
|               |                           | 8                       | 18,000                                                                | 400    | 0.02         | 0.25  | 14,000                                            | 250    | 0.01         | 0.2   | 22,000                 | 600    | 0.025        | 0.25  |
|               |                           | 4                       | 25,000                                                                | 1,100  | 0.05         | 0.3   | 20,000                                            | 700    | 0.03         | 0.24  | 30,000                 | 1,500  | 0.06         | 0.3   |
|               |                           | 8                       | 18,000                                                                | 500    | 0.03         | 0.3   | 14,000                                            | 350    | 0.01         | 0.24  | 22,000                 | 800    | 0.04         | 0.3   |
| 1             | 0.05<br>0.1<br>0.2<br>0.3 | 2                       | 25,000                                                                | 1,600  | 0.065        | 0.35  | 20,000                                            | 900    | 0.05         | 0.28  | 30,000                 | 2,200  | 0.08         | 0.35  |
|               |                           | 3                       | 25,000                                                                | 1,500  | 0.06         | 0.35  | 20,000                                            | 850    | 0.05         | 0.28  | 30,000                 | 2,100  | 0.07         | 0.35  |
|               |                           | 4                       | 25,000                                                                | 1,400  | 0.055        | 0.35  | 20,000                                            | 800    | 0.04         | 0.28  | 30,000                 | 2,000  | 0.065        | 0.35  |
|               |                           | 5                       | 22,000                                                                | 1,200  | 0.05         | 0.35  | 18,000                                            | 700    | 0.03         | 0.28  | 27,000                 | 1,700  | 0.06         | 0.35  |
|               |                           | 6                       | 20,000                                                                | 1,000  | 0.045        | 0.35  | 16,000                                            | 600    | 0.02         | 0.28  | 25,000                 | 1,500  | 0.055        | 0.35  |
|               |                           | 8                       | 18,000                                                                | 700    | 0.035        | 0.35  | 14,000                                            | 450    | 0.02         | 0.28  | 22,000                 | 1,000  | 0.045        | 0.35  |
|               |                           | 10                      | 16,000                                                                | 600    | 0.025        | 0.35  | 13,000                                            | 350    | 0.01         | 0.28  | 20,000                 | 800    | 0.03         | 0.35  |
|               |                           | 12                      | 14,000                                                                | 350    | 0.02         | 0.35  | 12,000                                            | 250    | 0.008        | 0.28  | 18,000                 | 600    | 0.025        | 0.35  |
|               |                           | 16                      | 12,000                                                                | 250    | 0.01         | 0.35  | 10,000                                            | 150    | 0.005        | 0.28  | 14,000                 | 350    | 0.012        | 0.35  |
| 20            | 11,000                    | 150                     | 0.005                                                                 | 0.35   | 9,000        | 100   | 0.003                                             | 0.28   | 13,000       | 250   | 0.006                  | 0.35   |              |       |
| 1.2           | 0.1<br>0.2<br>0.3         | 5                       | 22,000                                                                | 1,500  | 0.055        | 0.4   | 18,000                                            | 850    | 0.03         | 0.32  | 26,000                 | 2,200  | 0.065        | 0.4   |
|               |                           | 6                       | 20,000                                                                | 1,300  | 0.05         | 0.4   | 17,000                                            | 750    | 0.03         | 0.32  | 25,000                 | 2,000  | 0.06         | 0.4   |
|               |                           | 8                       | 18,000                                                                | 1,100  | 0.04         | 0.4   | 15,000                                            | 600    | 0.025        | 0.32  | 22,000                 | 1,600  | 0.05         | 0.4   |
|               |                           | 10                      | 16,000                                                                | 900    | 0.03         | 0.4   | 13,000                                            | 500    | 0.02         | 0.32  | 20,000                 | 1,400  | 0.04         | 0.4   |
|               |                           | 12                      | 14,000                                                                | 700    | 0.025        | 0.4   | 11,000                                            | 400    | 0.015        | 0.32  | 17,000                 | 1,000  | 0.03         | 0.4   |
|               |                           | 15                      | 12,000                                                                | 360    | 0.018        | 0.4   | 10,000                                            | 210    | 0.01         | 0.32  | 14,000                 | 520    | 0.022        | 0.4   |
|               |                           | 16                      | 12,000                                                                | 350    | 0.015        | 0.4   | 10,000                                            | 200    | 0.008        | 0.32  | 14,000                 | 500    | 0.02         | 0.4   |
|               |                           | 20                      | 10,000                                                                | 230    | 0.01         | 0.4   | 8,000                                             | 150    | 0.005        | 0.32  | 12,000                 | 330    | 0.012        | 0.4   |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55  
HRC

Hardened Steel

Coating

Long Neck  
Corner Radius

| MHR230R                        |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              | MHR230R                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|--------------------------------|-------------------------------|-------------------|-----------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|------------------------|--------|--------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------|-----------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------|--------|--------------|-------|------------------------|--------|--------------|-------|
| Recommended Milling Conditions |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              | Recommended Milling Conditions |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
| Work Material                  |                               |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Aluminium Alloy・Copper |        |              |                                | Work Material                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                               |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       | Hardened Steels<br>HPM38・STAVAX・SKD61<br>(~55HRC) |        |              |       | Copper・Aluminium Alloy |        |              |       |
| Dia.                           | Corner Radius                 | Under Neck Length | Spindle Speed                                                         | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed          | Feed   | Depth of Cut |                                | Dia.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Corner Radius                 | Under Neck Length | Spindle Speed                                                         | Feed   | Depth of Cut |       | Spindle Speed                                     | Feed   | Depth of Cut |       | Spindle Speed          | Feed   | Depth of Cut |       |
|                                |                               |                   | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>      | mm/min | ap mm        | ae mm                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                 | mm/min | ap mm        | ae mm | min <sup>-1</sup>      | mm/min | ap mm        | ae mm |
| 1.5                            | 0.1<br>0.2<br>0.3<br>0.5      | 4                 | 22,000                                                                | 1,600  | 0.09         | 0.45  | 18,000                                            | 1,000  | 0.05         | 0.36  | 26,000                 | 2,300  | 0.1          | 0.45                           | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.1<br>0.2<br>0.3<br>0.5<br>1 | 20                | 6,000                                                                 | 1,800  | 0.25         | 1.6   | 4,800                                             | 800    | 0.1          | 1.3   | 7,200                  | 3,000  | 0.36         | 1.6   |
|                                |                               | 6                 | 20,000                                                                | 1,400  | 0.08         | 0.45  | 16,000                                            | 850    | 0.045        | 0.36  | 24,000                 | 2,000  | 0.09         | 0.45                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               | 40                | 4,000                                                                 | 700    | 0.07         | 1.6   | 3,200                                             | 400    | 0.05         | 1.3   | 4,800                  | 1,300  | 0.16         | 1.6   |
|                                |                               | 8                 | 18,000                                                                | 1,200  | 0.07         | 0.45  | 15,000                                            | 700    | 0.04         | 0.36  | 22,000                 | 1,800  | 0.08         | 0.45                           | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.1<br>0.2<br>0.3<br>0.5<br>1 | 24                | 4,500                                                                 | 1,500  | 0.3          | 2.1   | 3,600                                             | 700    | 0.15         | 1.7   | 5,400                  | 2,600  | 0.48         | 2.1   |
|                                |                               | 10                | 16,000                                                                | 1,000  | 0.06         | 0.45  | 13,000                                            | 550    | 0.035        | 0.36  | 20,000                 | 1,500  | 0.07         | 0.45                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               | 48                | 3,000                                                                 | 600    | 0.1          | 2.1   | 2,400                                             | 350    | 0.05         | 1.7   | 3,600                  | 1,000  | 0.18         | 2.1   |
|                                |                               | 12                | 14,000                                                                | 800    | 0.05         | 0.45  | 11,000                                            | 450    | 0.03         | 0.36  | 17,000                 | 1,200  | 0.06         | 0.45                           | <div>Notes</div> <div>※1 Adjust milling conditions according to milling shape and machine type.<br/>※2 ap : Axial Depth of Cut, ae : Radial Depth of Cut.<br/>※3 Recommend to use oil mist coolant for machining hardened steels.<br/>※4 Recommend to apply helical or ramping for approaching into axial direction.<br/>※5 Adjust feed rate 50% lower and cutting depth (ae) 30% lower for milling deep wall area when L/D exceeds 8 for stable milling.<br/>※6 For slotting, recommend reciprocating milling by adjusting feed &amp; ap in below 50% of recommended milling condition.<br/>※7 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.</div> |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 16                | 12,000                                                                | 600    | 0.035        | 0.45  | 10,000                                            | 350    | 0.018        | 0.36  | 15,000                 | 900    | 0.04         | 0.45                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 18                | 11,000                                                                | 450    | 0.03         | 0.45  | 9,000                                             | 280    | 0.01         | 0.36  | 13,000                 | 650    | 0.035        | 0.45                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 20                | 10,000                                                                | 300    | 0.02         | 0.45  | 8,000                                             | 200    | 0.005        | 0.36  | 12,000                 | 450    | 0.025        | 0.45                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
| 2                              | 0.1<br>0.2<br>0.3<br>0.5      | 4                 | 16,000                                                                | 2,200  | 0.13         | 0.5   | 14,000                                            | 1,000  | 0.06         | 0.4   | 20,000                 | 3,000  | 0.15         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 6                 | 16,000                                                                | 2,100  | 0.12         | 0.5   | 14,000                                            | 900    | 0.055        | 0.4   | 20,000                 | 2,800  | 0.14         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 8                 | 16,000                                                                | 2,000  | 0.11         | 0.5   | 13,000                                            | 800    | 0.05         | 0.4   | 20,000                 | 2,600  | 0.13         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 10                | 16,000                                                                | 1,800  | 0.1          | 0.5   | 13,000                                            | 750    | 0.045        | 0.4   | 20,000                 | 2,300  | 0.12         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 12                | 14,000                                                                | 1,500  | 0.09         | 0.5   | 11,000                                            | 600    | 0.04         | 0.4   | 17,000                 | 1,900  | 0.11         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 16                | 12,000                                                                | 1,200  | 0.07         | 0.5   | 10,000                                            | 500    | 0.03         | 0.4   | 15,000                 | 1,600  | 0.085        | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 20                | 10,000                                                                | 800    | 0.05         | 0.5   | 8,000                                             | 350    | 0.02         | 0.4   | 12,000                 | 1,000  | 0.06         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 24                | 9,000                                                                 | 700    | 0.03         | 0.5   | 7,000                                             | 280    | 0.01         | 0.4   | 11,000                 | 900    | 0.04         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 26                | 9,000                                                                 | 600    | 0.025        | 0.5   | 7,000                                             | 250    | 0.008        | 0.4   | 11,000                 | 850    | 0.03         | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 30                | 8,000                                                                 | 400    | 0.02         | 0.5   | 6,400                                             | 200    | 0.005        | 0.4   | 9,000                  | 550    | 0.025        | 0.5                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
| 2.5                            | 0.1<br>0.2<br>0.3<br>0.5      | 10                | 13,000                                                                | 1,800  | 0.14         | 0.8   | 11,000                                            | 900    | 0.07         | 0.65  | 16,000                 | 3,000  | 0.17         | 0.8                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 20                | 9,000                                                                 | 1,000  | 0.08         | 0.8   | 7,000                                             | 450    | 0.05         | 0.65  | 11,000                 | 1,600  | 0.1          | 0.8                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 30                | 7,000                                                                 | 500    | 0.03         | 0.8   | 5,600                                             | 250    | 0.01         | 0.65  | 8,500                  | 850    | 0.035        | 0.8                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
| 3                              | 0.1<br>0.2<br>0.3<br>0.5<br>1 | 12                | 11,000                                                                | 1,800  | 0.16         | 0.9   | 9,000                                             | 900    | 0.08         | 0.75  | 13,000                 | 3,000  | 0.2          | 0.9                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 18                | 10,000                                                                | 1,400  | 0.12         | 0.9   | 8,000                                             | 700    | 0.07         | 0.75  | 12,000                 | 2,400  | 0.14         | 0.9                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 24                | 8,000                                                                 | 1,000  | 0.08         | 0.9   | 6,400                                             | 500    | 0.05         | 0.75  | 10,000                 | 1,800  | 0.1          | 0.9                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 30                | 7,000                                                                 | 800    | 0.06         | 0.9   | 5,600                                             | 400    | 0.03         | 0.75  | 8,500                  | 1,300  | 0.07         | 0.9                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 36                | 6,000                                                                 | 500    | 0.03         | 0.9   | 4,800                                             | 300    | 0.01         | 0.75  | 7,200                  | 1,000  | 0.04         | 0.9                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
| 4                              | 0.1<br>0.2<br>0.3<br>0.5<br>1 | 16                | 8,000                                                                 | 2,000  | 0.2          | 1.2   | 6,400                                             | 850    | 0.1          | 1     | 10,000                 | 3,200  | 0.3          | 1.2                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 24                | 7,000                                                                 | 1,500  | 0.12         | 1.2   | 5,600                                             | 700    | 0.08         | 1     | 8,500                  | 2,400  | 0.18         | 1.2                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 32                | 6,000                                                                 | 800    | 0.08         | 1.2   | 4,800                                             | 500    | 0.04         | 1     | 8,000                  | 1,800  | 0.14         | 1.2                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |
|                                |                               | 48                | 4,000                                                                 | 400    | 0.04         | 1.2   | 3,200                                             | 300    | 0.01         | 1     | 4,800                  | 700    | 0.05         | 1.2                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                   |                                                                       |        |              |       |                                                   |        |              |       |                        |        |              |       |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55  
HRC

Hardened Steel

Coating

Long Neck  
Corner Radius

I-070

I-071



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

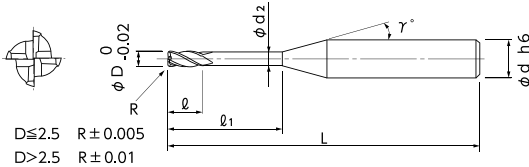
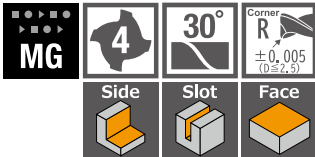
# MHR430R

Size  $\phi 1 \times R0.05 \sim \phi 6 \times R1$

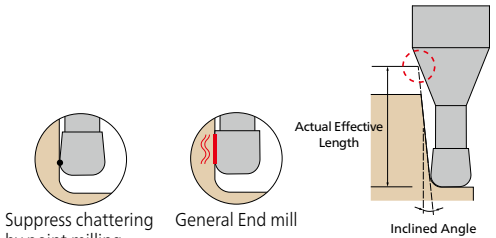


## MUGEN COATING 4-Flute Long Neck Radius End Mill

4-flute long neck corner radius end mill. Maximum L/D=12

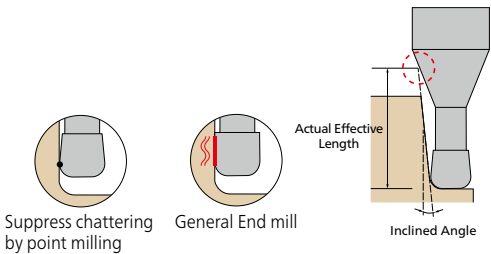


- Enhanced selectivity for machining process in all 146 sizes.
- Employing short flute length. Less contact to work material reduces chattering.
- Corner R accuracy :  $\pm 5\mu\text{m}$  (Dia.  $\sim 2.5$ )
- Upgraded MUGEN COATING brings outstanding performance for milling of Prehardened Steels and Copper Electrode as well.



| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>( $\ell_1$ ) | Length<br>of Cut<br>( $\ell$ ) | Neck<br>Dia.<br>( $d_2$ ) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|--------------------------------------|--------------------------------|---------------------------|-------------------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                                      |                                |                           |                                     |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 08-00230-10021 | 1           | R0.05                   | 3                                    | 0.8                            | 0.95                      | 12°                                 | 4                    | 50                       | 3.25                                                                | 3.39  | 3.55  | 3.73  | 4.13  |
| 08-00230-10022 |             |                         | 4                                    |                                |                           |                                     |                      | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 08-00230-10023 |             |                         | 5                                    |                                |                           |                                     |                      | 50                       | 5.34                                                                | 5.57  | 5.83  | 6.12  | 6.80  |
| 08-00230-10024 |             |                         | 6                                    |                                |                           |                                     |                      | 50                       | 6.38                                                                | 6.66  | 6.98  | 7.32  | 8.13  |
| 08-00230-10025 |             |                         | 8                                    |                                |                           |                                     |                      | 50                       | 8.46                                                                | 8.84  | 9.26  | 9.72  | 10.79 |
| 08-00230-10026 |             |                         | 10                                   |                                |                           |                                     |                      | 50                       | 10.55                                                               | 11.02 | 11.54 | 12.11 | 13.45 |
| 08-00230-10027 |             | R0.1                    | 12                                   |                                |                           |                                     |                      | 50                       | 12.64                                                               | 13.20 | 13.82 | 14.51 | 16.11 |
| 08-00230-10031 |             |                         | 3                                    |                                |                           |                                     |                      | 50                       | 3.25                                                                | 3.39  | 3.54  | 3.72  | 4.12  |
| 08-00230-10032 |             |                         | 4                                    |                                |                           |                                     |                      | 50                       | 4.29                                                                | 4.48  | 4.69  | 4.91  | 5.45  |
| 08-00230-10033 |             |                         | 5                                    |                                |                           |                                     |                      | 50                       | 5.33                                                                | 5.57  | 5.83  | 6.11  | 6.78  |
| 08-00230-10034 |             |                         | 6                                    |                                |                           |                                     |                      | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00230-10035 |             |                         | 8                                    |                                |                           |                                     |                      | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 08-00230-10036 |             | R0.2                    | 10                                   |                                |                           |                                     |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00230-10037 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00230-10041 |             |                         | 3                                    |                                |                           |                                     |                      | 50                       | 3.24                                                                | 3.38  | 3.53  | 3.70  | 4.08  |
| 08-00230-10042 |             |                         | 4                                    |                                |                           |                                     |                      | 50                       | 4.29                                                                | 4.47  | 4.67  | 4.89  | 5.42  |
| 08-00230-10043 |             |                         | 5                                    |                                |                           |                                     |                      | 50                       | 5.33                                                                | 5.56  | 5.81  | 6.09  | 6.75  |
| 08-00230-10044 |             |                         | 6                                    |                                |                           |                                     |                      | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00230-10045 |             | R0.3                    | 8                                    |                                |                           |                                     |                      | 50                       | 8.46                                                                | 8.83  | 9.24  | 9.69  | 10.74 |
| 08-00230-10046 |             |                         | 10                                   |                                |                           |                                     |                      | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00230-10047 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00230-10051 |             |                         | 3                                    |                                |                           |                                     |                      | 50                       | 3.24                                                                | 3.37  | 3.52  | 3.68  | 4.05  |
| 08-00230-10052 |             |                         | 4                                    |                                |                           |                                     |                      | 50                       | 4.28                                                                | 4.46  | 4.66  | 4.87  | 5.38  |
| 08-00230-10053 |             |                         | 5                                    |                                |                           |                                     |                      | 50                       | 5.32                                                                | 5.55  | 5.80  | 6.07  | 6.71  |
| 08-00230-10054 | 1.2         | R0.1                    | 6                                    |                                |                           |                                     |                      | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00230-10055 |             |                         | 8                                    |                                |                           |                                     |                      | 50                       | 8.45                                                                | 8.82  | 9.22  | 9.67  | 10.71 |
| 08-00230-10056 |             |                         | 10                                   |                                |                           |                                     |                      | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00230-10057 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00230-12031 |             | R0.2                    | 5                                    |                                |                           |                                     |                      | 50                       | 5.33                                                                | 5.57  | 5.83  | 6.11  | 6.78  |
| 08-00230-12032 |             |                         | 10                                   |                                |                           |                                     |                      | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.43 |
| 08-00230-12033 |             |                         | 15                                   |                                |                           |                                     |                      | 60                       | 15.76                                                               | 16.47 | 17.24 | 18.09 | 20.09 |

## MUGEN COATING 4-Flute Long Neck Radius End Mill



| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>( $\ell_1$ ) | Length<br>of Cut<br>( $\ell$ ) | Neck<br>Dia.<br>( $d_2$ ) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|--------------------------------------|--------------------------------|---------------------------|-------------------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                                      |                                |                           |                                     |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 08-00230-12041 | 1.2         | R0.2                    | 5                                    | 1                              | 1.14                      | 12°                                 | 4                    | 50                       | 5.33                                                                | 5.56  | 5.81  | 6.09  | 6.75  |
| 08-00230-12042 |             |                         | 10                                   |                                |                           |                                     |                      | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.40 |
| 08-00230-12043 |             |                         | 15                                   |                                |                           |                                     |                      | 60                       | 15.76                                                               | 16.46 | 17.23 | 18.07 | 20.06 |
| 08-00230-12051 |             | R0.3                    | 5                                    |                                |                           |                                     |                      | 50                       | 5.32                                                                | 5.55  | 5.80  | 6.07  | 6.71  |
| 08-00230-12052 |             |                         | 10                                   |                                |                           |                                     |                      | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.37 |
| 08-00230-12053 |             |                         | 15                                   |                                |                           |                                     |                      | 60                       | 15.75                                                               | 16.45 | 17.21 | 18.05 | 20.02 |
| 08-00230-15031 | 1.5         | R0.1                    | 6                                    | 1.2                            | 1.45                      | 12°                                 | 4                    | 50                       | 6.38                                                                | 6.66  | 6.97  | 7.31  | 8.11  |
| 08-00230-15032 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.50 | 16.10 |
| 08-00230-15033 |             |                         | 18                                   |                                |                           |                                     |                      | 60                       | 18.89                                                               | 19.74 | 20.66 | 21.69 | 24.08 |
| 08-00230-15041 |             | R0.2                    | 6                                    |                                |                           |                                     |                      | 50                       | 6.37                                                                | 6.65  | 6.95  | 7.29  | 8.08  |
| 08-00230-15042 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.63                                                               | 13.19 | 13.80 | 14.48 | 16.06 |
| 08-00230-15043 |             |                         | 18                                   |                                |                           |                                     |                      | 60                       | 18.89                                                               | 19.73 | 20.65 | 21.67 | 24.05 |
| 08-00230-15051 |             | R0.3                    | 6                                    |                                |                           |                                     |                      | 50                       | 6.37                                                                | 6.64  | 6.94  | 7.27  | 8.04  |
| 08-00230-15052 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.62                                                               | 13.18 | 13.79 | 14.46 | 16.03 |
| 08-00230-15053 |             |                         | 18                                   |                                |                           |                                     |                      | 60                       | 18.88                                                               | 19.72 | 20.64 | 21.65 | 24.01 |
| 08-00230-15061 |             | R0.5                    | 6                                    |                                |                           |                                     |                      | 50                       | 6.36                                                                | 6.62  | 6.91  | 7.23  | 7.98  |
| 08-00230-15062 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.62                                                               | 13.16 | 13.76 | 14.42 | 15.96 |
| 08-00230-15063 |             |                         | 18                                   |                                |                           |                                     |                      | 60                       | 18.87                                                               | 19.70 | 20.61 | 21.61 | 23.95 |
| 08-00230-20031 | 2           | R0.1                    | 8                                    | 1.6                            | 1.91                      | 12°                                 | 4                    | 50                       | 8.49                                                                | 8.86  | 9.28  | 9.73  | 10.80 |
| 08-00230-20032 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.66                                                               | 13.22 | 13.84 | 14.53 | 16.13 |
| 08-00230-20033 |             |                         | 16                                   |                                |                           |                                     |                      | 60                       | 16.83                                                               | 17.58 | 18.41 | 19.32 | Free  |
| 08-00230-20034 |             |                         | 20                                   |                                |                           |                                     |                      | 60                       | 21.00                                                               | 21.94 | 22.97 | 24.11 | Free  |
| 08-00230-20035 |             | R0.2                    | 24                                   |                                |                           |                                     |                      | 70                       | 25.17                                                               | 26.30 | 27.54 | 28.90 | Free  |
| 08-00230-20041 |             |                         | 8                                    |                                |                           |                                     |                      | 50                       | 8.48                                                                | 8.85  | 9.26  | 9.71  | 10.77 |
| 08-00230-20042 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.65                                                               | 13.21 | 13.83 | 14.51 | 16.09 |
| 08-00230-20043 |             |                         | 16                                   |                                |                           |                                     |                      | 60                       | 16.83                                                               | 17.57 | 18.39 | 19.30 | Free  |
| 08-00230-20044 |             |                         | 20                                   |                                |                           |                                     |                      | 60                       | 21.00                                                               | 21.93 | 22.96 | 24.09 | Free  |
| 08-00230-20045 |             |                         | 24                                   |                                |                           |                                     |                      | 70                       | 25.17                                                               | 26.29 | 27.52 | 28.88 | Free  |
| 08-00230-20051 |             | R0.3                    | 8                                    |                                |                           |                                     |                      | 50                       | 8.48                                                                | 8.85  | 9.25  | 9.70  | 10.74 |
| 08-00230-20052 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.65                                                               | 13.20 | 13.81 | 14.49 | 16.06 |
| 08-00230-20053 |             |                         | 16                                   |                                |                           |                                     |                      | 60                       | 16.82                                                               | 17.56 | 18.38 | 19.28 | Free  |
| 08-00230-20054 |             |                         | 20                                   |                                |                           |                                     |                      | 60                       | 20.99                                                               | 21.92 | 22.95 | 24.07 | Free  |
| 08-00230-20055 |             |                         | 24                                   |                                |                           |                                     |                      | 70                       | 25.16                                                               | 26.28 | 27.51 | 28.86 | Free  |
| 08-00230-20061 |             | R0.5                    | 8                                    |                                |                           |                                     |                      | 50                       | 8.47                                                                | 8.83  | 9.22  | 9.66  | 10.67 |
| 08-00230-20062 |             |                         | 12                                   |                                |                           |                                     |                      | 50                       | 12.64                                                               | 13.19 | 13.79 | 14.45 | 15.98 |
| 08-00230-20063 |             |                         | 16                                   |                                |                           |                                     |                      | 60                       | 16.81                                                               | 17.55 | 18.35 | 19.24 | Free  |
| 08-00230-20064 |             |                         | 20                                   |                                |                           |                                     |                      | 60                       | 20.98                                                               | 21.91 | 22.92 | 24.03 | Free  |
| 08-00230-20065 |             |                         | 24                                   |                                |                           |                                     |                      | 70                       | 25.16                                                               | 26.26 | 27.48 | 28.82 | Free  |

### How to Order

When you order, indicate MHR430R (D)×(R)×(ℓ1). ※(γ) is reference value.

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck  
Corner Radius

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel **P**

Alloy Steel **P**

Prehardened Steel **P**

Stainless Steel **M**

Aluminium Alloy **N**

Copper **N**

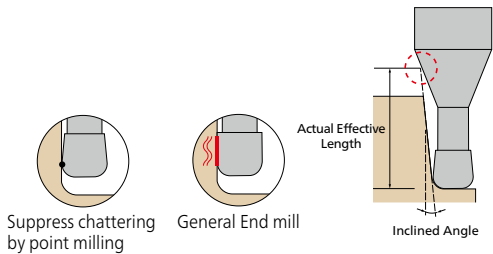
Resin **N**

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Corner Radius

MHR430R

MUGEN COATING 4-Flute Long Neck Radius End Mill



Unit : mm

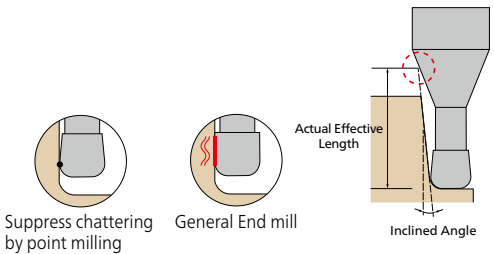
| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 08-00230-25031 | 2.5         | R0.1                    | 10                           | 2                       | 2.39                 | 12°                        | 4                    | 50                       | 10.67                                                               | 11.15 | 11.67 | 12.24 | 13.59 |
| 08-00230-25032 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.10                                                               | 22.04 | 23.08 | Free  | Free  |
| 08-00230-25033 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.53                                                               | 32.94 | Free  | Free  | Free  |
| 08-00230-25041 |             | R0.2                    | 10                           |                         |                      |                            |                      | 50                       | 10.67                                                               | 11.14 | 11.65 | 12.22 | 13.56 |
| 08-00230-25042 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.10                                                               | 22.04 | 23.07 | Free  | Free  |
| 08-00230-25043 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.52                                                               | 32.93 | Free  | Free  | Free  |
| 08-00230-25051 |             | R0.3                    | 10                           |                         |                      |                            |                      | 50                       | 10.66                                                               | 11.13 | 11.64 | 12.20 | 13.53 |
| 08-00230-25052 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.09                                                               | 22.03 | 23.05 | Free  | Free  |
| 08-00230-25053 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.52                                                               | 32.92 | Free  | Free  | Free  |
| 08-00230-25061 |             | R0.5                    | 10                           |                         |                      |                            |                      | 50                       | 10.65                                                               | 11.11 | 11.61 | 12.16 | 13.46 |
| 08-00230-25062 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.08                                                               | 22.01 | 23.02 | Free  | Free  |
| 08-00230-25063 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.51                                                               | 32.91 | Free  | Free  | Free  |
| 08-00230-30031 | 3           | R0.1                    | 12                           | 2.5                     | 2.85                 | 12°                        | 6                    | 50                       | 12.88                                                               | 13.45 | 14.09 | 14.78 | 16.41 |
| 08-00230-30032 |             |                         | 18                           |                         |                      |                            |                      | 60                       | 19.14                                                               | 19.99 | 20.93 | 21.97 | 24.40 |
| 08-00230-30033 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.39                                                               | 26.53 | 27.78 | 29.16 | Free  |
| 08-00230-30034 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.65                                                               | 33.07 | 34.63 | 36.35 | Free  |
| 08-00230-30035 |             |                         | 36                           |                         |                      |                            |                      | 80                       | 37.91                                                               | 39.61 | 41.48 | 43.54 | Free  |
| 08-00230-30041 |             | R0.2                    | 12                           |                         |                      |                            |                      | 50                       | 12.87                                                               | 13.45 | 14.07 | 14.76 | 16.38 |
| 08-00230-30042 |             |                         | 18                           |                         |                      |                            |                      | 60                       | 19.13                                                               | 19.98 | 20.92 | 21.95 | 24.36 |
| 08-00230-30043 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.39                                                               | 26.52 | 27.77 | 29.14 | Free  |
| 08-00230-30044 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.65                                                               | 33.06 | 34.62 | 36.33 | Free  |
| 08-00230-30045 |             |                         | 36                           |                         |                      |                            |                      | 80                       | 37.90                                                               | 39.60 | 41.46 | 43.52 | Free  |
| 08-00230-30051 |             | R0.3                    | 12                           |                         |                      |                            |                      | 50                       | 12.87                                                               | 13.44 | 14.06 | 14.74 | 16.34 |
| 08-00230-30052 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.21                                                               | 22.15 | 23.19 | 24.33 | 26.99 |
| 08-00230-30053 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.39                                                               | 26.51 | 27.75 | 29.12 | Free  |
| 08-00230-30054 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.64                                                               | 33.05 | 34.60 | 36.31 | Free  |
| 08-00230-30055 |             |                         | 36                           |                         |                      |                            |                      | 80                       | 37.90                                                               | 39.59 | 41.45 | 43.50 | Free  |
| 08-00230-30061 |             | R0.5                    | 12                           |                         |                      |                            |                      | 50                       | 12.86                                                               | 13.42 | 14.03 | 14.70 | 16.28 |
| 08-00230-30062 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.21                                                               | 22.14 | 23.16 | 24.29 | 26.93 |
| 08-00230-30063 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.38                                                               | 26.50 | 27.72 | 29.08 | Free  |
| 08-00230-30064 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.63                                                               | 33.03 | 34.57 | 36.27 | Free  |
| 08-00230-30065 |             |                         | 36                           |                         |                      |                            |                      | 80                       | 37.89                                                               | 39.57 | 41.42 | 43.46 | Free  |
| 08-00230-30071 |             | R1                      | 12                           |                         |                      |                            |                      | 50                       | 12.84                                                               | 13.37 | 13.96 | 14.60 | 16.11 |
| 08-00230-30072 |             |                         | 20                           |                         |                      |                            |                      | 60                       | 21.18                                                               | 22.09 | 23.09 | 24.19 | 26.76 |
| 08-00230-30073 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.36                                                               | 26.45 | 27.65 | 28.98 | Free  |
| 08-00230-30074 |             |                         | 30                           |                         |                      |                            |                      | 70                       | 31.61                                                               | 32.99 | 34.50 | 36.17 | Free  |
| 08-00230-30075 |             |                         | 36                           |                         |                      |                            |                      | 80                       | 37.87                                                               | 39.53 | 41.35 | 43.36 | Free  |

How to Order

When you order, indicate MHR430R (D)×(R)×(ℓ1). ※(γ) is reference value.

MHR430R

MUGEN COATING 4-Flute Long Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |      |
|----------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|------|
|                |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°   |
| 08-00230-40031 | 4           | R0.1                    | 16                           | 3.2                     | 3.8                  | 12°                        | 6                    | 60                       | 17.17                                                               | 17.94 | 18.79 | 19.72 | Free |
| 08-00230-40032 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.52                                                               | 26.66 | 27.92 | 29.30 | Free |
| 08-00230-40033 |             |                         | 32                           |                         |                      |                            |                      | 70                       | 33.86                                                               | 35.38 | 37.05 | Free  | Free |
| 08-00230-40034 |             |                         | 48                           |                         |                      |                            |                      | 100                      | 50.55                                                               | 52.82 | Free  | Free  | Free |
| 08-00230-40041 |             | R0.2                    | 16                           |                         |                      |                            |                      | 60                       | 17.17                                                               | 17.93 | 18.77 | 19.70 | Free |
| 08-00230-40042 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.51                                                               | 26.65 | 27.90 | 29.28 | Free |
| 08-00230-40043 |             |                         | 32                           |                         |                      |                            |                      | 70                       | 33.86                                                               | 35.37 | 37.03 | Free  | Free |
| 08-00230-40044 |             |                         | 48                           |                         |                      |                            |                      | 100                      | 50.54                                                               | 52.81 | Free  | Free  | Free |
| 08-00230-40051 |             | R0.3                    | 16                           |                         |                      |                            |                      | 60                       | 17.16                                                               | 17.92 | 18.76 | 19.68 | Free |
| 08-00230-40052 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.51                                                               | 26.64 | 27.89 | 29.26 | Free |
| 08-00230-40053 |             |                         | 32                           |                         |                      |                            |                      | 70                       | 33.85                                                               | 35.36 | 37.02 | Free  | Free |
| 08-00230-40054 |             |                         | 48                           |                         |                      |                            |                      | 100                      | 50.54                                                               | 52.80 | Free  | Free  | Free |
| 08-00230-40061 |             | R0.5                    | 16                           |                         |                      |                            |                      | 60                       | 17.16                                                               | 17.91 | 18.73 | 19.64 | Free |
| 08-00230-40062 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.50                                                               | 26.62 | 27.86 | 29.22 | Free |
| 08-00230-40063 |             |                         | 32                           |                         |                      |                            |                      | 70                       | 33.84                                                               | 35.34 | 36.99 | Free  | Free |
| 08-00230-40064 |             |                         | 48                           |                         |                      |                            |                      | 100                      | 50.53                                                               | 52.78 | Free  | Free  | Free |
| 08-00230-40071 |             | R1                      | 16                           |                         |                      |                            |                      | 60                       | 17.13                                                               | 17.86 | 18.66 | 19.54 | Free |
| 08-00230-40072 |             |                         | 24                           |                         |                      |                            |                      | 70                       | 25.48                                                               | 26.58 | 27.79 | 29.12 | Free |
| 08-00230-40073 |             |                         | 32                           |                         |                      |                            |                      | 70                       | 33.82                                                               | 35.30 | 36.92 | Free  | Free |
| 08-00230-40074 |             |                         | 48                           |                         |                      |                            |                      | 100                      | 50.51                                                               | 52.73 | Free  | Free  | Free |
| 08-00230-50031 | 5           | R0.1                    | 20                           | 4                       | 4.75                 | 12°                        | 6                    | 70                       | 21.35                                                               | 22.30 | Free  | Free  | Free |
| 08-00230-50032 |             |                         | 40                           |                         |                      |                            |                      | 90                       | 42.20                                                               | Free  | Free  | Free  | Free |
| 08-00230-50041 |             | R0.2                    | 20                           |                         |                      |                            |                      | 70                       | 21.34                                                               | 22.29 | Free  | Free  | Free |
| 08-00230-50042 |             |                         | 40                           |                         |                      |                            |                      | 90                       | 42.20                                                               | Free  | Free  | Free  | Free |
| 08-00230-50051 |             | R0.3                    | 20                           |                         |                      |                            |                      | 70                       | 21.34                                                               | 22.28 | Free  | Free  | Free |
| 08-00230-50052 |             |                         | 40                           |                         |                      |                            |                      | 90                       | 42.19                                                               | Free  | Free  | Free  | Free |
| 08-00230-50061 |             | R0.5                    | 20                           |                         |                      |                            |                      | 70                       | 21.33                                                               | 22.27 | Free  | Free  | Free |
| 08-00230-50062 |             |                         | 40                           |                         |                      |                            |                      | 90                       | 42.19                                                               | Free  | Free  | Free  | Free |
| 08-00230-50071 |             | R1                      | 20                           |                         |                      |                            |                      | 70                       | 21.31                                                               | 22.22 | Free  | Free  | Free |
| 08-00230-50072 |             |                         | 40                           |                         |                      |                            |                      | 90                       | 42.16                                                               | Free  | Free  | Free  | Free |
| 08-00230-60031 | 6           | R0.1                    | 24                           | 5                       | 5.7                  | -                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60032 |             |                         | 48                           |                         |                      |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60041 |             | R0.2                    | 24                           |                         |                      |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60042 |             |                         | 48                           |                         |                      |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60051 |             | R0.3                    | 24                           |                         |                      |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60052 |             |                         | 48                           |                         |                      |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60061 |             | R0.5                    | 24                           |                         |                      |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60062 |             |                         | 48                           |                         |                      |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60071 |             | R1                      | 24                           |                         |                      |                            |                      | 90                       | Free                                                                | Free  | Free  | Free  | Free |
| 08-00230-60072 |             |                         | 48                           |                         |                      |                            |                      | 110                      | Free                                                                | Free  | Free  | Free  | Free |

~ 55  
HRC  
Hardened Steel  
**H**

Coating  
Long Neck  
Corner Radius



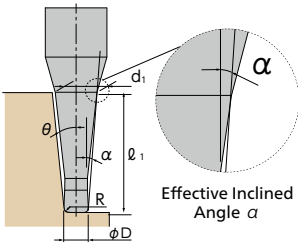
Regular Line  
MUGEN COATING  
Long Neck Type

## MUGEN COATING 2-Flute Long Taper Neck Radius End Mill



MG 2 30° Corner R  $\pm 0.005$   $\phi d$  h5

Side Slot Face



- Improve surface overall accuracy brought by high speed cutting with minimal chattering in roughing to finishing process.
- High R-Accuracy :  $\pm 5\mu\text{m}$ .
- Better performance in wide range of machining of direct carving on Hardened Steels, Prehardened Steels and Copper Electrode.

| Code No.       | Dia. (D) | Corner Radius (R) | Neck Taper Angle ( $\theta$ ) | Under Neck Length ( $\ell_1$ ) | Neck Dia. ( $d_1$ ) | Length of Cut ( $\ell$ ) | Under Neck Length 2 ( $\ell_2$ ) | Neck Taper Angle 2 ( $\gamma$ ) | Effective Inclined Angle ( $\alpha$ ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|-------------------------------|--------------------------------|---------------------|--------------------------|----------------------------------|---------------------------------|---------------------------------------|----------------|--------------------|
| 08-00770-05231 | 0.5      | R0.05             | 3°                            | 3                              | 0.71                | 0.4                      | 1                                | 12°                             | 2°02′                                 | 4              | 50                 |
| 5              |          |                   |                               | 0.92                           | 2°25′               |                          |                                  |                                 | 50                                    |                |                    |
| 8              |          |                   |                               | 1.24                           | 2°38′               |                          |                                  |                                 | 50                                    |                |                    |
| 10             |          |                   |                               | 1.45                           | 2°43′               |                          |                                  |                                 | 50                                    |                |                    |
| 12             |          |                   |                               | 1.66                           | 2°46′               |                          |                                  |                                 | 50                                    |                |                    |
| 08-00770-05251 |          |                   | 5°                            | 3                              | 0.85                |                          |                                  |                                 | 3°23′                                 |                | 50                 |
| 5              |          |                   |                               | 1.2                            | 4°02′               |                          |                                  |                                 | 50                                    |                |                    |
| 8              |          |                   |                               | 1.73                           | 4°25′               |                          |                                  |                                 | 50                                    |                |                    |
| 10             |          |                   |                               | 2.08                           | 4°32′               |                          |                                  |                                 | 50                                    |                |                    |
| 08-00770-05311 |          |                   |                               | R0.1                           | 1°                  |                          |                                  |                                 | 3                                     |                | 0.57               |
| 5              |          | 0.64              | 0°49′                         |                                |                     |                          |                                  |                                 | 50                                    |                |                    |
| 8              |          | 0.75              | 0°53′                         |                                |                     |                          |                                  |                                 | 50                                    |                |                    |
| 10             |          | 0.82              | 0°55′                         |                                |                     |                          |                                  |                                 | 50                                    |                |                    |
| 12             |          | 0.89              | 0°55′                         |                                |                     |                          |                                  |                                 | 50                                    |                |                    |
| 08-00770-05331 |          | 3°                | 3                             |                                | 0.71                |                          |                                  |                                 | 2°04′                                 |                | 50                 |
| 5              |          |                   | 0.92                          |                                | 2°27′               |                          |                                  |                                 | 50                                    |                |                    |
| 8              |          |                   | 1.24                          |                                | 2°40′               |                          |                                  |                                 | 50                                    |                |                    |
| 10             |          |                   | 1.45                          |                                | 2°44′               |                          |                                  |                                 | 50                                    |                |                    |
| 12             |          |                   | 1.66                          |                                | 2°46′               |                          |                                  |                                 | 50                                    |                |                    |
| 08-00770-05351 |          | 5°                | 3                             | 0.85                           | 3°27′               |                          |                                  |                                 | 50                                    |                |                    |
| 5              | 1.2      |                   | 4°05′                         | 50                             |                     |                          |                                  |                                 |                                       |                |                    |
| 8              | 1.73     |                   | 4°26′                         | 50                             |                     |                          |                                  |                                 |                                       |                |                    |
| 10             | 2.08     |                   | 4°33′                         | 50                             |                     |                          |                                  |                                 |                                       |                |                    |
| 08-00770-08211 | 0.8      |                   | R0.05                         | 1°                             | 5                   | 0.92                     | 0.65                             | 1.6                             | 12°                                   | 0°41′          | 4                  |
| 8              |          | 1.03              |                               |                                | 0°48′               | 50                       |                                  |                                 |                                       |                |                    |
| 3°             |          | 5                 |                               | 1.16                           | 2°04′               | 50                       |                                  |                                 |                                       |                |                    |
| 8              |          | 1.48              |                               | 2°25′                          | 50                  |                          |                                  |                                 |                                       |                |                    |
| 08-00770-08311 |          | R0.1              | 1°                            | 5                              | 0.92                | 0°42′                    |                                  |                                 |                                       | 50             |                    |
| 8              |          |                   |                               | 1.03                           | 0°49′               | 50                       |                                  |                                 |                                       |                |                    |
| 3°             |          |                   | 5                             | 1.16                           | 2°05′               | 50                       |                                  |                                 |                                       |                |                    |
| 8              |          |                   | 1.48                          | 2°26′                          | 50                  |                          |                                  |                                 |                                       |                |                    |
| 08-00770-08411 |          | R0.2              | 1°                            | 5                              | 0.92                | 0°43′                    |                                  |                                 |                                       | 50             |                    |
| 8              |          |                   |                               | 1.03                           | 0°49′               | 50                       |                                  |                                 |                                       |                |                    |
| 3°             |          |                   | 5                             | 1.16                           | 2°07′               | 50                       |                                  |                                 |                                       |                |                    |
| 8              |          |                   | 1.48                          | 2°28′                          | 50                  |                          |                                  |                                 |                                       |                |                    |
| 08-00770-10211 | 1        | R0.05             | 1°                            | 6                              | 1.14                | 0.8                      | 2                                | 12°                             | 0°40′                                 | 4              | 50                 |
| 10             |          |                   |                               | 1.28                           | 0°48′               |                          |                                  |                                 | 60                                    |                |                    |
| 15             |          |                   |                               | 1.46                           | 0°52′               |                          |                                  |                                 | 60                                    |                |                    |
| 20             |          |                   |                               | 1.63                           | 0°54′               |                          |                                  |                                 | 60                                    |                |                    |

When you order, indicate MSTNR230 (D)×(R)×(θ)×(ℓ1). ※(γ) is reference value.



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

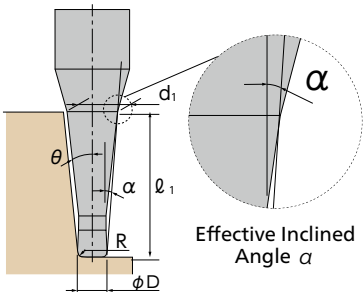
Resin N

~ 55  
HRC  
Hardened Steel  
H

Coating  
Long Neck Tapered  
Corner Radius

MSTNR230

MUGEN COATING 2-Flute Long Taper Neck Radius End Mill



Unit : mm

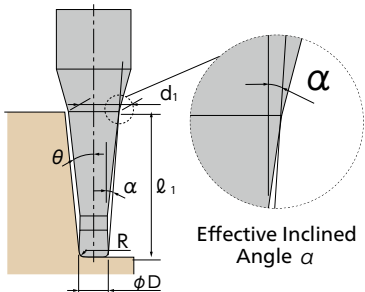
| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Neck Taper<br>Angle<br>( $\theta$ ) | Under Neck<br>Length<br>( $\ell_1$ ) | Neck<br>Dia.<br>( $d_1$ ) | Length of<br>Cut<br>( $\ell$ ) | Under Neck<br>Length 2<br>( $\ell_2$ ) | Neck Taper<br>Angle 2<br>( $\gamma$ ) | Effective<br>Inclined Angle<br>( $\alpha$ ) | Shank<br>Dia.<br>( $d$ ) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|--------------------------------------|---------------------------|--------------------------------|----------------------------------------|---------------------------------------|---------------------------------------------|--------------------------|--------------------------|
| 08-00770-10215 | 1           | R0.05                   | 1°                                  | 25                                   | 1.81                      | 0.8                            | 2                                      | 12°                                   | 0°55′                                       | 4                        | 70                       |
| 08-00770-10216 |             |                         |                                     | 30                                   | 1.98                      |                                |                                        |                                       | 0°56′                                       |                          | 80                       |
| 08-00770-10217 |             |                         |                                     | 35                                   | 2.16                      |                                |                                        |                                       | 0°56′                                       |                          | 80                       |
| 08-00770-10231 |             |                         | 3°                                  | 6                                    | 1.42                      |                                |                                        |                                       | 2°01′                                       |                          | 50                       |
| 08-00770-10232 |             |                         |                                     | 10                                   | 1.84                      |                                |                                        |                                       | 2°25′                                       |                          | 60                       |
| 08-00770-10311 |             |                         |                                     | R0.1                                 | 1°                        |                                |                                        |                                       | 6                                           |                          | 1.14                     |
| 08-00770-10312 |             | 10                      | 1.28                                |                                      |                           |                                |                                        |                                       | 0°49′                                       |                          | 60                       |
| 08-00770-10313 |             | 15                      | 1.46                                |                                      |                           |                                |                                        |                                       | 0°52′                                       |                          | 60                       |
| 08-00770-10314 |             | 20                      | 1.63                                |                                      |                           |                                |                                        |                                       | 0°54′                                       |                          | 60                       |
| 08-00770-10315 |             | 25                      | 1.81                                |                                      |                           |                                |                                        |                                       | 0°55′                                       |                          | 70                       |
| 08-00770-10316 |             | 30                      | 1.98                                |                                      |                           |                                |                                        |                                       | 0°56′                                       |                          | 80                       |
| 08-00770-10317 |             | 35                      | 2.16                                |                                      |                           |                                |                                        |                                       | 0°57′                                       |                          | 80                       |
| 08-00770-10331 |             | 3°                      | 6                                   |                                      |                           |                                |                                        |                                       | 1.42                                        |                          | 2°02′                    |
| 08-00770-10332 |             |                         | 10                                  | 1.84                                 | 2°26′                     |                                |                                        |                                       | 60                                          |                          |                          |
| 08-00770-10411 |             | R0.2                    | 1°                                  | 6                                    | 1.14                      |                                |                                        |                                       | 0°41′                                       |                          | 50                       |
| 08-00770-10412 |             |                         |                                     | 10                                   | 1.28                      |                                |                                        |                                       | 0°49′                                       |                          | 60                       |
| 08-00770-10413 |             |                         |                                     | 15                                   | 1.46                      |                                |                                        |                                       | 0°53′                                       |                          | 60                       |
| 08-00770-10414 |             |                         |                                     | 20                                   | 1.63                      |                                |                                        |                                       | 0°55′                                       |                          | 60                       |
| 08-00770-10415 |             |                         |                                     | 25                                   | 1.81                      |                                |                                        |                                       | 0°56′                                       |                          | 70                       |
| 08-00770-10416 |             |                         |                                     | 30                                   | 1.98                      |                                |                                        |                                       | 0°56′                                       |                          | 80                       |
| 08-00770-10417 |             |                         |                                     | 35                                   | 2.16                      |                                |                                        |                                       | 0°57′                                       |                          | 80                       |
| 08-00770-10431 |             |                         |                                     | 3°                                   | 6                         |                                |                                        |                                       | 1.42                                        |                          | 2°04′                    |
| 08-00770-10432 |             |                         | 10                                  |                                      | 1.84                      |                                |                                        |                                       | 2°27′                                       |                          | 60                       |
| 08-00770-10511 |             |                         | R0.3                                | 1°                                   | 6                         |                                |                                        |                                       | 1.14                                        |                          | 0°42′                    |
| 08-00770-10512 |             | 10                      |                                     |                                      | 1.28                      |                                |                                        |                                       | 0°49′                                       |                          | 60                       |
| 08-00770-10513 |             | 15                      |                                     |                                      | 1.46                      |                                |                                        |                                       | 0°53′                                       |                          | 60                       |
| 08-00770-10514 |             | 20                      |                                     |                                      | 1.63                      |                                |                                        |                                       | 0°55′                                       |                          | 60                       |
| 08-00770-10515 |             | 25                      |                                     |                                      | 1.81                      |                                |                                        |                                       | 0°56′                                       |                          | 70                       |
| 08-00770-10516 |             | 30                      |                                     |                                      | 1.98                      |                                |                                        |                                       | 0°56′                                       |                          | 80                       |
| 08-00770-10517 |             | 35                      |                                     |                                      | 2.16                      |                                |                                        |                                       | 0°57′                                       |                          | 80                       |
| 08-00770-10531 |             | 3°                      |                                     |                                      | 6                         |                                |                                        |                                       | 1.42                                        |                          | 2°06′                    |
| 08-00770-10532 |             |                         |                                     | 10                                   | 1.84                      |                                |                                        |                                       | 2°29′                                       |                          | 60                       |
| 08-00770-15311 | 1.5         | R0.1                    |                                     | 1°                                   | 10                        | 1.75                           | 1.2                                    | 3                                     | 12°                                         | 0°43′                    | 4                        |
| 08-00770-15312 |             |                         | 15                                  |                                      | 1.92                      | 0°49′                          |                                        |                                       |                                             | 60                       |                          |
| 08-00770-15313 |             |                         | 20                                  |                                      | 2.1                       | 0°51′                          |                                        |                                       |                                             | 60                       |                          |
| 08-00770-15314 |             |                         | 25                                  |                                      | 2.27                      | 0°53′                          |                                        |                                       |                                             | 70                       |                          |
| 08-00770-15315 |             |                         | 30                                  |                                      | 2.45                      | 0°54′                          |                                        |                                       |                                             | 80                       |                          |
| 08-00770-15331 |             |                         | 3°                                  |                                      | 10                        | 2.24                           |                                        |                                       |                                             | 2°07′                    |                          |
| 08-00770-15332 |             | 15                      |                                     | 2.76                                 | 2°25′                     | 60                             |                                        |                                       |                                             |                          |                          |

How to Order

When you order, indicate MSTNR230 (D)×(R)×(θ)×(ℓ1). ※(γ) is reference value.

MSTNR230

MUGEN COATING 2-Flute Long Taper Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Neck Taper<br>Angle<br>( $\theta$ ) | Under Neck<br>Length<br>( $\ell_1$ ) | Neck<br>Dia.<br>( $d_1$ ) | Length of<br>Cut<br>( $\ell$ ) | Under Neck<br>Length 2<br>( $\ell_2$ ) | Neck Taper<br>Angle 2<br>( $\gamma$ ) | Effective<br>Inclined Angle<br>( $\alpha$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|--------------------------------------|---------------------------|--------------------------------|----------------------------------------|---------------------------------------|---------------------------------------------|----------------------|--------------------------|
| 08-00770-15411 | 1.5         | R0.2                    | 1°                                  | 10                                   | 1.75                      | 1.2                            | 3                                      | 12°                                   | 0°43′                                       | 4                    | 60                       |
| 08-00770-15412 |             |                         |                                     | 15                                   | 1.92                      |                                |                                        |                                       | 0°49′                                       |                      | 60                       |
| 08-00770-15413 |             |                         |                                     | 20                                   | 2.1                       |                                |                                        |                                       | 0°52′                                       |                      | 60                       |
| 08-00770-15414 |             |                         | 3°                                  | 25                                   | 2.27                      |                                |                                        |                                       | 0°53′                                       |                      | 70                       |
| 08-00770-15415 |             |                         |                                     | 30                                   | 2.45                      |                                |                                        |                                       | 0°55′                                       |                      | 80                       |
| 08-00770-15431 |             |                         |                                     | 10                                   | 2.24                      |                                |                                        |                                       | 2°08′                                       |                      | 60                       |
| 08-00770-15432 |             | R0.3                    | 1°                                  | 15                                   | 2.76                      |                                |                                        |                                       | 2°26′                                       |                      | 60                       |
| 08-00770-15511 |             |                         |                                     | 10                                   | 1.75                      |                                |                                        |                                       | 0°43′                                       |                      | 60                       |
| 08-00770-15512 |             |                         |                                     | 15                                   | 1.92                      |                                |                                        |                                       | 0°49′                                       |                      | 60                       |
| 08-00770-15513 |             |                         |                                     | 20                                   | 2.1                       |                                |                                        |                                       | 0°52′                                       |                      | 60                       |
| 08-00770-15514 |             |                         | 3°                                  | 25                                   | 2.27                      |                                |                                        |                                       | 0°53′                                       |                      | 70                       |
| 08-00770-15515 |             |                         |                                     | 30                                   | 2.45                      |                                |                                        |                                       | 0°55′                                       |                      | 80                       |
| 08-00770-15531 |             |                         |                                     | 10                                   | 2.24                      |                                |                                        |                                       | 2°10′                                       |                      | 60                       |
| 08-00770-15532 |             |                         |                                     | 15                                   | 2.76                      |                                |                                        |                                       | 2°27′                                       |                      | 60                       |
| 08-00770-20311 | 2           | R0.1                    | 1°                                  | 15                                   | 2.39                      | 1.6                            | 4                                      | 12°                                   | 0°44′                                       | 4                    | 60                       |
| 08-00770-20312 |             |                         |                                     | 20                                   | 2.56                      |                                |                                        |                                       | 0°48′                                       |                      | 60                       |
| 08-00770-20313 |             |                         |                                     | 25                                   | 2.74                      |                                |                                        |                                       | 0°50′                                       |                      | 70                       |
| 08-00770-20314 |             |                         | 3°                                  | 30                                   | 2.91                      |                                |                                        |                                       | 0°52′                                       |                      | 80                       |
| 08-00770-20315 |             |                         |                                     | 40                                   | 3.26                      |                                |                                        |                                       | 0°54′                                       |                      | 80                       |
| 08-00770-20316 |             |                         |                                     | 50                                   | 3.61                      |                                |                                        |                                       | 0°55′                                       |                      | 100                      |
| 08-00770-20331 |             |                         |                                     | 15                                   | 3.16                      |                                |                                        |                                       | 2°13′                                       |                      | 60                       |
| 08-00770-20332 |             |                         | 1°                                  | 20                                   | 3.68                      |                                |                                        |                                       | 2°25′                                       |                      | 60                       |
| 08-00770-20411 |             | R0.2                    |                                     | 15                                   | 2.39                      |                                |                                        |                                       | 0°44′                                       |                      | 60                       |
| 08-00770-20412 |             | 1°                      | 20                                  | 2.56                                 | 0°49′                     |                                |                                        |                                       | 60                                          |                      |                          |
| 08-00770-20413 |             |                         | 25                                  | 2.74                                 | 0°51′                     |                                |                                        |                                       | 70                                          |                      |                          |
| 08-00770-20414 |             |                         | 30                                  | 2.91                                 | 0°52′                     |                                |                                        |                                       | 80                                          |                      |                          |
| 08-00770-20415 |             |                         | 40                                  | 3.26                                 | 0°54′                     |                                |                                        |                                       | 80                                          |                      |                          |
| 08-00770-20416 |             |                         | 50                                  | 3.61                                 | 0°55′                     |                                |                                        |                                       | 100                                         |                      |                          |
| 08-00770-20431 |             | 3°                      | 15                                  | 3.16                                 | 2°14′                     |                                |                                        |                                       | 60                                          |                      |                          |
| 08-00770-20432 |             |                         | 20                                  | 3.68                                 | 2°25′                     |                                |                                        |                                       | 60                                          |                      |                          |
| 08-00770-20511 |             | R0.3                    | 1°                                  | 15                                   | 2.39                      |                                |                                        |                                       | 0°45′                                       |                      | 60                       |
| 08-00770-20512 |             |                         |                                     | 20                                   | 2.56                      |                                |                                        |                                       | 0°49′                                       |                      | 60                       |
| 08-00770-20513 |             |                         |                                     | 25                                   | 2.74                      |                                |                                        |                                       | 0°51′                                       |                      | 70                       |
| 08-00770-20514 |             |                         |                                     | 30                                   | 2.91                      |                                |                                        |                                       | 0°53′                                       |                      | 80                       |
| 08-00770-20515 |             |                         | 3°                                  | 40                                   | 3.26                      |                                |                                        |                                       | 0°55′                                       |                      | 80                       |
| 08-00770-20516 |             |                         |                                     | 50                                   | 3.61                      |                                |                                        |                                       | 0°56′                                       |                      | 100                      |
| 08-00770-20531 |             |                         |                                     | 15                                   | 3.16                      |                                |                                        |                                       | 2°15′                                       |                      | 60                       |
| 08-00770-20532 |             |                         |                                     | 20                                   | 3.68                      |                                |                                        |                                       | 2°26′                                       |                      | 60                       |



Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

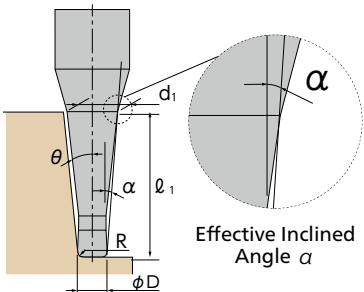
Resin N

Hardened Steel  
~ 55 HRC  
H

Coating  
Long Neck Tapered  
Corner Radius

MSTNR230

MUGEN COATING 2-Flute Long Taper Neck Radius End Mill



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Neck Taper<br>Angle<br>(θ) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Neck<br>Dia.<br>(d <sub>1</sub> ) | Length of<br>Cut<br>(ℓ) | Under Neck<br>Length 2<br>(ℓ <sub>2</sub> ) | Neck Taper<br>Angle 2<br>(γ) | Effective<br>Inclined Angle<br>(α) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|----------------------------|-------------------------------------------|-----------------------------------|-------------------------|---------------------------------------------|------------------------------|------------------------------------|----------------------|--------------------------|
| 08-00770-20611 | 2           | R0.5                    | 1°                         | 15                                        | 2.39                              | 1.6                     | 4                                           | 12°                          | 0°46′                              | 4                    | 60                       |
| 08-00770-20612 |             |                         |                            | 20                                        | 2.56                              |                         |                                             |                              | 0°49′                              |                      | 60                       |
| 08-00770-20613 |             |                         |                            | 25                                        | 2.74                              |                         |                                             |                              | 0°52′                              |                      | 70                       |
| 08-00770-20614 |             |                         |                            | 30                                        | 2.91                              |                         |                                             |                              | 0°53′                              |                      | 80                       |
| 08-00770-20615 |             |                         |                            | 40                                        | 3.26                              |                         |                                             |                              | 0°55′                              |                      | 80                       |
| 08-00770-20616 |             |                         |                            | 50                                        | 3.61                              |                         |                                             |                              | 0°56′                              |                      | 100                      |
| 08-00770-20631 | 3           | R0.2                    | 3°                         | 15                                        | 3.16                              | 2.5                     | 6                                           | 12°                          | 2°17′                              | 6                    | 60                       |
| 08-00770-20632 |             |                         |                            | 20                                        | 3.68                              |                         |                                             |                              | 2°28′                              |                      | 60                       |
| 08-00770-30411 |             |                         | 1°                         | 15                                        | 3.32                              |                         |                                             |                              | 0°37′                              |                      | 60                       |
| 08-00770-30412 |             |                         |                            | 20                                        | 3.49                              |                         |                                             |                              | 0°43′                              |                      | 60                       |
| 08-00770-30413 |             |                         |                            | 30                                        | 3.84                              |                         |                                             |                              | 0°49′                              |                      | 80                       |
| 08-00770-30414 |             |                         |                            | 40                                        | 4.19                              |                         |                                             |                              | 0°51′                              |                      | 80                       |
| 08-00770-30415 | 3           | R0.5                    | 1°                         | 50                                        | 4.54                              |                         |                                             |                              | 0°53′                              |                      | 100                      |
| 08-00770-30416 |             |                         |                            | 60                                        | 4.89                              |                         |                                             |                              | 0°54′                              |                      | 110                      |
| 08-00770-30611 |             |                         | 1°                         | 15                                        | 3.32                              |                         |                                             |                              | 0°37′                              |                      | 60                       |
| 08-00770-30612 |             |                         |                            | 20                                        | 3.49                              |                         |                                             |                              | 0°43′                              |                      | 60                       |
| 08-00770-30613 |             |                         |                            | 30                                        | 3.84                              |                         |                                             |                              | 0°49′                              |                      | 80                       |
| 08-00770-30614 |             |                         |                            | 40                                        | 4.19                              |                         |                                             |                              | 0°52′                              |                      | 80                       |
| 08-00770-30615 |             |                         |                            | 50                                        | 4.54                              |                         |                                             |                              | 0°53′                              |                      | 100                      |
| 08-00770-30616 |             |                         |                            | 60                                        | 4.89                              |                         |                                             |                              | 0°55′                              |                      | 110                      |

How to Order

When you order, indicate MSTNR230 (D)×(R)×(θ)×(ℓ<sub>1</sub>). ※(γ) is reference value.

MSTNR230

Recommended Milling Conditions

| Work Material |                    |                        |                         | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(~43HRC) |        |              |       | Hardened Steels<br>SKD11・SKD61・STAVAX・HPM38<br>(~55HRC) |        |              |       | Copper・Aluminium Alloy |        |              |       |
|---------------|--------------------|------------------------|-------------------------|-----------------------------------------------------------------------|--------|--------------|-------|---------------------------------------------------------|--------|--------------|-------|------------------------|--------|--------------|-------|
|               |                    |                        |                         | Spindle<br>Speed                                                      | Feed   | Depth of Cut |       | Spindle<br>Speed                                        | Feed   | Depth of Cut |       | Spindle<br>Speed       | Feed   | Depth of Cut |       |
| Dia.          | Corner<br>Radius   | Neck<br>Taper<br>Angle | Under<br>Neck<br>Length | min <sup>-1</sup>                                                     | mm/min | ap mm        | ae mm | min <sup>-1</sup>                                       | mm/min | ap mm        | ae mm | min <sup>-1</sup>      | mm/min | ap mm        | ae mm |
| 0.2           | 0.05               | 1°                     | 1                       | 30,000                                                                | 200    | 0.005        | 0.02  | 30,000                                                  | 150    | 0.005        | 0.02  | 30,000                 | 250    | 0.015        | 0.06  |
|               |                    |                        | 2                       | 30,000                                                                | 200    | 0.005        | 0.02  | 30,000                                                  | 150    | 0.005        | 0.02  | 30,000                 | 250    | 0.015        | 0.06  |
|               |                    | 3°                     | 1                       | 30,000                                                                | 300    | 0.005        | 0.03  | 30,000                                                  | 200    | 0.005        | 0.02  | 30,000                 | 360    | 0.02         | 0.06  |
|               |                    |                        | 2                       | 30,000                                                                | 300    | 0.005        | 0.03  | 30,000                                                  | 200    | 0.005        | 0.02  | 30,000                 | 360    | 0.02         | 0.06  |
|               |                    | 5°                     | 1                       | 30,000                                                                | 350    | 0.01         | 0.03  | 30,000                                                  | 250    | 0.01         | 0.03  | 30,000                 | 420    | 0.04         | 0.06  |
|               |                    |                        | 2                       | 30,000                                                                | 350    | 0.01         | 0.03  | 30,000                                                  | 250    | 0.01         | 0.03  | 30,000                 | 420    | 0.04         | 0.06  |
| 0.3           | 0.05               | 1°                     | 2                       | 30,000                                                                | 200    | 0.007        | 0.03  | 30,000                                                  | 150    | 0.005        | 0.03  | 30,000                 | 250    | 0.02         | 0.06  |
|               |                    |                        | 3                       | 30,000                                                                | 200    | 0.007        | 0.03  | 30,000                                                  | 150    | 0.005        | 0.03  | 30,000                 | 250    | 0.02         | 0.06  |
|               |                    | 3°                     | 2                       | 30,000                                                                | 300    | 0.01         | 0.05  | 30,000                                                  | 200    | 0.01         | 0.03  | 30,000                 | 360    | 0.03         | 0.15  |
|               |                    |                        | 3                       | 30,000                                                                | 300    | 0.01         | 0.05  | 30,000                                                  | 200    | 0.01         | 0.03  | 30,000                 | 360    | 0.03         | 0.15  |
|               |                    | 5°                     | 2                       | 30,000                                                                | 350    | 0.02         | 0.06  | 30,000                                                  | 250    | 0.02         | 0.05  | 30,000                 | 420    | 0.06         | 0.15  |
|               |                    |                        | 3                       | 30,000                                                                | 350    | 0.02         | 0.06  | 30,000                                                  | 250    | 0.02         | 0.05  | 30,000                 | 420    | 0.06         | 0.15  |
| 0.4           | 0.05<br>0.1        | 1°                     | 3                       | 30,000                                                                | 300    | 0.015        | 0.05  | 30,000                                                  | 200    | 0.01         | 0.04  | 30,000                 | 360    | 0.03         | 0.15  |
|               |                    |                        | 4                       | 30,000                                                                | 300    | 0.015        | 0.05  | 30,000                                                  | 200    | 0.01         | 0.04  | 30,000                 | 360    | 0.03         | 0.15  |
|               |                    | 3°                     | 3                       | 30,000                                                                | 350    | 0.02         | 0.06  | 30,000                                                  | 250    | 0.02         | 0.05  | 30,000                 | 420    | 0.06         | 0.15  |
|               |                    |                        | 4                       | 30,000                                                                | 350    | 0.02         | 0.06  | 30,000                                                  | 250    | 0.02         | 0.05  | 30,000                 | 420    | 0.06         | 0.15  |
|               |                    | 5°                     | 3                       | 30,000                                                                | 450    | 0.03         | 0.07  | 30,000                                                  | 300    | 0.03         | 0.06  | 30,000                 | 540    | 0.09         | 0.15  |
|               |                    |                        | 4                       | 30,000                                                                | 450    | 0.03         | 0.07  | 30,000                                                  | 300    | 0.03         | 0.06  | 30,000                 | 540    | 0.09         | 0.15  |
| 0.5           | 0.05<br>0.1        | 1°                     | 3                       | 30,000                                                                | 500    | 0.02         | 0.1   | 30,000                                                  | 350    | 0.02         | 0.1   | 30,000                 | 600    | 0.06         | 0.24  |
|               |                    |                        | 5                       | 30,000                                                                | 500    | 0.015        | 0.1   | 30,000                                                  | 350    | 0.015        | 0.1   | 30,000                 | 600    | 0.045        | 0.24  |
|               |                    |                        | 8                       | 30,000                                                                | 500    | 0.01         | 0.08  | 30,000                                                  | 350    | 0.01         | 0.05  | 30,000                 | 600    | 0.03         | 0.24  |
|               |                    |                        | 10                      | 24,000                                                                | 400    | 0.007        | 0.06  | 24,000                                                  | 250    | 0.007        | 0.04  | 24,000                 | 480    | 0.02         | 0.18  |
|               |                    |                        | 12                      | 24,000                                                                | 300    | 0.005        | 0.05  | 24,000                                                  | 150    | 0.005        | 0.03  | 24,000                 | 360    | 0.015        | 0.15  |
|               |                    | 3°                     | 3                       | 30,000                                                                | 600    | 0.03         | 0.1   | 30,000                                                  | 400    | 0.03         | 0.1   | 30,000                 | 700    | 0.09         | 0.25  |
|               |                    |                        | 5                       | 30,000                                                                | 600    | 0.02         | 0.1   | 30,000                                                  | 400    | 0.02         | 0.1   | 30,000                 | 700    | 0.06         | 0.25  |
|               |                    |                        | 8                       | 30,000                                                                | 600    | 0.02         | 0.08  | 30,000                                                  | 400    | 0.02         | 0.05  | 30,000                 | 700    | 0.06         | 0.24  |
|               |                    |                        | 10                      | 24,000                                                                | 500    | 0.015        | 0.08  | 24,000                                                  | 350    | 0.01         | 0.05  | 24,000                 | 600    | 0.03         | 0.24  |
|               |                    |                        | 12                      | 24,000                                                                | 350    | 0.015        | 0.05  | 24,000                                                  | 200    | 0.01         | 0.03  | 24,000                 | 420    | 0.03         | 0.15  |
|               |                    | 5°                     | 3                       | 30,000                                                                | 750    | 0.05         | 0.15  | 30,000                                                  | 500    | 0.05         | 0.1   | 30,000                 | 900    | 0.15         | 0.25  |
|               |                    |                        | 5                       | 30,000                                                                | 750    | 0.03         | 0.15  | 30,000                                                  | 500    | 0.03         | 0.1   | 30,000                 | 900    | 0.09         | 0.25  |
|               |                    |                        | 8                       | 24,000                                                                | 750    | 0.03         | 0.11  | 24,000                                                  | 500    | 0.03         | 0.08  | 24,000                 | 900    | 0.09         | 0.25  |
|               |                    |                        | 10                      | 24,000                                                                | 600    | 0.02         | 0.08  | 24,000                                                  | 400    | 0.02         | 0.06  | 24,000                 | 720    | 0.06         | 0.25  |
| 0.8           | 0.05<br>0.1<br>0.2 | 1°                     | 5                       | 26,000                                                                | 1,000  | 0.06         | 0.2   | 21,000                                                  | 700    | 0.06         | 0.1   | 26,000                 | 1,200  | 0.18         | 0.3   |
|               |                    |                        | 8                       | 24,000                                                                | 800    | 0.04         | 0.2   | 19,000                                                  | 560    | 0.04         | 0.1   | 24,000                 | 950    | 0.12         | 0.3   |
|               |                    | 3°                     | 5                       | 26,000                                                                | 1,200  | 0.08         | 0.3   | 21,000                                                  | 840    | 0.08         | 0.3   | 26,000                 | 1,400  | 0.24         | 0.35  |
|               |                    |                        | 8                       | 24,000                                                                | 1,000  | 0.06         | 0.3   | 19,000                                                  | 700    | 0.06         | 0.3   | 24,000                 | 1,200  | 0.18         | 0.35  |

Regular Line  
MUGEN COATING  
Long Neck Type

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

Hardened Steel  
~ 55 HRC  
H

Coating  
Long Neck Tapered  
Corner Radius

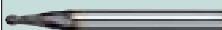
MSTNR230

Recommended Milling Conditions

| Work Material |                           |                  |                   | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM1<br>(～43HRC)                                                                                                                                                                                                                                                                                          |        |              |        | Hardened Steels<br>SKD11・SKD61・STAVAX・HPM38<br>(～55HRC) |        |              |        | Copper・Aluminium Alloy |        |              |        |       |     |     |
|---------------|---------------------------|------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|--------|---------------------------------------------------------|--------|--------------|--------|------------------------|--------|--------------|--------|-------|-----|-----|
| Dia.          | Corner Radius             | Neck Taper Angle | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                  | Feed   | Depth of Cut |        | Spindle Speed                                           | Feed   | Depth of Cut |        | Spindle Speed          | Feed   | Depth of Cut |        |       |     |     |
|               |                           |                  |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                              | mm/min | ap mm        | ae mm  | min <sup>-1</sup>                                       | mm/min | ap mm        | ae mm  | min <sup>-1</sup>      | mm/min | ap mm        | ae mm  |       |     |     |
| 1             | 0.05<br>0.1<br>0.2<br>0.3 | 1°               | 6                 | 22,000                                                                                                                                                                                                                                                                                                                                                         | 1,300  | 0.08         | 0.35   | 17,000                                                  | 900    | 0.06         | 0.35   | 22,000                 | 1,500  | 0.24         | 0.5    |       |     |     |
|               |                           |                  | 10                | 18,000                                                                                                                                                                                                                                                                                                                                                         | 1,000  | 0.05         | 0.35   | 14,000                                                  | 700    | 0.05         | 0.35   | 18,000                 | 1,200  | 0.15         | 0.5    |       |     |     |
|               |                           |                  | 15                | 18,000                                                                                                                                                                                                                                                                                                                                                         | 850    | 0.03         | 0.2    | 14,000                                                  | 600    | 0.03         | 0.13   | 18,000                 | 1,000  | 0.09         | 0.5    |       |     |     |
|               |                           |                  | 20                | 14,000                                                                                                                                                                                                                                                                                                                                                         | 700    | 0.025        | 0.1    | 11,000                                                  | 500    | 0.025        | 0.06   | 14,000                 | 850    | 0.075        | 0.3    |       |     |     |
|               |                           |                  | 25                | 14,000                                                                                                                                                                                                                                                                                                                                                         | 600    | 0.02         | 0.05   | 11,000                                                  | 400    | 0.02         | 0.03   | 14,000                 | 700    | 0.06         | 0.15   |       |     |     |
|               |                           |                  | 30                | 10,000                                                                                                                                                                                                                                                                                                                                                         | 480    | 0.015        | 0.03   | 8,000                                                   | 300    | 0.015        | 0.02   | 10,000                 | 600    | 0.045        | 0.09   |       |     |     |
|               |                           |                  | 35                | 10,000                                                                                                                                                                                                                                                                                                                                                         | 350    | 0.01         | 0.02   | 8,000                                                   | 250    | 0.01         | 0.01   | 10,000                 | 400    | 0.03         | 0.06   |       |     |     |
|               |                           | 3°               | 6                 | 22,000                                                                                                                                                                                                                                                                                                                                                         | 1,500  | 0.1          | 0.35   | 17,600                                                  | 1,000  | 0.1          | 0.35   | 22,000                 | 1,800  | 0.3          | 0.5    |       |     |     |
|               |                           |                  | 10                | 18,000                                                                                                                                                                                                                                                                                                                                                         | 1,200  | 0.08         | 0.35   | 14,400                                                  | 800    | 0.08         | 0.35   | 18,000                 | 1,400  | 0.24         | 0.5    |       |     |     |
|               |                           |                  | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                         | 1,300  | 0.1          | 0.55   | 12,800                                                  | 900    | 0.1          | 0.55   | 16,000                 | 1,500  | 0.3          | 0.6    |       |     |     |
| 1.5           | 0.1<br>0.2<br>0.3         | 1°               | 15                | 14,000                                                                                                                                                                                                                                                                                                                                                         | 1,000  | 0.07         | 0.55   | 11,200                                                  | 700    | 0.07         | 0.55   | 14,000                 | 1,200  | 0.2          | 0.6    |       |     |     |
|               |                           |                  | 20                | 14,000                                                                                                                                                                                                                                                                                                                                                         | 800    | 0.05         | 0.3    | 11,200                                                  | 550    | 0.05         | 0.2    | 14,000                 | 900    | 0.16         | 0.5    |       |     |     |
|               |                           |                  | 25                | 14,000                                                                                                                                                                                                                                                                                                                                                         | 600    | 0.03         | 0.1    | 11,200                                                  | 400    | 0.03         | 0.06   | 14,000                 | 700    | 0.1          | 0.3    |       |     |     |
|               |                           |                  | 30                | 12,000                                                                                                                                                                                                                                                                                                                                                         | 450    | 0.03         | 0.05   | 9,600                                                   | 300    | 0.03         | 0.03   | 12,000                 | 550    | 0.09         | 0.15   |       |     |     |
|               |                           |                  | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                         | 1,500  | 0.15         | 0.55   | 12,800                                                  | 1,000  | 0.15         | 0.55   | 16,000                 | 1,800  | 0.45         | 0.6    |       |     |     |
|               |                           | 3°               | 15                | 14,000                                                                                                                                                                                                                                                                                                                                                         | 1,200  | 0.1          | 0.55   | 11,200                                                  | 850    | 0.1          | 0.55   | 14,000                 | 1,400  | 0.3          | 0.6    |       |     |     |
|               |                           |                  | 2                 | 0.1<br>0.2<br>0.3<br>0.5                                                                                                                                                                                                                                                                                                                                       | 1°     | 15           | 14,000 | 1,200                                                   | 0.1    | 0.7          | 11,200 | 850                    | 0.07   | 0.7          | 14,000 | 1,400 | 0.3 | 0.7 |
|               |                           |                  |                   |                                                                                                                                                                                                                                                                                                                                                                |        | 20           | 12,000 | 1,200                                                   | 0.07   | 0.7          | 9,600  | 850                    | 0.07   | 0.7          | 12,000 | 1,400 | 0.2 | 0.7 |
| 25            | 12,000                    | 1,000            |                   |                                                                                                                                                                                                                                                                                                                                                                |        | 0.05         | 0.5    | 9,600                                                   | 700    | 0.04         | 0.5    | 12,000                 | 1,200  | 0.15         | 0.7    |       |     |     |
| 30            | 10,000                    | 750              |                   |                                                                                                                                                                                                                                                                                                                                                                |        | 0.04         | 0.3    | 8,000                                                   | 500    | 0.03         | 0.3    | 10,000                 | 900    | 0.13         | 0.7    |       |     |     |
| 40            | 8,000                     | 400              |                   |                                                                                                                                                                                                                                                                                                                                                                |        | 0.03         | 0.2    | 6,400                                                   | 300    | 0.02         | 0.2    | 8,000                  | 500    | 0.1          | 0.5    |       |     |     |
| 50            | 6,000                     | 350              |                   |                                                                                                                                                                                                                                                                                                                                                                | 0.015  | 0.1          | 4,800  | 250                                                     | 0.01   | 0.1          | 6,000  | 400                    | 0.05   | 0.3          |        |       |     |     |
| 3°            | 15                        | 20,000           | 2,000             | 0.2                                                                                                                                                                                                                                                                                                                                                            | 0.7    | 16,000       | 1,400  | 0.2                                                     | 0.7    | 20,000       | 2,400  | 0.6                    | 0.7    |              |        |       |     |     |
|               | 20                        | 16,000           | 1,600             | 0.1                                                                                                                                                                                                                                                                                                                                                            | 0.7    | 12,800       | 1,100  | 0.1                                                     | 0.7    | 16,000       | 2,000  | 0.4                    | 0.7    |              |        |       |     |     |
| 3             | 0.2<br>0.5                | 1°               | 15                | 11,000                                                                                                                                                                                                                                                                                                                                                         | 1,600  | 0.15         | 1.05   | 8,800                                                   | 1,100  | 0.1          | 1.05   | 11,000                 | 1,900  | 0.6          | 1.1    |       |     |     |
|               |                           |                  | 20                | 11,000                                                                                                                                                                                                                                                                                                                                                         | 1,600  | 0.13         | 1.05   | 8,800                                                   | 1,100  | 0.1          | 1.05   | 11,000                 | 1,900  | 0.45         | 1.1    |       |     |     |
|               |                           |                  | 30                | 9,000                                                                                                                                                                                                                                                                                                                                                          | 1,200  | 0.1          | 1.05   | 7,200                                                   | 850    | 0.07         | 1.05   | 9,000                  | 1,400  | 0.3          | 1.1    |       |     |     |
|               |                           |                  | 40                | 9,000                                                                                                                                                                                                                                                                                                                                                          | 1,000  | 0.07         | 0.6    | 7,200                                                   | 700    | 0.05         | 0.6    | 9,000                  | 1,200  | 0.21         | 0.9    |       |     |     |
|               |                           |                  | 50                | 8,000                                                                                                                                                                                                                                                                                                                                                          | 640    | 0.05         | 0.35   | 6,400                                                   | 450    | 0.04         | 0.35   | 8,000                  | 750    | 0.15         | 0.8    |       |     |     |
|               |                           |                  | 60                | 8,000                                                                                                                                                                                                                                                                                                                                                          | 480    | 0.03         | 0.2    | 6,400                                                   | 300    | 0.02         | 0.2    | 8,000                  | 550    | 0.1          | 0.7    |       |     |     |
| Notes         |                           |                  |                   | ※1 Adjust milling conditions according to machining profile and machine status.<br>※2 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※3 Recommend to use oil mist coolant for machining hardened steels.<br>※4 Coolant supply and chip disposal are important for machining deep-rib. |        |              |        |                                                         |        |              |        |                        |        |              |        |       |     |     |

MUGEN COATING  
Long Neck Tapered Corner Radius  
MSTNR230



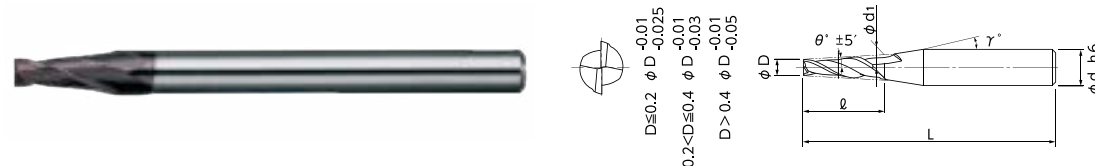
| Model                                                                                 | Size                                                                              | Maximum Cutting Depth                                                                               | Coating       | Number of Flute                                                                   | Helix Angle                                                                       | Side Milling                                                                      | Slot Milling                                                                      | Face Milling                                                                      | 3D Milling | Work Material                                                                     |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       |                          |                |        |                                                                                     | Number of Sizes | Page |     |       |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------|-----------------------|--------------------------|----------------|--------|-------------------------------------------------------------------------------------|-----------------|------|-----|-------|
|                                                                                       |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            | P                                                                                 | P                                                                                 | P                                                                                 | M                                                                                 | N               | N                                                                                  | N                                                                                   | N        | S                     | H                        |                |        |                                                                                     |                 |      |     |       |
|                                                                                       |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            | Carbon Steel                                                                      | Alloy Steel                                                                       | Prehardened Steel                                                                 | Stainless Steel                                                                   | Aluminium Alloy | Copper                                                                             | Resin                                                                               | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |        |                                                                                     |                 |      |     |       |
|                                                                                       |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       | 55 HRC                   | 65 HRC         | 70 HRC |                                                                                     |                 |      |     |       |
| Tapered Square                                                                        |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       |                          |                |        |                                                                                     |                 |      |     |       |
| MTE230                                                                                |   | $\phi 0.2 \times \text{taper angle } 30^\circ$<br>$\sim \phi 10 \times \text{taper angle } 5^\circ$ | 4D            |  |  |  |  |  | -          | -                                                                                 |  |  |  | -               |  |  | -        | -                     | -                        | -              | -      |  | -               | -    | 189 | J-004 |
| Standard type taper end mill. Suitable for various shapes by wide range of size       |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       |                          |                |        |                                                                                     |                 |      |     |       |
| MRT425                                                                                |   | $\phi 0.2 \times \text{taper angle } 30^\circ$<br>$\sim \phi 3 \times \text{taper angle } 2^\circ$  | $\approx 16D$ |  |  |  | -                                                                                 |  | -          | -                                                                                 |  |  |  | -               | -                                                                                  | -                                                                                   | -        | -                     | -                        | -              | -      |  | -               | -    | 245 | J-010 |
| Taper end mill for direct milling on rib shape without pre-processing. Maximum L/D=16 |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       |                          |                |        |                                                                                     |                 |      |     |       |
| Tapered Ball                                                                          |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       |                          |                |        |                                                                                     |                 |      |     |       |
| MTB230                                                                                |  | $R0.1 \times \text{taper angle } 1^\circ$<br>$\sim R2 \times \text{taper angle } 15^\circ$          | 5D            |  |  |  |  |  | -          |  |  |  |  | -               |  |  | -        | -                     | -                        | -              | -      |  | -               | -    | 111 | J-014 |
| Line up to maximum neck taper angle 15° of standard type taper ball end mill          |                                                                                   |                                                                                                     |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                 |                                                                                    |                                                                                     |          |                       |                          |                |        |                                                                                     |                 |      |     |       |



Tapered

## MUGEN COATING 2-Flute Taper End Mill

The MG logo is shown in a black square. Below it are two icons: 'Side' showing a yellow U-shaped component and 'Slot' showing a yellow rectangular component with a slot.



- MUGEN COATING realizes long tool life at tapered cutting.
- Available from Dia. 0.2 to Dia.10mm and taper angle are from 30' to 20°.

|                |             |                    |                      |                           |                         |                   | Unit : mm             |
|----------------|-------------|--------------------|----------------------|---------------------------|-------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Taper Angle<br>(θ) | Length of Cut<br>(ℓ) | Dia. at Large End<br>(d1) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 08-00300-00202 | 0.2         | 30′                | 0.8                  | 0.21                      | 9°                      | 4                 | 45                    |
| 08-00300-00204 |             | 1°                 | 0.8                  | 0.23                      | 9°                      | 4                 | 45                    |
| 08-00300-00205 |             | 1°30′              | 0.8                  | 0.24                      | 9°                      | 4                 | 45                    |
| 08-00300-00206 |             | 2°                 | 0.8                  | 0.26                      | 9°                      | 4                 | 45                    |
| 08-00300-00208 |             | 3°                 | 0.8                  | 0.28                      | 9°                      | 4                 | 45                    |
| 08-00300-00212 |             | 5°                 | 0.8                  | 0.34                      | 9°                      | 4                 | 45                    |
| 08-00300-00219 |             | 10°                | 0.8                  | 0.48                      | 10°                     | 4                 | 45                    |
| 08-00300-00302 | 0.3         | 30′                | 1.2                  | 0.32                      | 9°                      | 4                 | 45                    |
| 08-00300-00304 |             | 1°                 | 1.2                  | 0.34                      | 9°                      | 4                 | 45                    |
| 08-00300-00305 |             | 1°30′              | 1.2                  | 0.36                      | 9°                      | 4                 | 45                    |
| 08-00300-00306 |             | 2°                 | 1.2                  | 0.38                      | 9°                      | 4                 | 45                    |
| 08-00300-00308 |             | 3°                 | 1.2                  | 0.43                      | 9°                      | 4                 | 45                    |
| 08-00300-00312 |             | 5°                 | 1.2                  | 0.51                      | 9°                      | 4                 | 45                    |
| 08-00300-00319 |             | 10°                | 1.2                  | 0.72                      | 10°                     | 4                 | 45                    |
| 08-00300-00402 | 0.4         | 30′                | 1.6                  | 0.43                      | 9°                      | 4                 | 45                    |
| 08-00300-00404 |             | 1°                 | 1.6                  | 0.46                      | 9°                      | 4                 | 45                    |
| 08-00300-00405 |             | 1°30′              | 1.6                  | 0.48                      | 9°                      | 4                 | 45                    |
| 08-00300-00406 |             | 2°                 | 1.6                  | 0.51                      | 9°                      | 4                 | 45                    |
| 08-00300-00408 |             | 3°                 | 1.6                  | 0.57                      | 9°                      | 4                 | 45                    |
| 08-00300-00412 |             | 5°                 | 1.6                  | 0.68                      | 9°                      | 4                 | 45                    |
| 08-00300-00419 |             | 10°                | 1.6                  | 0.96                      | 10°                     | 4                 | 45                    |
| 08-00300-00502 | 0.5         | 30′                | 2                    | 0.53                      | 9°                      | 4                 | 45                    |
| 08-00300-00504 |             | 1°                 | 2                    | 0.57                      | 9°                      | 4                 | 45                    |
| 08-00300-00505 |             | 1°30′              | 2                    | 0.60                      | 9°                      | 4                 | 45                    |
| 08-00300-00506 |             | 2°                 | 2                    | 0.64                      | 9°                      | 4                 | 45                    |
| 08-00300-00508 |             | 3°                 | 2                    | 0.71                      | 9°                      | 4                 | 45                    |
| 08-00300-00510 |             | 4°                 | 2                    | 0.78                      | 9°                      | 4                 | 45                    |
| 08-00300-00512 |             | 5°                 | 2                    | 0.85                      | 9°                      | 4                 | 45                    |
| 08-00300-00514 |             | 6°                 | 2                    | 0.92                      | 9°                      | 4                 | 45                    |
| 08-00300-00516 |             | 7°                 | 2                    | 0.99                      | 9°                      | 4                 | 45                    |
| 08-00300-00519 |             | 10°                | 2                    | 1.21                      | 10°                     | 4                 | 45                    |
| 08-00300-00524 |             | 15°                | 2                    | 1.57                      | 15°                     | 4                 | 45                    |
| 08-00300-00525 |             | 20°                | 2                    | 1.96                      | 15°                     | 4                 | 45                    |

When you order, indicate MTE230 (D)×(θ). ※(d<sub>1</sub>) and (γ) is reference value.

| Unit : mm      |          |                          |                       |                        |                             |                |                    |
|----------------|----------|--------------------------|-----------------------|------------------------|-----------------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Taper Angle ( $\theta$ ) | Length of Cut ( $l$ ) | Dia. at Large End (d1) | Neck Taper Angle ( $\tau$ ) | Shank Dia. (d) | Overall Length (L) |
| 08-00300-00602 | 0.6      | 30'                      | 2                     | 0.63                   | 9°                          | 4              | 45                 |
| 08-00300-00604 |          | 1°                       | 2                     | 0.67                   | 9°                          | 4              | 45                 |
| 08-00300-00605 |          | 1°30'                    | 2                     | 0.70                   | 9°                          | 4              | 45                 |
| 08-00300-00606 |          | 2°                       | 2                     | 0.74                   | 9°                          | 4              | 45                 |
| 08-00300-00608 |          | 3°                       | 2                     | 0.81                   | 9°                          | 4              | 45                 |
| 08-00300-00610 |          | 4°                       | 2                     | 0.88                   | 9°                          | 4              | 45                 |
| 08-00300-00612 |          | 5°                       | 2                     | 0.95                   | 9°                          | 4              | 45                 |
| 08-00300-00614 |          | 6°                       | 2                     | 1.02                   | 9°                          | 4              | 45                 |
| 08-00300-00616 |          | 7°                       | 2                     | 1.09                   | 9°                          | 4              | 45                 |
| 08-00300-00619 |          | 10°                      | 2                     | 1.31                   | 10°                         | 4              | 45                 |
| 08-00300-00624 |          | 15°                      | 2                     | 1.67                   | 15°                         | 4              | 45                 |
| 08-00300-00625 |          | 20°                      | 2                     | 2.06                   | 15°                         | 4              | 45                 |
| 08-00300-00702 | 0.7      | 30'                      | 2                     | 0.73                   | 9°                          | 4              | 45                 |
| 08-00300-00704 |          | 1°                       | 2                     | 0.77                   | 9°                          | 4              | 45                 |
| 08-00300-00705 |          | 1°30'                    | 2                     | 0.80                   | 9°                          | 4              | 45                 |
| 08-00300-00706 |          | 2°                       | 2                     | 0.84                   | 9°                          | 4              | 45                 |
| 08-00300-00708 |          | 3°                       | 2                     | 0.91                   | 9°                          | 4              | 45                 |
| 08-00300-00710 |          | 4°                       | 2                     | 0.98                   | 9°                          | 4              | 45                 |
| 08-00300-00712 |          | 5°                       | 2                     | 1.05                   | 9°                          | 4              | 45                 |
| 08-00300-00714 |          | 6°                       | 2                     | 1.12                   | 9°                          | 4              | 45                 |
| 08-00300-00716 |          | 7°                       | 2                     | 1.19                   | 9°                          | 4              | 45                 |
| 08-00300-00719 |          | 10°                      | 2                     | 1.41                   | 10°                         | 4              | 45                 |
| 08-00300-00724 |          | 15°                      | 2                     | 1.77                   | 15°                         | 4              | 45                 |
| 08-00300-00725 |          | 20°                      | 2                     | 2.16                   | 15°                         | 4              | 45                 |
| 08-00300-00802 | 0.8      | 30'                      | 3                     | 0.85                   | 9°                          | 4              | 45                 |
| 08-00300-00804 |          | 1°                       | 3                     | 0.90                   | 9°                          | 4              | 45                 |
| 08-00300-00805 |          | 1°30'                    | 3                     | 0.96                   | 9°                          | 4              | 45                 |
| 08-00300-00806 |          | 2°                       | 3                     | 1.01                   | 9°                          | 4              | 45                 |
| 08-00300-00808 |          | 3°                       | 3                     | 1.11                   | 9°                          | 4              | 45                 |
| 08-00300-00810 |          | 4°                       | 3                     | 1.21                   | 9°                          | 4              | 45                 |
| 08-00300-00812 |          | 5°                       | 3                     | 1.32                   | 9°                          | 4              | 45                 |
| 08-00300-00814 |          | 6°                       | 3                     | 1.43                   | 9°                          | 4              | 45                 |
| 08-00300-00816 |          | 7°                       | 3                     | 1.54                   | 9°                          | 4              | 45                 |
| 08-00300-00819 |          | 10°                      | 3                     | 1.86                   | 10°                         | 4              | 45                 |
| 08-00300-00824 |          | 15°                      | 3                     | 2.41                   | 15°                         | 4              | 45                 |
| 08-00300-00825 |          | 20°                      | 3                     | 2.98                   | 20°                         | 4              | 45                 |
| 08-00300-00902 | 0.9      | 30'                      | 3                     | 0.95                   | 9°                          | 4              | 45                 |
| 08-00300-00904 |          | 1°                       | 3                     | 1.00                   | 9°                          | 4              | 45                 |
| 08-00300-00905 |          | 1°30'                    | 3                     | 1.06                   | 9°                          | 4              | 45                 |
| 08-00300-00906 |          | 2°                       | 3                     | 1.11                   | 9°                          | 4              | 45                 |
| 08-00300-00908 |          | 3°                       | 3                     | 1.21                   | 9°                          | 4              | 45                 |
| 08-00300-00910 |          | 4°                       | 3                     | 1.32                   | 9°                          | 4              | 45                 |
| 08-00300-00912 |          | 5°                       | 3                     | 1.42                   | 9°                          | 4              | 45                 |
| 08-00300-00914 |          | 6°                       | 3                     | 1.53                   | 9°                          | 4              | 45                 |
| 08-00300-00916 |          | 7°                       | 3                     | 1.64                   | 9°                          | 4              | 45                 |
| 08-00300-00919 |          | 10°                      | 3                     | 1.96                   | 10°                         | 4              | 45                 |
| 08-00300-00924 |          | 15°                      | 3                     | 2.51                   | 15°                         | 4              | 45                 |
| 08-00300-00925 |          | 20°                      | 3                     | 3.08                   | 20°                         | 4              | 45                 |



Tapered

Carbon Steel

Alloy Steel

Prehardened Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Hardened Steel

Coating

Tapered

MTE230

MUGEN COATING 2-Flute Taper End Mill

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |    |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|----|
| 08-00300-01002 | 1        | 30′             | 4                 | 1.07                   | 9°                   | 4              | 45                 |    |
| 08-00300-01004 |          | 1°              | 4                 | 1.14                   | 9°                   | 4              | 45                 |    |
| 08-00300-01005 |          | 1°30′           | 4                 | 1.21                   | 9°                   | 4              | 45                 |    |
| 08-00300-01006 |          | 2°              | 4                 | 1.28                   | 9°                   | 4              | 45                 |    |
| 08-00300-01008 |          | 3°              | 4                 | 1.42                   | 9°                   | 4              | 45                 |    |
| 08-00300-01010 |          | 4°              | 4                 | 1.56                   | 9°                   | 4              | 45                 |    |
| 08-00300-01012 |          | 5°              | 4                 | 1.70                   | 9°                   | 4              | 45                 |    |
| 08-00300-01014 |          | 6°              | 4                 | 1.84                   | 9°                   | 4              | 45                 |    |
| 08-00300-01016 |          | 7°              | 4                 | 1.98                   | 9°                   | 4              | 45                 |    |
| 08-00300-01019 |          | 10°             | 4                 | 2.41                   | 10°                  | 4              | 45                 |    |
| 08-00300-01024 |          | 15°             | 4                 | 3.14                   | 15°                  | 6              | 50                 |    |
| 08-00300-01025 |          | 20°             | 4                 | 3.91                   | 15°                  | 6              | 50                 |    |
| 08-00300-01502 |          | 1.5             | 30′               | 5                      | 1.59                 | 9°             | 4                  | 45 |
| 08-00300-01504 |          |                 | 1°                | 5                      | 1.67                 | 9°             | 4                  | 45 |
| 08-00300-01505 |          |                 | 1°30′             | 5                      | 1.76                 | 9°             | 4                  | 45 |
| 08-00300-01506 |          |                 | 2°                | 5                      | 1.85                 | 9°             | 4                  | 45 |
| 08-00300-01508 | 3°       |                 | 5                 | 2.02                   | 9°                   | 4              | 45                 |    |
| 08-00300-01510 | 4°       |                 | 5                 | 2.20                   | 9°                   | 4              | 45                 |    |
| 08-00300-01512 | 5°       |                 | 5                 | 2.37                   | 9°                   | 4              | 45                 |    |
| 08-00300-01514 | 6°       |                 | 5                 | 2.55                   | 9°                   | 4              | 45                 |    |
| 08-00300-01516 | 7°       |                 | 5                 | 2.73                   | 9°                   | 4              | 45                 |    |
| 08-00300-01519 | 10°      |                 | 5                 | 3.26                   | 10°                  | 4              | 45                 |    |
| 08-00300-01524 | 15°      |                 | 5                 | 4.18                   | 15°                  | 6              | 50                 |    |
| 08-00300-01525 | 20°      |                 | 5                 | 5.14                   | 20°                  | 6              | 50                 |    |
| 08-00300-02002 | 2        |                 | 30′               | 6                      | 2.10                 | 9°             | 4                  | 45 |
| 08-00300-02004 |          |                 | 1°                | 6                      | 2.21                 | 9°             | 4                  | 45 |
| 08-00300-02005 |          |                 | 1°30′             | 6                      | 2.31                 | 9°             | 4                  | 45 |
| 08-00300-02006 |          |                 | 2°                | 6                      | 2.41                 | 9°             | 4                  | 45 |
| 08-00300-02008 |          | 3°              | 6                 | 2.62                   | 9°                   | 4              | 45                 |    |
| 08-00300-02010 |          | 4°              | 6                 | 2.84                   | 9°                   | 4              | 45                 |    |
| 08-00300-02012 |          | 5°              | 6                 | 3.05                   | 9°                   | 4              | 45                 |    |
| 08-00300-02014 |          | 6°              | 6                 | 3.26                   | 9°                   | 4              | 45                 |    |
| 08-00300-02016 |          | 7°              | 6                 | 3.47                   | 7°                   | 4              | 45                 |    |
| 08-00300-02019 |          | 10°             | 6                 | 4.11                   | 10°                  | 6              | 50                 |    |
| 08-00300-02024 |          | 15°             | 6                 | 5.22                   | 15°                  | 6              | 50                 |    |
| 08-00300-02025 |          | 20°             | 6                 | 6.37                   | —                    | 6              | 50                 |    |
| 08-00300-02502 |          | 2.5             | 30′               | 8                      | 2.64                 | 9°             | 4                  | 45 |
| 08-00300-02504 |          |                 | 1°                | 8                      | 2.78                 | 9°             | 4                  | 45 |
| 08-00300-02505 |          |                 | 1°30′             | 8                      | 2.91                 | 9°             | 4                  | 45 |
| 08-00300-02506 |          |                 | 2°                | 8                      | 3.05                 | 9°             | 4                  | 45 |
| 08-00300-02508 | 3°       |                 | 8                 | 3.33                   | 9°                   | 4              | 45                 |    |
| 08-00300-02510 | 4°       |                 | 8                 | 3.62                   | 4°                   | 4              | 45                 |    |
| 08-00300-02512 | 5°       |                 | 8                 | 3.90                   | 5°                   | 4              | 45                 |    |
| 08-00300-02514 | 6°       |                 | 8                 | 4.18                   | —                    | 4              | 50                 |    |
| 08-00300-02516 | 7°       |                 | 8                 | 4.46                   | —                    | 4              | 50                 |    |
| 08-00300-02519 | 10°      |                 | 8                 | 5.32                   | 10°                  | 6              | 50                 |    |
| 08-00300-02524 | 15°      |                 | 8                 | 6.79                   | —                    | 6              | 50                 |    |
| 08-00300-02525 | 20°      |                 | 8                 | 8.32                   | —                    | 8              | 60                 |    |
| 08-00300-03002 | 3        |                 | 30′               | 10                     | 3.17                 | 9°             | 6                  | 50 |
| 08-00300-03004 |          |                 | 1°                | 10                     | 3.35                 | 9°             | 6                  | 50 |
| 08-00300-03005 |          |                 | 1°30′             | 10                     | 3.52                 | 9°             | 6                  | 50 |
| 08-00300-03006 |          |                 | 2°                | 10                     | 3.69                 | 9°             | 6                  | 50 |
| 08-00300-03008 |          | 3°              | 10                | 4.05                   | 9°                   | 6              | 50                 |    |
| 08-00300-03010 |          | 4°              | 10                | 4.40                   | 9°                   | 6              | 50                 |    |

How to Order

When you order, indicate MTE230 (D)x(ℓ). ※(d1) and ( γ ) is reference value.

J-006

MTE230

MUGEN COATING 2-Flute Taper End Mill

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |    |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|----|
| 08-00300-03012 | 3        | 5°              | 10                | 4.75                   | 9°                   | 6              | 50                 |    |
| 08-00300-03014 |          | 6°              | 10                | 5.10                   | 6°                   | 6              | 50                 |    |
| 08-00300-03016 |          | 7°              | 10                | 5.46                   | 7°                   | 6              | 50                 |    |
| 08-00300-03019 |          | 10°             | 10                | 6.53                   | —                    | 6              | 50                 |    |
| 08-00300-03024 |          | 15°             | 10                | 8.36                   | —                    | 8              | 60                 |    |
| 08-00300-03025 |          | 20°             | 10                | 10.30                  | —                    | 10             | 70                 |    |
| 08-00300-04002 | 4        | 30′             | 15                | 4.26                   | 9°                   | 6              | 50                 |    |
| 08-00300-04004 |          | 1°              | 15                | 4.52                   | 9°                   | 6              | 50                 |    |
| 08-00300-04005 |          | 1°30′           | 15                | 4.79                   | 9°                   | 6              | 50                 |    |
| 08-00300-04006 |          | 2°              | 15                | 5.04                   | 9°                   | 6              | 50                 |    |
| 08-00300-04008 |          | 3°              | 15                | 5.57                   | 9°                   | 6              | 50                 |    |
| 08-00300-04010 |          | 4°              | 15                | 6.10                   | —                    | 6              | 55                 |    |
| 08-00300-04012 |          | 5°              | 15                | 6.62                   | —                    | 6              | 55                 |    |
| 08-00300-04014 |          | 6°              | 15                | 7.15                   | —                    | 6              | 55                 |    |
| 08-00300-04016 |          | 7°              | 15                | 7.68                   | —                    | 6              | 55                 |    |
| 08-00300-04019 |          | 10°             | 15                | 9.29                   | —                    | 8              | 60                 |    |
| 08-00300-04024 |          | 15°             | 15                | 12.04                  | —                    | 12             | 80                 |    |
| 08-00300-04025 |          | 20°             | 15                | 14.92                  | —                    | 12             | 80                 |    |
| 08-00300-05002 |          | 5               | 30′               | 20                     | 5.34                 | 9°             | 6                  | 55 |
| 08-00300-05004 |          |                 | 1°                | 20                     | 5.70                 | 9°             | 6                  | 55 |
| 08-00300-05005 | 1°30′    |                 | 20                | 6.04                   | —                    | 6              | 55                 |    |
| 08-00300-05006 | 2°       |                 | 20                | 6.39                   | —                    | 6              | 55                 |    |
| 08-00300-05008 | 3°       |                 | 20                | 7.10                   | —                    | 6              | 55                 |    |
| 08-00300-05010 | 4°       |                 | 20                | 7.80                   | —                    | 6              | 60                 |    |
| 08-00300-05012 | 5°       |                 | 20                | 8.50                   | —                    | 8              | 60                 |    |
| 08-00300-05014 | 6°       |                 | 20                | 9.20                   | —                    | 8              | 60                 |    |
| 08-00300-05016 | 7°       |                 | 20                | 9.91                   | 7°                   | 10             | 70                 |    |
| 08-00300-05019 | 10°      |                 | 20                | 12.05                  | —                    | 12             | 80                 |    |
| 08-00300-05024 | 15°      |                 | 20                | 15.72                  | 15°                  | 16             | 90                 |    |
| 08-00300-05025 | 20°      |                 | 20                | 19.56                  | 20°                  | 20             | 100                |    |
| 08-00300-06002 | 6        |                 | 30′               | 20                     | 6.35                 | —              | 6                  | 55 |
| 08-00300-06004 |          |                 | 1°                | 20                     | 6.70                 | —              | 6                  | 55 |
| 08-00300-06005 |          | 1°30′           | 20                | 7.05                   | —                    | 6              | 55                 |    |
| 08-00300-06006 |          | 2°              | 20                | 7.40                   | —                    | 6              | 55                 |    |
| 08-00300-06008 |          | 3°              | 20                | 8.10                   | —                    | 8              | 60                 |    |
| 08-00300-06010 |          | 4°              | 20                | 8.80                   | —                    | 8              | 65                 |    |
| 08-00300-06012 |          | 5°              | 20                | 9.50                   | —                    | 8              | 65                 |    |
| 08-00300-06014 |          | 6°              | 20                | 10.20                  | —                    | 10             | 70                 |    |
| 08-00300-06016 |          | 7°              | 20                | 10.91                  | —                    | 10             | 70                 |    |
| 08-00300-06019 |          | 10°             | 20                | 13.05                  | —                    | 12             | 80                 |    |
| 08-00300-06024 |          | 15°             | 20                | 16.72                  | —                    | 16             | 90                 |    |
| 08-00300-06025 |          | 20°             | 20                | 20.56                  | —                    | 20             | 100                |    |
| 08-00300-08002 |          | 8               | 30′               | 25                     | 8.44                 | —              | 8                  | 65 |
| 08-00300-08004 |          |                 | 1°                | 25                     | 8.87                 | —              | 8                  | 65 |
| 08-00300-08005 | 1°30′    |                 | 25                | 9.31                   | —                    | 8              | 65                 |    |
| 08-00300-08006 | 2°       |                 | 25                | 9.74                   | —                    | 8              | 65                 |    |
| 08-00300-08008 | 3°       |                 | 25                | 10.62                  | —                    | 10             | 70                 |    |
| 08-00300-08012 | 5°       |                 | 25                | 12.37                  | —                    | 12             | 90                 |    |
| 08-00300-10002 | 10       | 30′             | 35                | 10.61                  | —                    | 10             | 85                 |    |
| 08-00300-10004 |          | 1°              | 35                | 11.22                  | —                    | 10             | 85                 |    |
| 08-00300-10005 |          | 1°30′           | 35                | 11.83                  | —                    | 10             | 85                 |    |
| 08-00300-10006 |          | 2°              | 35                | 12.44                  | —                    | 12             | 90                 |    |
| 08-00300-10008 |          | 3°              | 35                | 13.67                  | —                    | 12             | 90                 |    |
| 08-00300-10012 |          | 5°              | 35                | 16.12                  | —                    | 16             | 90                 |    |

How to Order

When you order, indicate MTE230 (D)x(ℓ). ※(d1) and ( γ ) is reference value.

J-007

J-006

J-007



Carbon Steel

Alloy Steel

Prehardened Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Hardened Steel

Tapered

MTE230

Recommended Milling Conditions

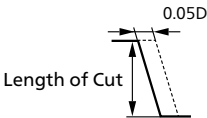
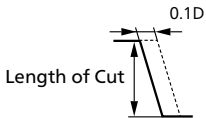
[φ 0.5~1 Slotting]

| Work Material |                    | Carbon Steels・Alloy Steels・Prehardened Steels (～40HRC)                                                                                                                                                                                                                                                                         |        | Aluminium Alloy   |        | Copper            |        |
|---------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|
| Cutting Speed |                    | 40～70m/min                                                                                                                                                                                                                                                                                                                     |        | 150～300m/min      |        | 80～150m/min       |        |
| Dia.          | Depth of Cut<br>ap | Spindle Speed                                                                                                                                                                                                                                                                                                                  | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   |
|               | mm                 | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                              | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 0.5           | 0.005 ～ 0.01       | 38,000                                                                                                                                                                                                                                                                                                                         | 300    | 50,000            | 400    | 25,000            | 200    |
| 0.6           | 0.01 ～ 0.02        | 32,000                                                                                                                                                                                                                                                                                                                         | 300    | 50,000            | 400    | 25,000            | 200    |
| 0.7           | 0.01 ～ 0.03        | 27,000                                                                                                                                                                                                                                                                                                                         | 300    | 50,000            | 500    | 25,000            | 250    |
| 0.8           | 0.02 ～ 0.04        | 24,000                                                                                                                                                                                                                                                                                                                         | 400    | 50,000            | 650    | 25,000            | 330    |
| 0.9           | 0.03 ～ 0.06        | 21,000                                                                                                                                                                                                                                                                                                                         | 400    | 50,000            | 800    | 25,000            | 400    |
| 1             | 0.03 ～ 0.08        | 19,000                                                                                                                                                                                                                                                                                                                         | 400    | 50,000            | 1,000  | 25,000            | 500    |
| Notes         |                    | ※1 Use cutting fluid.<br>※2 Adjust spindle speed and feed according to inclined angle.<br>※3 When corner machining, reduce the feed by approximately 50%～30%.<br>※4 Adjust spindle speed and feed at the same rate also reduce depth of cut, if the machine spindle speed insufficient.<br>※5 Recommend reciprocating cutting. |        |                   |        |                   |        |

[φ 1.5～10 Side Milling]

| Work Material                 | Carbon Steels S50C                                                                                                                                                                                                                                                                      |        | Alloy Steels・Tool Steels・Prehardened Steels SKD・HPM・NAK |        | Prehardened Steels NAK80 (～45HRC) |        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------|--------|-----------------------------------|--------|
| Cutting Speed                 | 50～70m/min                                                                                                                                                                                                                                                                              |        | 40～60m/min                                              |        | 30～50m/min                        |        |
| Dia.                          | Spindle Speed                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed                                           | Feed   | Spindle Speed                     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup>                                       | mm/min | min <sup>-1</sup>                 | mm/min |
| 1.5                           | 12,700                                                                                                                                                                                                                                                                                  | 330    | 10,600                                                  | 250    | 8,500                             | 200    |
| 2                             | 9,600                                                                                                                                                                                                                                                                                   | 400    | 8,000                                                   | 300    | 6,400                             | 270    |
| 2.5                           | 7,600                                                                                                                                                                                                                                                                                   | 450    | 6,400                                                   | 330    | 5,100                             | 300    |
| 3                             | 6,400                                                                                                                                                                                                                                                                                   | 450    | 5,300                                                   | 330    | 4,300                             | 300    |
| 4                             | 4,800                                                                                                                                                                                                                                                                                   | 450    | 4,000                                                   | 330    | 3,200                             | 300    |
| 5                             | 3,800                                                                                                                                                                                                                                                                                   | 450    | 3,200                                                   | 330    | 2,600                             | 300    |
| 6                             | 3,200                                                                                                                                                                                                                                                                                   | 450    | 2,700                                                   | 330    | 2,200                             | 300    |
| 8                             | 2,400                                                                                                                                                                                                                                                                                   | 480    | 2,000                                                   | 360    | 1,600                             | 330    |
| 10                            | 1,900                                                                                                                                                                                                                                                                                   | 480    | 1,600                                                   | 360    | 1,300                             | 330    |
| Depth of Cut<br><br>(D: Dia.) | <div>Taper Side Milling</div> <div>Length of Cut</div> <div>0.1D</div>                                                                                                                                                                                                                  |        |                                                         |        |                                   |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 Adjust spindle speed and feed according to inclined angle.<br>※3 When corner machining, reduce the feed by approximately 50%～30%.<br>※4 Adjust spindle speed and feed at the same rate also reduce depth of cut, if the machine spindle speed insufficient. |        |                                                         |        |                                   |        |

[φ 1.5 ~ 10 Side Milling]

| Work Material                 | Hardened Steels<br>(~55HRC)                                                                                                                                                                                                                                                                      |        | Aluminium Alloy                                                                                             |        | Copper            |        |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed                 | 20m/min                                                                                                                                                                                                                                                                                          |        | 150~300m/min                                                                                                |        | 80~150m/min       |        |
| Dia.                          | Spindle Speed                                                                                                                                                                                                                                                                                    | Feed   | Spindle Speed                                                                                               | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                | mm/min | min <sup>-1</sup>                                                                                           | mm/min | min <sup>-1</sup> | mm/min |
| 1.5                           | 4,300                                                                                                                                                                                                                                                                                            | 110    | 50,000                                                                                                      | 1,300  | 25,000            | 650    |
| 2                             | 3,200                                                                                                                                                                                                                                                                                            | 130    | 48,000                                                                                                      | 2,000  | 24,000            | 1,000  |
| 2.5                           | 2,700                                                                                                                                                                                                                                                                                            | 150    | 38,200                                                                                                      | 2,200  | 19,100            | 1,100  |
| 3                             | 2,200                                                                                                                                                                                                                                                                                            | 150    | 32,000                                                                                                      | 2,200  | 16,000            | 1,100  |
| 4                             | 1,600                                                                                                                                                                                                                                                                                            | 150    | 24,000                                                                                                      | 2,200  | 12,000            | 1,100  |
| 5                             | 1,300                                                                                                                                                                                                                                                                                            | 150    | 19,100                                                                                                      | 2,200  | 9,600             | 1,100  |
| 6                             | 1,100                                                                                                                                                                                                                                                                                            | 150    | 16,000                                                                                                      | 2,200  | 8,000             | 1,100  |
| 8                             | 800                                                                                                                                                                                                                                                                                              | 160    | 12,000                                                                                                      | 2,200  | 6,000             | 1,100  |
| 10                            | 650                                                                                                                                                                                                                                                                                              | 160    | 9,600                                                                                                       | 2,200  | 4,800             | 1,100  |
| Depth of Cut<br><br>(D: Dia.) | Taper Side Milling<br>                                                                                                                                                                                      |        | Taper Side Milling<br> |        |                   |        |
|                               | Notes<br>※1 Use cutting fluid.<br>※2 Adjust spindle speed and feed according to inclined angle.<br>※3 When corner machining, reduce the feed by approximately 50%~30%.<br>※4 Adjust spindle speed and feed at the same rate also reduce depth of cut, if the machine spindle speed insufficient. |        |                                                                                                             |        |                   |        |

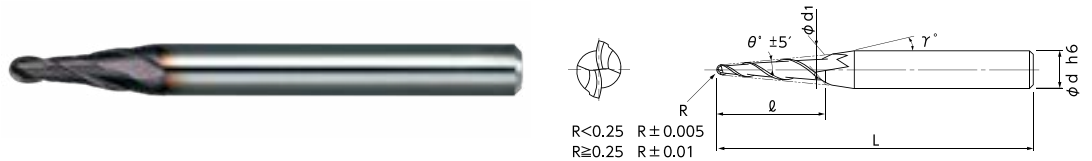






## MUGEN COATING 2-Flute Taper Ball End Mill

Line up to maximum neck taper angle  $15^\circ$  of standard type taper ball end mill



- It is possible to cut both taper and ball simultaneously.
- The available sizes are from radius 0.1 and single angles up to 15°.

Unit : mm

| Code No.       | Radius (R) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 08-00540-01004 | R0.1       | 1°              | 1                 | 0.23                   | 9°                   | 4              | 50                 |
| 08-00540-01006 |            | 2°              | 1                 | 0.26                   | 9°                   | 4              | 50                 |
| 08-00540-01008 |            | 3°              | 1                 | 0.29                   | 9°                   | 4              | 50                 |
| 08-00540-01012 |            | 5°              | 1                 | 0.36                   | 9°                   | 4              | 50                 |
| 08-00540-01016 |            | 7°              | 1                 | 0.42                   | 9°                   | 4              | 50                 |
| 08-00540-01019 |            | 10°             | 1                 | 0.52                   | 10°                  | 4              | 50                 |
| 08-00540-01504 | R0.15      | 1°              | 1.5               | 0.35                   | 9°                   | 4              | 50                 |
| 08-00540-01506 |            | 2°              | 1.5               | 0.39                   | 9°                   | 4              | 50                 |
| 08-00540-01508 |            | 3°              | 1.5               | 0.44                   | 9°                   | 4              | 50                 |
| 08-00540-01512 |            | 5°              | 1.5               | 0.54                   | 9°                   | 4              | 50                 |
| 08-00540-01516 |            | 7°              | 1.5               | 0.63                   | 9°                   | 4              | 50                 |
| 08-00540-01519 |            | 10°             | 1.5               | 0.78                   | 10°                  | 4              | 50                 |
| 08-00540-01524 |            | 15°             | 1.5               | 1.03                   | 15°                  | 4              | 50                 |
| 08-00540-02004 | R0.2       | 1°              | 2                 | 0.46                   | 9°                   | 4              | 50                 |
| 08-00540-02006 |            | 2°              | 2                 | 0.53                   | 9°                   | 4              | 50                 |
| 08-00540-02008 |            | 3°              | 2                 | 0.59                   | 9°                   | 4              | 50                 |
| 08-00540-02012 |            | 5°              | 2                 | 0.72                   | 9°                   | 4              | 50                 |
| 08-00540-02016 |            | 7°              | 2                 | 0.84                   | 9°                   | 4              | 50                 |
| 08-00540-02019 |            | 10°             | 2                 | 1.04                   | 10°                  | 4              | 50                 |
| 08-00540-02024 |            | 15°             | 2                 | 1.38                   | 15°                  | 4              | 50                 |
| 08-00540-02504 | R0.25      | 1°              | 2.5               | 0.58                   | 9°                   | 4              | 50                 |
| 08-00540-02506 |            | 2°              | 2.5               | 0.66                   | 9°                   | 4              | 50                 |
| 08-00540-02508 |            | 3°              | 2.5               | 0.74                   | 9°                   | 4              | 50                 |
| 08-00540-02512 |            | 5°              | 2.5               | 0.90                   | 9°                   | 4              | 50                 |
| 08-00540-02516 |            | 7°              | 2.5               | 1.06                   | 9°                   | 4              | 50                 |
| 08-00540-02519 |            | 10°             | 2.5               | 1.30                   | 10°                  | 4              | 50                 |
| 08-00540-02524 |            | 15°             | 2.5               | 1.72                   | 15°                  | 4              | 50                 |
| 08-00540-03004 | R0.3       | 1°              | 3                 | 0.69                   | 9°                   | 4              | 50                 |
| 08-00540-03006 |            | 2°              | 3                 | 0.79                   | 9°                   | 4              | 50                 |
| 08-00540-03008 |            | 3°              | 3                 | 0.88                   | 9°                   | 4              | 50                 |
| 08-00540-03012 |            | 5°              | 3                 | 1.07                   | 9°                   | 4              | 50                 |
| 08-00540-03016 |            | 7°              | 3                 | 1.27                   | 9°                   | 4              | 50                 |
| 08-00540-03019 |            | 10°             | 3                 | 1.56                   | 10°                  | 4              | 50                 |
| 08-00540-03024 |            | 15°             | 3                 | 2.07                   | 15°                  | 4              | 50                 |
| 08-00540-03504 | R0.35      | 1°              | 3.5               | 0.81                   | 9°                   | 4              | 50                 |
| 08-00540-03506 |            | 2°              | 3.5               | 0.92                   | 9°                   | 4              | 50                 |
| 08-00540-03508 |            | 3°              | 3.5               | 1.03                   | 9°                   | 4              | 50                 |
| 08-00540-03512 |            | 5°              | 3.5               | 1.25                   | 9°                   | 4              | 50                 |
| 08-00540-03516 |            | 7°              | 3.5               | 1.48                   | 9°                   | 4              | 50                 |
| 08-00540-03519 |            | 10°             | 3.5               | 1.82                   | 10°                  | 4              | 50                 |
| 08-00540-03524 |            | 15°             | 3.5               | 2.41                   | 15°                  | 4              | 50                 |
| 08-00540-04004 | R0.4       | 1°              | 4                 | 0.93                   | 9°                   | 4              | 50                 |
| 08-00540-04006 |            | 2°              | 4                 | 1.05                   | 9°                   | 4              | 50                 |
| 08-00540-04008 |            | 3°              | 4                 | 1.18                   | 9°                   | 4              | 50                 |
| 08-00540-04012 |            | 5°              | 4                 | 1.43                   | 9°                   | 4              | 50                 |
| 08-00540-04016 |            | 7°              | 4                 | 1.69                   | 9°                   | 4              | 50                 |
| 08-00540-04019 |            | 10°             | 4                 | 2.08                   | 10°                  | 4              | 50                 |
| 08-00540-04024 |            | 15°             | 4                 | 2.76                   | 15°                  | 4              | 50                 |

## How to Order

When you order, indicate MTB230 (R) x (θ).

※( $d_1$ ) and ( $\gamma$ ) is reference value.

| Code No.       | Radius (R) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 08-00540-04504 | R0.45      | 1°              | 4                 | 1.02                   | 9°                   | 4              | 50                 |
| 08-00540-04506 |            | 2°              | 4                 | 1.15                   | 9°                   | 4              | 50                 |
| 08-00540-04508 |            | 3°              | 4                 | 1.27                   | 9°                   | 4              | 50                 |
| 08-00540-04512 |            | 5°              | 4                 | 1.52                   | 9°                   | 4              | 50                 |
| 08-00540-04516 |            | 7°              | 4                 | 1.74                   | 9°                   | 4              | 50                 |
| 08-00540-04519 |            | 10°             | 4                 | 2.17                   | 10°                  | 4              | 50                 |
| 08-00540-04524 |            | 15°             | 4                 | 2.83                   | 15°                  | 4              | 50                 |
| 08-00540-05004 |            | R0.5            | 1°                | 4                      | 1.12                 | 9°             | 4                  |
| 08-00540-05006 | 2°         |                 | 4                 | 1.25                   | 9°                   | 4              | 55                 |
| 08-00540-05008 | 3°         |                 | 4                 | 1.37                   | 9°                   | 4              | 55                 |
| 08-00540-05012 | 5°         |                 | 4                 | 1.62                   | 9°                   | 4              | 55                 |
| 08-00540-05016 | 7°         |                 | 4                 | 1.87                   | 9°                   | 4              | 55                 |
| 08-00540-05019 | 10°        |                 | 4                 | 2.25                   | 10°                  | 4              | 55                 |
| 08-00540-05024 | 15°        |                 | 4                 | 2.91                   | 15°                  | 4              | 55                 |
| 08-00540-06004 | R0.6       |                 | 1°                | 5                      | 1.35                 | 9°             | 4                  |
| 08-00540-06006 |            | 2°              | 5                 | 1.50                   | 9°                   | 4              | 55                 |
| 08-00540-06008 |            | 3°              | 5                 | 1.66                   | 9°                   | 4              | 55                 |
| 08-00540-06012 |            | 5°              | 5                 | 1.97                   | 9°                   | 4              | 55                 |
| 08-00540-06016 |            | 7°              | 5                 | 2.29                   | 9°                   | 4              | 55                 |
| 08-00540-06019 |            | 10°             | 5                 | 2.77                   | 10°                  | 4              | 55                 |
| 08-00540-06024 |            | 15°             | 5                 | 3.60                   | 15°                  | 4              | 55                 |
| 08-00540-07504 |            | R0.75           | 1°                | 6                      | 1.68                 | 9°             | 4                  |
| 08-00540-07506 | 2°         |                 | 6                 | 1.87                   | 9°                   | 4              | 55                 |
| 08-00540-07508 | 3°         |                 | 6                 | 2.05                   | 9°                   | 4              | 55                 |
| 08-00540-07512 | 5°         |                 | 6                 | 2.42                   | 9°                   | 4              | 55                 |
| 08-00540-07516 | 7°         |                 | 6                 | 2.80                   | 9°                   | 4              | 55                 |
| 08-00540-07519 | 10°        |                 | 6                 | 3.37                   | 10°                  | 4              | 55                 |
| 08-00540-07524 | 15°        |                 | 6                 | 4.37                   | —                    | 4              | 55                 |
| 08-00540-08004 | R0.8       |                 | 1°                | 6                      | 1.78                 | 9°             | 4                  |
| 08-00540-08006 |            | 2°              | 6                 | 1.96                   | 9°                   | 4              | 55                 |
| 08-00540-08008 |            | 3°              | 6                 | 2.15                   | 9°                   | 4              | 55                 |
| 08-00540-08012 |            | 5°              | 6                 | 2.52                   | 9°                   | 4              | 55                 |
| 08-00540-08016 |            | 7°              | 6                 | 2.89                   | 9°                   | 4              | 55                 |
| 08-00540-08019 |            | 10°             | 6                 | 3.46                   | 10°                  | 4              | 55                 |
| 08-00540-08024 |            | 15°             | 6                 | 4.44                   | —                    | 4              | 55                 |
| 08-00540-10004 |            | R1              | 1°                | 8                      | 2.24                 | 9°             | 4                  |
| 08-00540-10006 | 2°         |                 | 8                 | 2.49                   | 9°                   | 4              | 60                 |
| 08-00540-10008 | 3°         |                 | 8                 | 2.74                   | 9°                   | 4              | 60                 |
| 08-00540-10012 | 5°         |                 | 8                 | 3.23                   | 9°                   | 4              | 60                 |
| 08-00540-10016 | 7°         |                 | 8                 | 3.73                   | 7°                   | 4              | 60                 |
| 08-00540-10019 | 10°        |                 | 8                 | 4.50                   | 10°                  | 6              | 60                 |
| 08-00540-10024 | 15°        |                 | 8                 | 5.82                   | 15°                  | 6              | 60                 |
| 08-00540-12504 | R1.25      |                 | 1°                | 10                     | 2.81                 | 9°             | 4                  |
| 08-00540-12506 |            | 2°              | 10                | 3.11                   | 9°                   | 4              | 60                 |
| 08-00540-12508 |            | 3°              | 10                | 3.42                   | 9°                   | 4              | 60                 |
| 08-00540-12512 |            | 5°              | 10                | 4.04                   | 9°                   | 6              | 60                 |
| 08-00540-12516 |            | 7°              | 10                | 4.67                   | 9°                   | 6              | 60                 |
| 08-00540-12519 |            | 10°             | 10                | 5.62                   | 10°                  | 6              | 60                 |
| 08-00540-12524 |            | 15°             | 10                | 7.28                   | —                    | 6              | 60                 |
| 08-00540-15004 |            | R1.5            | 1°                | 12                     | 3.37                 | 9°             | 4                  |
| 08-00540-15006 | 2°         |                 | 12                | 3.74                   | 2°                   | 4              | 60                 |
| 08-00540-15008 | 3°         |                 | 12                | 4.10                   | 9°                   | 6              | 60                 |
| 08-00540-15012 | 5°         |                 | 12                | 4.85                   | 9°                   | 6              | 60                 |
| 08-00540-15016 | 7°         |                 | 12                | 5.60                   | 7°                   | 6              | 60                 |
| 08-00540-15019 | 10°        |                 | 12                | 6.75                   | —                    | 6              | 60                 |
| 08-00540-15024 | 15°        |                 | 12                | 8.73                   | —                    | 8              | 60                 |
| 08-00540-20004 | R2         |                 | 1°                | 16                     | 4.49                 | 9°             | 6                  |
| 08-00540-20006 |            | 2°              | 16                | 4.98                   | 9°                   | 6              | 65                 |
| 08-00540-20008 |            | 3°              | 16                | 5.47                   | 9°                   | 6              | 65                 |
| 08-00540-20012 |            | 5°              | 16                | 6.46                   | —                    | 6              | 65                 |
| 08-00540-20016 |            | 7°              | 16                | 7.47                   | 7°                   | 8              | 65                 |
| 08-00540-20019 |            | 10°             | 16                | 9.00                   | —                    | 8              | 65                 |
| 08-00540-20024 |            | 15°             | 16                | 11.64                  | —                    | 10             | 70                 |

Unit : mm

Hardener





Carbon Steel

Alloy Steel

Prehardened Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Hardened Steel

Coating

Tapered

MTB230

Recommended Milling Conditions

| Work Material |             | Carbon Steels・Alloy Steels・Prehardened Steels S50C・SKD・NAK |        |              | Hardened Steels (52HRC) |        |              | Aluminium Alloy・Copper |        |              |
|---------------|-------------|------------------------------------------------------------|--------|--------------|-------------------------|--------|--------------|------------------------|--------|--------------|
|               |             | Slotting                                                   |        |              | Slotting                |        |              | Slotting               |        |              |
| Radius        | Taper Angle | Spindle Speed                                              | Feed   | Depth of Cut | Spindle Speed           | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut |
|               |             | min <sup>-1</sup>                                          | mm/min | ap mm        | min <sup>-1</sup>       | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        |
| R0.1          | 1°          | 40,000                                                     | 90     | 0.005        | 40,000                  | 60     | 0.003        | 40,000                 | 100    | 0.006        |
|               | 2°          | 40,000                                                     | 100    | 0.006        | 40,000                  | 70     | 0.004        | 40,000                 | 110    | 0.007        |
|               | 3°          | 40,000                                                     | 120    | 0.006        | 40,000                  | 80     | 0.004        | 40,000                 | 140    | 0.007        |
|               | 5°          | 40,000                                                     | 130    | 0.007        | 40,000                  | 90     | 0.005        | 40,000                 | 140    | 0.008        |
|               | 7°          | 40,000                                                     | 160    | 0.007        | 40,000                  | 100    | 0.005        | 40,000                 | 180    | 0.008        |
|               | 10°         | 40,000                                                     | 180    | 0.008        | 40,000                  | 120    | 0.005        | 40,000                 | 200    | 0.01         |
| R0.15         | 1°          | 40,000                                                     | 120    | 0.005        | 40,000                  | 80     | 0.004        | 40,000                 | 140    | 0.006        |
|               | 2°          | 40,000                                                     | 130    | 0.005        | 40,000                  | 90     | 0.004        | 40,000                 | 140    | 0.006        |
|               | 3°          | 40,000                                                     | 140    | 0.006        | 40,000                  | 100    | 0.004        | 40,000                 | 160    | 0.007        |
|               | 5°          | 40,000                                                     | 150    | 0.006        | 40,000                  | 100    | 0.005        | 40,000                 | 170    | 0.007        |
|               | 7°          | 40,000                                                     | 180    | 0.007        | 40,000                  | 120    | 0.005        | 40,000                 | 200    | 0.008        |
| R0.2          | 10°         | 40,000                                                     | 210    | 0.008        | 40,000                  | 140    | 0.005        | 40,000                 | 230    | 0.01         |
|               | 15°         | 40,000                                                     | 240    | 0.01         | 40,000                  | 160    | 0.007        | 40,000                 | 260    | 0.012        |
|               | 1°          | 40,000                                                     | 390    | 0.015        | 40,000                  | 260    | 0.01         | 40,000                 | 430    | 0.018        |
|               | 2°          | 40,000                                                     | 400    | 0.015        | 40,000                  | 260    | 0.01         | 40,000                 | 440    | 0.018        |
|               | 3°          | 40,000                                                     | 420    | 0.02         | 40,000                  | 280    | 0.013        | 40,000                 | 460    | 0.024        |
| R0.25         | 5°          | 40,000                                                     | 430    | 0.02         | 40,000                  | 290    | 0.013        | 40,000                 | 470    | 0.024        |
|               | 7°          | 40,000                                                     | 450    | 0.02         | 40,000                  | 300    | 0.013        | 40,000                 | 500    | 0.024        |
|               | 10°         | 40,000                                                     | 470    | 0.02         | 40,000                  | 310    | 0.013        | 40,000                 | 520    | 0.024        |
|               | 15°         | 40,000                                                     | 500    | 0.02         | 37,000                  | 310    | 0.013        | 40,000                 | 550    | 0.024        |
|               | 1°          | 40,000                                                     | 420    | 0.015        | 38,000                  | 260    | 0.01         | 40,000                 | 460    | 0.018        |
| R0.3          | 2°          | 40,000                                                     | 430    | 0.02         | 37,000                  | 260    | 0.013        | 40,000                 | 470    | 0.024        |
|               | 3°          | 40,000                                                     | 440    | 0.02         | 36,000                  | 260    | 0.013        | 40,000                 | 490    | 0.024        |
|               | 5°          | 40,000                                                     | 450    | 0.025        | 35,000                  | 260    | 0.017        | 40,000                 | 500    | 0.03         |
|               | 7°          | 40,000                                                     | 480    | 0.03         | 34,000                  | 270    | 0.02         | 40,000                 | 530    | 0.036        |
|               | 10°         | 40,000                                                     | 510    | 0.03         | 32,000                  | 270    | 0.02         | 40,000                 | 560    | 0.036        |
|               | 15°         | 40,000                                                     | 540    | 0.03         | 29,000                  | 270    | 0.02         | 40,000                 | 600    | 0.036        |
| R0.35         | 1°          | 40,000                                                     | 500    | 0.03         | 31,000                  | 260    | 0.02         | 40,000                 | 550    | 0.036        |
|               | 2°          | 40,000                                                     | 520    | 0.035        | 30,500                  | 260    | 0.023        | 40,000                 | 580    | 0.042        |
|               | 3°          | 40,000                                                     | 530    | 0.04         | 30,000                  | 260    | 0.026        | 40,000                 | 580    | 0.05         |
|               | 5°          | 40,000                                                     | 550    | 0.045        | 29,000                  | 270    | 0.03         | 40,000                 | 610    | 0.055        |
|               | 7°          | 38,000                                                     | 570    | 0.05         | 28,000                  | 280    | 0.033        | 40,000                 | 660    | 0.06         |
|               | 10°         | 35,000                                                     | 580    | 0.05         | 27,000                  | 300    | 0.033        | 40,000                 | 730    | 0.06         |
| R0.4          | 15°         | 32,000                                                     | 600    | 0.05         | 24,000                  | 300    | 0.033        | 40,000                 | 820    | 0.06         |
|               | 1°          | 36,000                                                     | 720    | 0.06         | 27,000                  | 360    | 0.04         | 40,000                 | 880    | 0.07         |
|               | 2°          | 35,000                                                     | 720    | 0.065        | 26,500                  | 360    | 0.043        | 40,000                 | 900    | 0.08         |
|               | 3°          | 34,000                                                     | 720    | 0.07         | 26,000                  | 360    | 0.046        | 40,000                 | 940    | 0.085        |
|               | 5°          | 33,000                                                     | 720    | 0.075        | 25,000                  | 360    | 0.05         | 40,000                 | 960    | 0.09         |
|               | 7°          | 32,000                                                     | 720    | 0.08         | 24,000                  | 360    | 0.053        | 40,000                 | 990    | 0.095        |
| R0.45         | 10°         | 30,000                                                     | 720    | 0.085        | 23,000                  | 360    | 0.056        | 40,000                 | 1,060  | 0.1          |
|               | 15°         | 28,000                                                     | 720    | 0.09         | 21,000                  | 360    | 0.06         | 40,000                 | 1,140  | 0.11         |
|               | 1°          | 32,000                                                     | 900    | 0.065        | 23,500                  | 460    | 0.043        | 40,000                 | 1,240  | 0.08         |
|               | 2°          | 31,000                                                     | 900    | 0.07         | 23,000                  | 460    | 0.046        | 40,000                 | 1,280  | 0.085        |
|               | 3°          | 30,000                                                     | 900    | 0.075        | 22,500                  | 460    | 0.05         | 40,000                 | 1,320  | 0.09         |
|               | 5°          | 29,000                                                     | 900    | 0.08         | 22,000                  | 460    | 0.053        | 40,000                 | 1,370  | 0.095        |
| R0.5          | 7°          | 28,000                                                     | 900    | 0.09         | 21,000                  | 460    | 0.06         | 40,000                 | 1,420  | 0.11         |
|               | 10°         | 27,000                                                     | 900    | 0.1          | 20,000                  | 460    | 0.066        | 40,000                 | 1,470  | 0.12         |
|               | 15°         | 25,000                                                     | 900    | 0.11         | 18,500                  | 460    | 0.073        | 37,000                 | 1,470  | 0.13         |

J-016

Carbon Steel

Alloy Steel

Prehardened Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Hardened Steel

Coating

Tapered

MTB230

Recommended Milling Conditions

| Work Material |             | Carbon Steels・Alloy Steels・Prehardened Steels S50C・SKD・NAK |        |              | Hardened Steels (52HRC) |        |              | Aluminium Alloy・Copper |        |              |
|---------------|-------------|------------------------------------------------------------|--------|--------------|-------------------------|--------|--------------|------------------------|--------|--------------|
|               |             | Slotting                                                   |        |              | Slotting                |        |              | Slotting               |        |              |
| Radius        | Taper Angle | Spindle Speed                                              | Feed   | Depth of Cut | Spindle Speed           | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut |
|               |             | min <sup>-1</sup>                                          | mm/min | ap mm        | min <sup>-1</sup>       | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        |
| R0.45         | 1°          | 28,000                                                     | 1,100  | 0.1          | 21,000                  | 550    | 0.065        | 40,000                 | 1,730  | 0.12         |
|               | 2°          | 27,500                                                     | 1,100  | 0.1          | 20,500                  | 550    | 0.067        | 40,000                 | 1,760  | 0.125        |
|               | 3°          | 27,000                                                     | 1,100  | 0.11         | 20,000                  | 550    | 0.073        | 40,000                 | 1,790  | 0.13         |
|               | 5°          | 26,000                                                     | 1,100  | 0.12         | 19,500                  | 550    | 0.08         | 39,000                 | 1,820  | 0.145        |
|               | 7°          | 25,000                                                     | 1,100  | 0.13         | 19,000                  | 550    | 0.086        | 37,500                 | 1,820  | 0.16         |
|               | 10°         | 24,000                                                     | 1,100  | 0.14         | 18,000                  | 550    | 0.092        | 36,000                 | 1,820  | 0.17         |
|               | 15°         | 22,000                                                     | 1,100  | 0.15         | 16,500                  | 550    | 0.1          | 33,000                 | 1,820  | 0.18         |
| R0.5          | 1°          | 25,000                                                     | 1,200  | 0.12         | 19,000                  | 570    | 0.08         | 38,000                 | 2,000  | 0.145        |
|               | 2°          | 24,500                                                     | 1,200  | 0.13         | 18,500                  | 570    | 0.085        | 37,000                 | 2,000  | 0.16         |
|               | 3°          | 24,000                                                     | 1,200  | 0.14         | 18,000                  | 570    | 0.09         | 36,000                 | 2,000  | 0.17         |
|               | 5°          | 23,000                                                     | 1,200  | 0.15         | 17,500                  | 570    | 0.1          | 35,000                 | 2,000  | 0.18         |
|               | 7°          | 22,500                                                     | 1,200  | 0.16         | 17,000                  | 570    | 0.105        | 34,000                 | 2,000  | 0.19         |
|               | 10°         | 21,000                                                     | 1,200  | 0.17         | 16,000                  | 570    | 0.11         | 32,000                 | 2,000  | 0.2          |
| R0.6          | 15°         | 20,000                                                     | 1,200  | 0.18         | 15,000                  | 570    | 0.12         | 29,000                 | 2,000  | 0.21         |
|               | 1°          | 21,000                                                     | 1,300  | 0.13         | 16,000                  | 590    | 0.085        | 32,000                 | 2,100  | 0.16         |
|               | 2°          | 20,500                                                     | 1,300  | 0.15         | 15,500                  | 590    | 0.1          |                        |        |              |



## Recommended Milling Conditions

| Work Material |                | Carbon Steels・Alloy Steels・<br>Prehardened Steels<br>S50C・SKD・NAK                                                                                                  |        |                 | Hardened Steels<br>(52HRC) |        |                 | Aluminium Alloy・Copper |        |                 |
|---------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------|----------------------------|--------|-----------------|------------------------|--------|-----------------|
|               |                | Slotting                                                                                                                                                           |        |                 | Slotting                   |        |                 | Slotting               |        |                 |
| Radius        | Taper<br>Angle | Spindle<br>Speed                                                                                                                                                   | Feed   | Depth of<br>Cut | Spindle<br>Speed           | Feed   | Depth of<br>Cut | Spindle<br>Speed       | Feed   | Depth of<br>Cut |
|               |                | min <sup>-1</sup>                                                                                                                                                  | mm/min | ap mm           | min <sup>-1</sup>          | mm/min | ap mm           | min <sup>-1</sup>      | mm/min | ap mm           |
| R1.5          | 1°             | 8,300                                                                                                                                                              | 1,200  | 0.22            | 6,300                      | 600    | 0.145           | 13,000                 | 2,000  | 0.26            |
|               | 2°             | 8,200                                                                                                                                                              | 1,200  | 0.24            | 6,100                      | 600    | 0.16            | 12,500                 | 2,000  | 0.29            |
|               | 3°             | 8,100                                                                                                                                                              | 1,200  | 0.26            | 6,000                      | 600    | 0.17            | 12,000                 | 2,000  | 0.31            |
|               | 5°             | 7,800                                                                                                                                                              | 1,200  | 0.28            | 5,800                      | 600    | 0.185           | 11,500                 | 2,000  | 0.33            |
|               | 7°             | 7,500                                                                                                                                                              | 1,200  | 0.3             | 5,600                      | 600    | 0.2             | 11,000                 | 2,000  | 0.36            |
|               | 10°            | 7,100                                                                                                                                                              | 1,200  | 0.32            | 5,300                      | 600    | 0.21            | 10,500                 | 2,000  | 0.38            |
|               | 15°            | 6,500                                                                                                                                                              | 1,200  | 0.35            | 4,900                      | 600    | 0.23            | 10,000                 | 2,000  | 0.42            |
| R2            | 1°             | 6,300                                                                                                                                                              | 1,100  | 0.25            | 4,700                      | 550    | 0.165           | 9,400                  | 1,800  | 0.3             |
|               | 2°             | 6,100                                                                                                                                                              | 1,100  | 0.27            | 4,600                      | 550    | 0.18            | 9,200                  | 1,800  | 0.32            |
|               | 3°             | 6,000                                                                                                                                                              | 1,100  | 0.29            | 4,500                      | 550    | 0.19            | 9,100                  | 1,800  | 0.35            |
|               | 5°             | 5,800                                                                                                                                                              | 1,100  | 0.32            | 4,400                      | 550    | 0.21            | 8,800                  | 1,800  | 0.38            |
|               | 7°             | 5,600                                                                                                                                                              | 1,100  | 0.35            | 4,200                      | 550    | 0.23            | 8,400                  | 1,800  | 0.42            |
|               | 10°            | 5,300                                                                                                                                                              | 1,100  | 0.37            | 4,000                      | 550    | 0.245           | 8,000                  | 1,800  | 0.44            |
| Notes         |                | ※1 Recommend to use the milling condition as just reference. Adjust milling conditions according to machining shape and machine status.                            |        |                 |                            |        |                 |                        |        |                 |
|               |                | ※2 This cutting condition assumes cutting depth of Rx2 from the tip of the tool.<br>Please adjust both spindle speed and feed when the slotting depth is over 2xR. |        |                 |                            |        |                 |                        |        |                 |
|               |                | ※3 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.                                            |        |                 |                            |        |                 |                        |        |                 |
|               |                | ※4 Recommend reciprocating cutting.                                                                                                                                |        |                 |                            |        |                 |                        |        |                 |
|               |                | ※5 Oil mist coolant is recommended for the machining of hardened steels.                                                                                           |        |                 |                            |        |                 |                        |        |                 |



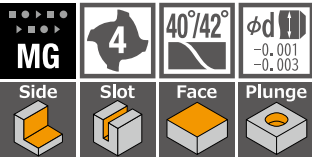
| High Efficient Milling |                                                                                                                                                                                                                   | End mill lineup to realize high efficient machining |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               | Page | Number of Sizes     |        |        |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------|---------------|---------|-----------------|-------------|--------------|--------------|--------------|----------------------------------------------------------------------|-------------------|------------------|------------------------|----------------------|----------------------|-------------|------------|---------------|----------------------------|-------------------------------|------|---------------------|--------|--------|
| NEW                    | Model                                                                                                                                                                                                             | Size                                                | Maximum Cutting Depth | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunge Milling<br><small>There is a depth note in each model</small> | Work Material     |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
|                        |                                                                                                                                                                                                                   |                                                     |                       |               |         |                 |             |              |              |              |                                                                      | P<br>Carbon Steel | P<br>Alloy Steel | M<br>Prehardened Steel | N<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc |      | H<br>Hardened Steel |        |        |
|                        |                                                                                                                                                                                                                   |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      | 55 HRC              | 65 HRC | 70 HRC |
| Square                 |                                                                                                                                                                                                                   |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
| NEW                    | MSUSZ440                                                                                                                                                                                                          | φ1 ~ φ6                                             | 3D                    | 3D            |         | 4               | 40°/42°     | Side         | Slot         | Face         | Plunge                                                               | -                 | -                |                        | -                    | -                    | -           | -          | -             | -                          |                               | -    | -                   | -      | -      |
|                        | For machining on stainless steels and heat resistant alloy<br>Continuous machining from plunging to slotting. Unequal flute spacing and unequal helix angle design                                                |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
| NEW                    | MSCZ440                                                                                                                                                                                                           | φ1 ~ φ6                                             | 3D                    | 3D            |         | 4               | 40°/42°     | Side         | Slot         | Face         | Plunge                                                               |                   |                  |                        | -                    | -                    | -           | -          | -             | -                          | -                             | -    | -                   | -      |        |
|                        | High efficient machining on carbon steels. Continuous machining from plunging approach to slotting                                                                                                                |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
|                        | MSZ345                                                                                                                                                                                                            | φ1 ~ φ12                                            | 2.4D                  | ≒ 2.4D        |         | 3               | 45°         | Side         | Slot         | Face         | Plunge                                                               |                   |                  |                        |                      | -                    | -           | -          | -             | -                          | -                             | -    | -                   | -      |        |
|                        | For machining on steels<br>Continuous machining from plunging without guide-hole and stepping to slotting                                                                                                         |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
|                        | AL3D-345                                                                                                                                                                                                          | φ1 ~ φ12                                            | 3D                    | 3D            | -       | 3               | 45°         | Side         | Slot         | Face         | Plunge                                                               | -                 | -                | -                      |                      |                      |             | -          | -             | -                          | -                             | -    | -                   | -      |        |
|                        | For machining on aluminium alloy<br>Continuous machining from plunging without guide-hole and stepping to slotting ※Listed at "Aluminium Milling" as well (Page L-020)                                            |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
| Long Neck Square       |                                                                                                                                                                                                                   |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
| NEW                    | MSUSZ440-LN                                                                                                                                                                                                       | φ1 ~ φ6                                             | 5D                    | 1.5D          |         | 4               | 40°/42°     | Side         | Slot         | Face         | Plunge                                                               | -                 | -                |                        | -                    | -                    | -           | -          | -             | -                          |                               | -    | -                   | -      | -      |
|                        | For machining on stainless steels and heat resistant alloy<br>Continuous machining from plunging to slotting Unequal flute spacing and unequal helix angle design                                                 |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
| NEW                    | MSCZ440-LN                                                                                                                                                                                                        | φ1 ~ φ6                                             | 5D                    | 1.5D          |         | 4               | 40°/42°     | Side         | Slot         | Face         | Plunge                                                               |                   |                  |                        | -                    | -                    | -           | -          | -             | -                          | -                             | -    | -                   | -      |        |
|                        | High efficient machining on carbon steels.<br>Continuous machining from plunging approach to slotting. Long neck type to prevent interference                                                                     |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |
|                        | ALZ345-DLC                                                                                                                                                                                                        | φ1 ~ φ12                                            | 3D                    | 1.5D          | DLC     | 3               | 45°         | Side         | Slot         | Face         | Plunge                                                               | -                 | -                | -                      |                      |                      |             | -          | -             | -                          | -                             | -    | -                   | -      |        |
|                        | For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting.<br>DLC coating applied for longer tool life ※Listed at "Aluminium Milling" as well (Page L-028) |                                                     |                       |               |         |                 |             |              |              |              |                                                                      |                   |                  |                        |                      |                      |             |            |               |                            |                               |      |                     |        |        |

| High Efficient Milling                                                                                                |                       | End mill lineup to realize high efficient machining |               |         |                 |             |              |              |              |                                                                      |                                                     |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       | Page | Number of Sizes |       |       |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------|---------------|---------|-----------------|-------------|--------------|--------------|--------------|----------------------------------------------------------------------|-----------------------------------------------------|------------------|------------------------|----------------------|----------------------|-------------|------------|---------------|----------------------------|-------------------------------|---------------------------------------------------------------------------------------|------|-----------------|-------|-------|
| Model                                                                                                                 | Size                  | Maximum Cutting Depth                               | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunge Milling<br><small>There is a depth note in each model</small> | Work Material                                       |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       |      |                 |       |       |
|                                                                                                                       |                       |                                                     |               |         |                 |             |              |              |              |                                                                      | P<br>Carbon Steel                                   | P<br>Alloy Steel | P<br>Prehardened Steel | M<br>Stainless Steel | N<br>Aluminium Alloy | N<br>Copper | N<br>Resin | N<br>Graphite | N<br>Hard Brittle Material | S<br>Heat Resistant Alloy etc | H<br>Hardened Steel<br><div><div>55 HRC</div><div>65 HRC</div><div>70 HRC</div></div> |      |                 |       |       |
| Square • Long Neck Square                                                                                             |                       |                                                     |               |         |                 |             |              |              |              |                                                                      |                                                     |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       |      |                 |       |       |
| ALZ345                                                                                                                | φ1 ~ φ12              | 5D                                                  | 1.5D          | -       | 3               | 45°         | Side         | Slot         | Face         | Plunge                                                               | -                                                   | -                | -                      | -                    |                      |             |            | -             | -                          | -                             | -                                                                                     | -    | -               | 124   | K-020 |
| For machining on aluminium alloy<br>Continuous machining from plunging without guide-hole and stepping to slotting    |                       |                                                     |               |         |                 |             |              |              |              |                                                                      | ※Listed at "Aluminium Milling" as well (Page L-024) |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       |      |                 |       |       |
| Corner Radius                                                                                                         |                       |                                                     |               |         |                 |             |              |              |              |                                                                      |                                                     |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       |      |                 |       |       |
| MSXH440R                                                                                                              | φ3× R0.3<br>~ φ12× R2 | 2.5D                                                | ≒ 2.5D        |         | 4               | 40°/42°     | Side         | Slot         | Face         | -                                                                    | -                                                   |                  |                        |                      | -                    | -           | -          | -             | -                          |                               | -                                                                                     | -    | -               | 19    | K-024 |
| For machining on stainless steels and heat resistant alloy<br>High efficient machining with unequal flute spacing and |                       |                                                     |               |         |                 |             |              |              |              |                                                                      | unequal helix angle design to suppress chattering   |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       |      |                 |       |       |
| MSX440                                                                                                                | φ3× R0.2<br>~ φ20× R1 | 2.5D                                                | ≒ 2.5D        |         | 4               | 35°/38°     | Side         | Slot         | Face         | -                                                                    |                                                     |                  |                        |                      | -                    | -           | -          | -             | -                          | -                             | -                                                                                     | -    | 16              | K-026 |       |
| Unequal helix angle and flute spacing to minimize chattering. Suitable for steels to stainless steels                 |                       |                                                     |               |         |                 |             |              |              |              |                                                                      |                                                     |                  |                        |                      |                      |             |            |               |                            |                               |                                                                                       |      |                 |       |       |

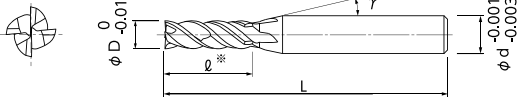
MUGEN COATING PREMIUM 4-Flute High Efficient "Z" End Mill for Stainless Steels

Recommended Milling Conditions

For machining on stainless steels and heat resistant alloy  
Continuous machining from plunging to slotting  
Unequal flute spacing and unequal helix angle design

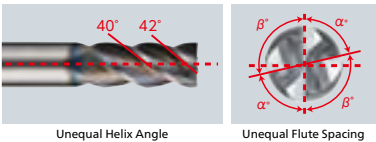


※ Plunge depth is referred to recommended milling conditions



- Unequal flute spacing, unequal helix angle and high rigid end profile design to minimize chatter realize high efficient machining.
- New developed special edge profile realized multi-functional performance of side milling, slot milling and plunging approaches on stainless steel.
- Optimized high heat-resistance MUGEN COATING PREMIUM to realize stable long time machining.
- Total 62 sizes, some sizes line up with L/D=2 or 3.

※ The practical Length of Cut is 0.1mm longer than the specification table.



| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| 08-00152-01020 | 1           | 2                       | 12°                         | 4                    | 50                       |
| 08-00152-01030 |             | 3                       | 12°                         | 4                    | 50                       |
| 08-00152-01120 | 1.1         | 2.2                     | 12°                         | 4                    | 50                       |
| 08-00152-01220 | 1.2         | 2.4                     | 12°                         | 4                    | 50                       |
| 08-00152-01320 | 1.3         | 2.6                     | 12°                         | 4                    | 50                       |
| 08-00152-01420 | 1.4         | 2.8                     | 12°                         | 4                    | 50                       |
| 08-00152-01520 | 1.5         | 3                       | 12°                         | 4                    | 50                       |
| 08-00152-01530 |             | 4.5                     | 12°                         | 4                    | 50                       |
| 08-00152-01620 | 1.6         | 3.2                     | 12°                         | 6                    | 50                       |
| 08-00152-01720 | 1.7         | 3.4                     | 12°                         | 6                    | 50                       |
| 08-00152-01820 | 1.8         | 3.6                     | 12°                         | 6                    | 50                       |
| 08-00152-01920 | 1.9         | 3.8                     | 12°                         | 6                    | 50                       |
| 08-00152-02020 | 2           | 4                       | 12°                         | 6                    | 50                       |
| 08-00152-02030 |             | 6                       | 12°                         | 6                    | 60                       |
| 08-00152-02120 | 2.1         | 4.2                     | 12°                         | 6                    | 50                       |
| 08-00152-02220 | 2.2         | 4.4                     | 12°                         | 6                    | 50                       |
| 08-00152-02320 | 2.3         | 4.6                     | 12°                         | 6                    | 50                       |
| 08-00152-02420 | 2.4         | 4.8                     | 12°                         | 6                    | 50                       |
| 08-00152-02520 | 2.5         | 5                       | 12°                         | 6                    | 50                       |
| 08-00152-02530 |             | 7.5                     | 12°                         | 6                    | 60                       |
| 08-00152-02620 | 2.6         | 5.2                     | 12°                         | 6                    | 50                       |
| 08-00152-02720 | 2.7         | 5.4                     | 12°                         | 6                    | 50                       |
| 08-00152-02820 | 2.8         | 5.6                     | 12°                         | 6                    | 50                       |
| 08-00152-02920 | 2.9         | 5.8                     | 12°                         | 6                    | 50                       |
| 08-00152-03020 | 3           | 6                       | 12°                         | 6                    | 50                       |
| 08-00152-03030 |             | 9                       | 12°                         | 6                    | 60                       |
| 08-00152-03120 | 3.1         | 6.2                     | 12°                         | 6                    | 50                       |
| 08-00152-03220 | 3.2         | 6.4                     | 12°                         | 6                    | 50                       |
| 08-00152-03320 | 3.3         | 6.6                     | 12°                         | 6                    | 50                       |
| 08-00152-03420 | 3.4         | 6.8                     | 12°                         | 6                    | 50                       |

**How to Order** When you order, indicate MSUSZ440 (D)×(ℓ).  
※ (γ) is reference value.

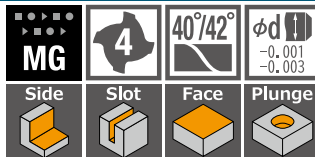
**Machining case** W-018

| Unit : mm      |             |                         |                             |                      |                          |
|----------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
| 08-00152-03520 | 3.5         | 7                       | 12°                         | 6                    | 50                       |
| 08-00152-03530 |             | 10.5                    | 12°                         | 6                    | 60                       |
| 08-00152-03620 | 3.6         | 7.2                     | 12°                         | 6                    | 50                       |
| 08-00152-03720 | 3.7         | 7.4                     | 12°                         | 6                    | 50                       |
| 08-00152-03820 | 3.8         | 7.6                     | 12°                         | 6                    | 50                       |
| 08-00152-03920 | 3.9         | 7.8                     | 12°                         | 6                    | 50                       |
| 08-00152-04020 | 4           | 8                       | 12°                         | 6                    | 50                       |
| 08-00152-04030 |             | 12                      | 12°                         | 6                    | 60                       |
| 08-00152-04120 | 4.1         | 8.2                     | 12°                         | 6                    | 50                       |
| 08-00152-04220 | 4.2         | 8.4                     | 12°                         | 6                    | 50                       |
| 08-00152-04320 | 4.3         | 8.6                     | 12°                         | 6                    | 50                       |
| 08-00152-04420 | 4.4         | 8.8                     | 12°                         | 6                    | 50                       |
| 08-00152-04520 | 4.5         | 9                       | 12°                         | 6                    | 50                       |
| 08-00152-04530 |             | 13.5                    | 12°                         | 6                    | 60                       |
| 08-00152-04620 | 4.6         | 9.2                     | 12°                         | 6                    | 50                       |
| 08-00152-04720 | 4.7         | 9.4                     | 12°                         | 6                    | 50                       |
| 08-00152-04820 | 4.8         | 9.6                     | 12°                         | 6                    | 50                       |
| 08-00152-04920 | 4.9         | 9.8                     | 12°                         | 6                    | 50                       |
| 08-00152-05020 | 5           | 10                      | 12°                         | 6                    | 50                       |
| 08-00152-05030 |             | 15                      | 12°                         | 6                    | 60                       |
| 08-00152-05120 | 5.1         | 10.2                    | 12°                         | 6                    | 50                       |
| 08-00152-05220 | 5.2         | 10.4                    | 12°                         | 6                    | 50                       |
| 08-00152-05320 | 5.3         | 10.6                    | 12°                         | 6                    | 50                       |
| 08-00152-05420 | 5.4         | 10.8                    | 12°                         | 6                    | 50                       |
| 08-00152-05520 | 5.5         | 11                      | 12°                         | 6                    | 50                       |
| 08-00152-05530 |             | 16.5                    | 12°                         | 6                    | 60                       |
| 08-00152-05620 | 5.6         | 11.2                    | 12°                         | 6                    | 50                       |
| 08-00152-05720 | 5.7         | 11.4                    | 12°                         | 6                    | 50                       |
| 08-00152-05820 | 5.8         | 11.6                    | 12°                         | 6                    | 50                       |
| 08-00152-05920 | 5.9         | 11.8                    | 12°                         | 6                    | 50                       |
| 08-00152-06020 | 6           | 12                      | —                           | 6                    | 60                       |
| 08-00152-06030 |             | 18                      | —                           | 6                    | 60                       |

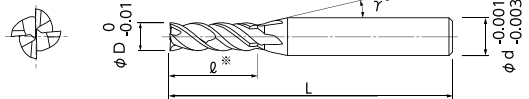
| Work Material                 |                  |     | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |                   |        |                   |        | Titanium Alloy<br>Ti-6Al-4V                                                                      |        |                   |        |                   |        |
|-------------------------------|------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|--------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|
| Dia.                          | Length<br>of Cut | L/D | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |        | Slotting          |        | Plunging          |        | Side Milling                                                                                     |        | Slotting          |        | Plunging          |        |
|                               |                  |     | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed                                                                                 | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed  | Feed   |
|                               |                  |     | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 1                             | 2                | 2   | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 600    | 15,000            | 200    | 15,000            | 50     | 16,800                                                                                           | 600    | 13,500            | 200    | 13,500            | 50     |
|                               | 3                | 3   | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 500    | 12,000            | 150    | 12,000            | 30     | 14,900                                                                                           | 500    | 10,800            | 150    | 10,800            | 30     |
| 1.5                           | 3                | 2   | 12,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 700    | 11,000            | 220    | 11,000            | 50     | 11,700                                                                                           | 700    | 10,000            | 220    | 10,000            | 50     |
|                               | 4.5              | 3   | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 550    | 8,500             | 160    | 8,500             | 30     | 10,300                                                                                           | 550    | 7,700             | 160    | 7,700             | 30     |
| 2                             | 4                | 2   | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 850    | 8,600             | 240    | 8,600             | 50     | 9,300                                                                                            | 850    | 7,800             | 240    | 7,800             | 50     |
|                               | 6                | 3   | 8,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 650    | 7,300             | 180    | 7,300             | 30     | 7,900                                                                                            | 650    | 6,600             | 180    | 6,600             | 30     |
| 2.5                           | 5                | 2   | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000  | 7,600             | 280    | 7,600             | 50     | 7,600                                                                                            | 1,000  | 6,900             | 280    | 6,900             | 50     |
|                               | 7.5              | 3   | 7,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 750    | 6,300             | 200    | 6,300             | 30     | 6,600                                                                                            | 750    | 5,700             | 200    | 5,700             | 30     |
| 3                             | 6                | 2   | 7,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,100  | 6,800             | 300    | 6,800             | 50     | 6,700                                                                                            | 1,100  | 6,200             | 300    | 6,200             | 50     |
|                               | 9                | 3   | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 800    | 5,400             | 220    | 5,400             | 30     | 5,600                                                                                            | 800    | 4,900             | 220    | 4,900             | 30     |
| 3.5                           | 7                | 2   | 6,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,150  | 5,700             | 330    | 5,700             | 50     | 6,200                                                                                            | 1,150  | 5,200             | 330    | 5,200             | 50     |
|                               | 10.5             | 3   | 5,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 900    | 4,800             | 230    | 4,800             | 30     | 5,100                                                                                            | 900    | 4,400             | 230    | 4,400             | 30     |
| 4                             | 8                | 2   | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200  | 5,300             | 330    | 5,300             | 50     | 6,000                                                                                            | 1,200  | 4,800             | 330    | 4,800             | 50     |
|                               | 12               | 3   | 5,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 920    | 4,400             | 230    | 4,400             | 30     | 5,000                                                                                            | 920    | 4,000             | 230    | 4,000             | 30     |
| 4.5                           | 9                | 2   | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200  | 4,900             | 350    | 4,900             | 50     | 5,600                                                                                            | 1,200  | 4,500             | 350    | 4,500             | 50     |
|                               | 13.5             | 3   | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000  | 4,000             | 240    | 4,000             | 30     | 4,800                                                                                            | 1,000  | 3,700             | 240    | 3,700             | 30     |
| 5                             | 10               | 2   | 5,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200  | 4,600             | 360    | 4,600             | 50     | 5,200                                                                                            | 1,200  | 4,200             | 360    | 4,200             | 50     |
|                               | 15               | 3   | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000  | 3,700             | 240    | 3,700             | 30     | 4,700                                                                                            | 1,000  | 3,400             | 240    | 3,400             | 30     |
| 5.5                           | 11               | 2   | 5,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200  | 4,400             | 380    | 4,400             | 50     | 4,900                                                                                            | 1,200  | 4,000             | 380    | 4,000             | 50     |
|                               | 16.5             | 3   | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000  | 3,400             | 250    | 3,400             | 30     | 4,500                                                                                            | 1,000  | 3,100             | 250    | 3,100             | 30     |
| 6                             | 12               | 2   | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200  | 4,200             | 400    | 4,200             | 50     | 4,600                                                                                            | 1,200  | 3,800             | 400    | 3,800             | 50     |
|                               | 18               | 3   | 4,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000  | 3,200             | 250    | 3,200             | 30     | 4,200                                                                                            | 1,000  | 2,900             | 250    | 2,900             | 30     |
| Depth of Cut<br><br>(D: Dia.) |                  |     | <div><div>Side Milling</div></div> <div><div>Slotting</div></div> <div><div>Plunging</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                   |        |                   |        | <div><div>Side Milling</div></div> <div><div>Slotting</div></div> <div><div>Plunging</div></div> |        |                   |        |                   |        |
| Notes                         |                  |     | ※1 Please choose the short end tooth when measure the tool length.<br>※2 Adjust milling condition conforming with machine rigidity and clamping condition.<br>Final milling conditions are subject to machining profile, purpose and machine status.<br>※3 Adjust both Spindle Speed and Feed at the same rate.<br>※4 Water-soluble fluid is recommended.<br>※5 Please increasing the coolant flow rate and pressure as much as possible, and supply it sufficiently to the machining point and flute.<br>※6 Please change the Depth of Cut or Feed when chips could not remove smoothly during plunging.<br>※7 Please be noted there would be a possible tool chipping or breakage when the chip removal is insufficient.<br>※8 Use a rigid and precise machine and chuck holder.<br>※9 Overhang of end mill should be as short as possible from spindle nose. |        |                   |        |                   |        |                                                                                                  |        |                   |        |                   |        |



High efficient machining on carbon steels !  
Continuous machining from plunging approach to slotting

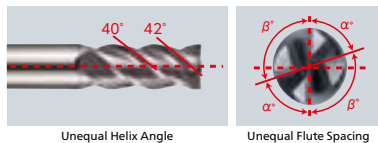


※ Plunge depth is referred to recommended milling conditions



- Unequal flute spacing, unequal helix angle and high rigid end profile design to minimize chatter realize high efficient machining.
- New developed special edge profile realized multi-functional performance of side milling, slot milling and plunging approaches on carbon steels.
- Long time stable machining is realized by adopting MUGEN COATING.
- Total 62 sizes, some sizes line up with L/D=2 or 3.

※ The practical Length of Cut is 0.1mm longer than the specification table.



| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 08-00135-01020 | 1           | 2                       | 12°                                 | 4                    | 50                       |
| 08-00135-01030 |             | 3                       | 12°                                 | 4                    | 50                       |
| 08-00135-01120 | 1.1         | 2.2                     | 12°                                 | 4                    | 50                       |
| 08-00135-01220 | 1.2         | 2.4                     | 12°                                 | 4                    | 50                       |
| 08-00135-01320 | 1.3         | 2.6                     | 12°                                 | 4                    | 50                       |
| 08-00135-01420 | 1.4         | 2.8                     | 12°                                 | 4                    | 50                       |
| 08-00135-01520 | 1.5         | 3                       | 12°                                 | 4                    | 50                       |
| 08-00135-01530 |             | 4.5                     | 12°                                 | 4                    | 50                       |
| 08-00135-01620 | 1.6         | 3.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-01720 | 1.7         | 3.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-01820 | 1.8         | 3.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-01920 | 1.9         | 3.8                     | 12°                                 | 6                    | 50                       |
| 08-00135-02020 | 2           | 4                       | 12°                                 | 6                    | 50                       |
| 08-00135-02030 |             | 6                       | 12°                                 | 6                    | 60                       |
| 08-00135-02120 | 2.1         | 4.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-02220 | 2.2         | 4.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-02320 | 2.3         | 4.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-02420 | 2.4         | 4.8                     | 12°                                 | 6                    | 50                       |
| 08-00135-02520 | 2.5         | 5                       | 12°                                 | 6                    | 50                       |
| 08-00135-02530 |             | 7.5                     | 12°                                 | 6                    | 60                       |
| 08-00135-02620 | 2.6         | 5.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-02720 | 2.7         | 5.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-02820 | 2.8         | 5.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-02920 | 2.9         | 5.8                     | 12°                                 | 6                    | 50                       |
| 08-00135-03020 | 3           | 6                       | 12°                                 | 6                    | 50                       |
| 08-00135-03030 |             | 9                       | 12°                                 | 6                    | 60                       |
| 08-00135-03120 | 3.1         | 6.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-03220 | 3.2         | 6.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-03320 | 3.3         | 6.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-03420 | 3.4         | 6.8                     | 12°                                 | 6                    | 50                       |

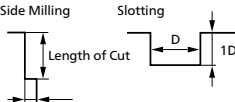
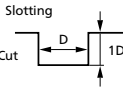
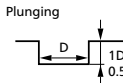
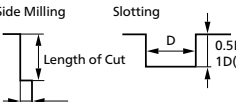
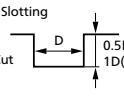
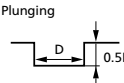
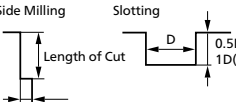
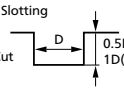
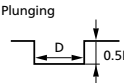
### How to Order

When you order, indicate MSCZ440 (D)×(L).  
※(γ) is reference value.

### Machining case

W-019

| Unit : mm      |             |                         |                                     |                      |                          |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
| 08-00135-03520 | 3.5         | 7                       | 12°                                 | 6                    | 50                       |
| 08-00135-03530 |             | 10.5                    | 12°                                 | 6                    | 60                       |
| 08-00135-03620 | 3.6         | 7.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-03720 | 3.7         | 7.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-03820 | 3.8         | 7.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-03920 | 3.9         | 7.8                     | 12°                                 | 6                    | 50                       |
| 08-00135-04020 | 4           | 8                       | 12°                                 | 6                    | 50                       |
| 08-00135-04030 |             | 12                      | 12°                                 | 6                    | 60                       |
| 08-00135-04120 | 4.1         | 8.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-04220 | 4.2         | 8.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-04320 | 4.3         | 8.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-04420 | 4.4         | 8.8                     | 12°                                 | 6                    | 50                       |
| 08-00135-04520 | 4.5         | 9                       | 12°                                 | 6                    | 50                       |
| 08-00135-04530 |             | 13.5                    | 12°                                 | 6                    | 60                       |
| 08-00135-04620 | 4.6         | 9.2                     | 12°                                 | 6                    | 50                       |
| 08-00135-04720 | 4.7         | 9.4                     | 12°                                 | 6                    | 50                       |
| 08-00135-04820 | 4.8         | 9.6                     | 12°                                 | 6                    | 50                       |
| 08-00135-04920 | 4.9         | 9.8                     | 12°                                 | 6                    | 50                       |
| 08-00135-05020 | 5           | 10                      | 12°                                 | 6                    | 50                       |
| 08-00135-05030 |             | 15                      | 12°                                 | 6                    | 60                       |
| 08-00135-05120 | 5.1         | 10.2                    | 12°                                 | 6                    | 50                       |
| 08-00135-05220 | 5.2         | 10.4                    | 12°                                 | 6                    | 50                       |
| 08-00135-05320 | 5.3         | 10.6                    | 12°                                 | 6                    | 50                       |
| 08-00135-05420 | 5.4         | 10.8                    | 12°                                 | 6                    | 50                       |
| 08-00135-05520 | 5.5         | 11                      | 12°                                 | 6                    | 50                       |
| 08-00135-05530 |             | 16.5                    | 12°                                 | 6                    | 60                       |
| 08-00135-05620 | 5.6         | 11.2                    | 12°                                 | 6                    | 50                       |
| 08-00135-05720 | 5.7         | 11.4                    | 12°                                 | 6                    | 50                       |
| 08-00135-05820 | 5.8         | 11.6                    | 12°                                 | 6                    | 50                       |
| 08-00135-05920 | 5.9         | 11.8                    | 12°                                 | 6                    | 50                       |
| 08-00135-06020 | 6           | 12                      | —                                   | 6                    | 60                       |
| 08-00135-06030 |             | 18                      | —                                   | 6                    | 60                       |

| Work Material                 |                  |     | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |                                                                                                                           |        |                                                                                                                        |        | Alloy Steels<br>SCM・SKD                                                                                                              |        |                                                                                                                     |        |                                                                                                    |        | Prehardened Steels<br>(~40HRC)                                                                                                       |        |                                                                                                                     |        |                                                                                                    |        |
|-------------------------------|------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------|--------|
| Dia.                          | Length<br>of Cut | L/D | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        | Slotting                                                                                                                  |        | Plunging                                                                                                               |        | Side Milling                                                                                                                         |        | Slotting                                                                                                            |        | Plunging                                                                                           |        | Side Milling                                                                                                                         |        | Slotting                                                                                                            |        | Plunging                                                                                           |        |
|                               |                  |     | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Feed   | Spindle<br>Speed                                                                                                          | Feed   | Spindle<br>Speed                                                                                                       | Feed   | Spindle<br>Speed                                                                                                                     | Feed   | Spindle<br>Speed                                                                                                    | Feed   | Spindle<br>Speed                                                                                   | Feed   | Spindle<br>Speed                                                                                                                     | Feed   | Spindle<br>Speed                                                                                                    | Feed   | Spindle<br>Speed                                                                                   | Feed   |
|                               |                  |     | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mm/min | min <sup>-1</sup>                                                                                                         | mm/min | min <sup>-1</sup>                                                                                                      | mm/min | min <sup>-1</sup>                                                                                                                    | mm/min | min <sup>-1</sup>                                                                                                   | mm/min | min <sup>-1</sup>                                                                                  | mm/min | min <sup>-1</sup>                                                                                                                    | mm/min | min <sup>-1</sup>                                                                                                   | mm/min | min <sup>-1</sup>                                                                                  | mm/min |
| 1                             | 2                | 2   | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 800    | 18,000                                                                                                                    | 450    | 18,000                                                                                                                 | 150    | 19,000                                                                                                                               | 700    | 16,000                                                                                                              | 360    | 16,000                                                                                             | 100    | 16,200                                                                                                                               | 500    | 12,800                                                                                                              | 290    | 12,800                                                                                             | 100    |
|                               | 3                | 3   | 17,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 700    | 16,000                                                                                                                    | 350    | 16,000                                                                                                                 | 100    | 16,800                                                                                                                               | 580    | 14,500                                                                                                              | 250    | 14,500                                                                                             | 50     | 14,300                                                                                                                               | 430    | 11,600                                                                                                              | 200    | 11,600                                                                                             | 50     |
| 1.5                           | 3                | 2   | 14,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 900    | 13,500                                                                                                                    | 560    | 13,500                                                                                                                 | 150    | 13,500                                                                                                                               | 800    | 12,500                                                                                                              | 450    | 12,500                                                                                             | 120    | 11,500                                                                                                                               | 600    | 10,100                                                                                                              | 360    | 10,100                                                                                             | 120    |
|                               | 4.5              | 3   | 12,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 770    | 11,500                                                                                                                    | 420    | 11,500                                                                                                                 | 100    | 12,000                                                                                                                               | 650    | 10,300                                                                                                              | 300    | 10,300                                                                                             | 75     | 10,200                                                                                                                               | 500    | 8,300                                                                                                               | 240    | 8,300                                                                                              | 75     |
| 2                             | 4                | 2   | 12,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,100  | 11,000                                                                                                                    | 650    | 11,000                                                                                                                 | 150    | 11,000                                                                                                                               | 1,000  | 9,500                                                                                                               | 520    | 9,500                                                                                              | 150    | 9,400                                                                                                                                | 750    | 7,700                                                                                                               | 420    | 7,700                                                                                              | 150    |
|                               | 6                | 3   | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 900    | 10,000                                                                                                                    | 500    | 10,000                                                                                                                 | 100    | 9,600                                                                                                                                | 750    | 8,400                                                                                                               | 360    | 8,400                                                                                              | 100    | 8,200                                                                                                                                | 580    | 6,800                                                                                                               | 290    | 6,800                                                                                              | 100    |
| 2.5                           | 5                | 2   | 10,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,300  | 9,000                                                                                                                     | 850    | 9,000                                                                                                                  | 200    | 9,000                                                                                                                                | 1,120  | 8,000                                                                                                               | 680    | 8,000                                                                                              | 150    | 7,700                                                                                                                                | 850    | 6,400                                                                                                               | 540    | 6,400                                                                                              | 150    |
|                               | 7.5              | 3   | 9,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,050  | 8,200                                                                                                                     | 600    | 8,200                                                                                                                  | 150    | 7,800                                                                                                                                | 920    | 7,200                                                                                                               | 430    | 7,200                                                                                              | 120    | 6,600                                                                                                                                | 700    | 5,800                                                                                                               | 340    | 5,800                                                                                              | 120    |
| 3                             | 6                | 2   | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,600  | 8,600                                                                                                                     | 1,000  | 8,600                                                                                                                  | 250    | 8,000                                                                                                                                | 1,300  | 7,500                                                                                                               | 720    | 7,500                                                                                              | 200    | 6,800                                                                                                                                | 900    | 6,000                                                                                                               | 580    | 6,000                                                                                              | 200    |
|                               | 9                | 3   | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,300  | 7,800                                                                                                                     | 730    | 7,800                                                                                                                  | 200    | 6,600                                                                                                                                | 1,000  | 6,400                                                                                                               | 530    | 6,400                                                                                              | 150    | 5,600                                                                                                                                | 720    | 5,300                                                                                                               | 420    | 5,300                                                                                              | 150    |
| 3.5                           | 7                | 2   | 9,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,650  | 7,900                                                                                                                     | 1,000  | 7,900                                                                                                                  | 250    | 7,400                                                                                                                                | 1,340  | 6,900                                                                                                               | 800    | 6,900                                                                                              | 200    | 6,300                                                                                                                                | 920    | 5,500                                                                                                               | 640    | 5,500                                                                                              | 200    |
|                               | 10.5             | 3   | 8,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,400  | 6,900                                                                                                                     | 820    | 6,900                                                                                                                  | 200    | 6,000                                                                                                                                | 1,050  | 5,800                                                                                                               | 590    | 5,800                                                                                              | 150    | 5,300                                                                                                                                | 730    | 4,700                                                                                                               | 440    | 4,700                                                                                              | 150    |
| 4                             | 8                | 2   | 8,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,700  | 7,000                                                                                                                     | 1,100  | 7,000                                                                                                                  | 300    | 7,200                                                                                                                                | 1,400  | 6,300                                                                                                               | 850    | 6,300                                                                                              | 200    | 6,100                                                                                                                                | 950    | 5,000                                                                                                               | 700    | 5,000                                                                                              | 200    |
|                               | 12               | 3   | 7,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,400  | 6,100                                                                                                                     | 850    | 6,100                                                                                                                  | 250    | 5,900                                                                                                                                | 1,100  | 5,600                                                                                                               | 610    | 5,600                                                                                              | 150    | 5,100                                                                                                                                | 760    | 4,300                                                                                                               | 470    | 4,300                                                                                              | 150    |
| 4.5                           | 9                | 2   | 7,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,700  | 6,300                                                                                                                     | 1,100  | 6,300                                                                                                                  | 300    | 6,600                                                                                                                                | 1,500  | 5,700                                                                                                               | 880    | 5,700                                                                                              | 200    | 5,600                                                                                                                                | 1,000  | 4,600                                                                                                               | 700    | 4,600                                                                                              | 200    |
|                               | 13.5             | 3   | 7,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,550  | 5,500                                                                                                                     | 900    | 5,500                                                                                                                  | 250    | 5,800                                                                                                                                | 1,150  | 5,000                                                                                                               | 650    | 5,000                                                                                              | 150    | 4,900                                                                                                                                | 780    | 3,900                                                                                                               | 500    | 3,900                                                                                              | 150    |
| 5                             | 10               | 2   | 7,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,900  | 5,700                                                                                                                     | 1,100  | 5,700                                                                                                                  | 300    | 6,300                                                                                                                                | 1,600  | 5,200                                                                                                               | 880    | 5,200                                                                                              | 200    | 5,400                                                                                                                                | 1,100  | 4,200                                                                                                               | 700    | 4,200                                                                                              | 200    |
|                               | 15               | 3   | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,700  | 5,000                                                                                                                     | 900    | 5,000                                                                                                                  | 250    | 5,700                                                                                                                                | 1,250  | 4,600                                                                                                               | 650    | 4,600                                                                                              | 150    | 4,800                                                                                                                                | 800    | 3,600                                                                                                               | 520    | 3,600                                                                                              | 150    |
| 5.5                           | 11               | 2   | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2,000  | 5,300                                                                                                                     | 1,100  | 5,300                                                                                                                  | 300    | 6,100                                                                                                                                | 1,600  | 4,800                                                                                                               | 880    | 4,800                                                                                              | 200    | 5,200                                                                                                                                | 1,100  | 3,900                                                                                                               | 700    | 3,900                                                                                              | 200    |
|                               | 16.5             | 3   | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,800  | 4,600                                                                                                                     | 900    | 4,600                                                                                                                  | 250    | 5,600                                                                                                                                | 1,250  | 4,300                                                                                                               | 650    | 4,300                                                                                              | 150    | 4,700                                                                                                                                | 800    | 3,300                                                                                                               | 520    | 3,300                                                                                              | 150    |
| 6                             | 12               | 2   | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2,000  | 4,900                                                                                                                     | 1,100  | 4,900                                                                                                                  | 300    | 5,700                                                                                                                                | 1,600  | 4,500                                                                                                               | 880    | 4,500                                                                                              | 200    | 4,800                                                                                                                                | 1,100  | 3,600                                                                                                               | 700    | 3,600                                                                                              | 200    |
|                               | 18               | 3   | 5,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,800  | 4,300                                                                                                                     | 900    | 4,300                                                                                                                  | 250    | 5,300                                                                                                                                | 1,250  | 4,000                                                                                                               | 650    | 4,000                                                                                              | 150    | 4,500                                                                                                                                | 800    | 3,100                                                                                                               | 520    | 3,100                                                                                              | 150    |
| Depth of Cut<br><br>(D: Dia.) |                  |     | <br>Length of Cut<br>0.2D(L/D=2)<br>0.1D(L/D=3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        | <br>D<br>1D<br>0.5D(D<3)<br>1D(φD≥3) |        | <br>D<br>1D(L/D=2)<br>0.5D(L/D=3) |        | <br>Length of Cut<br>0.2D(L/D=2)<br>0.1D(L/D=3) |        | <br>D<br>0.5D(D<3)<br>1D(φD≥3) |        | <br>D<br>0.5D |        | <br>Length of Cut<br>0.2D(L/D=2)<br>0.1D(L/D=3) |        | <br>D<br>0.5D(D<3)<br>1D(φD≥3) |        | <br>D<br>0.5D |        |
| Notes                         |                  |     | ※1 Please choose the short end tooth when measure the tool length.<br>※2 Adjust milling condition conforming with machine rigidity and clamping condition.<br>Final milling conditions are subject to machining profile, purpose and machine status.<br>※3 Adjust both Spindle Speed and Feed at the same rate.<br>※4 Please increasing the coolant flow rate and pressure as much as possible, and supply it sufficiently to the machining point and flute.<br>※5 Please change the Depth of Cut or Feed when chips could not remove smoothly during plunging.<br>※6 Please be noted there would be a possible tool chipping or breakage when the chip removal is insufficient.<br>※7 Use a rigid and precise machine and chuck holder.<br>※8 Overhang of end mill should be as short as possible from spindle nose. |        |                                                                                                                           |        |                                                                                                                        |        |                                                                                                                                      |        |                                                                                                                     |        |                                                                                                    |        |                                                                                                                                      |        |                                                                                                                     |        |                                                                                                    |        |

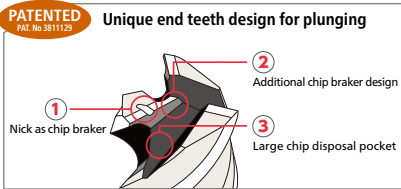
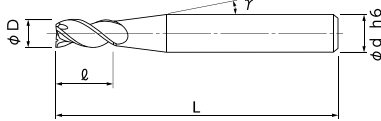


For machining on steels Continuous machining from plunging without guide-hole and stepping to slotting

**PATENTED** PAT. No. 3811129



$D < \phi D$  0  
 $-0.02$   
 $D \geq \phi D$   $-0.015$   
 $-0.035$



- New flute design brought a remarkable shearing ability.
- High efficient machining is realized both for plunge cutting and slotting.

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00133-00100 | 1        | 1.5               | 9°                   | 4              | 45                 |
| 08-00133-00110 | 1.1      | 1.7               | 9°                   | 4              | 45                 |
| 08-00133-00120 | 1.2      | 1.8               | 9°                   | 4              | 45                 |
| 08-00133-00130 | 1.3      | 2                 | 9°                   | 4              | 45                 |
| 08-00133-00140 | 1.4      | 2.1               | 9°                   | 4              | 45                 |
| 08-00133-00150 | 1.5      | 2.3               | 9°                   | 4              | 45                 |
| 08-00133-00160 | 1.6      | 2.4               | 9°                   | 4              | 45                 |
| 08-00133-00170 | 1.7      | 2.6               | 9°                   | 4              | 45                 |
| 08-00133-00180 | 1.8      | 2.7               | 9°                   | 4              | 45                 |
| 08-00133-00190 | 1.9      | 2.9               | 9°                   | 4              | 45                 |
| 08-00133-00200 | 2        | 3                 | 9°                   | 4              | 45                 |
| 08-00133-00210 | 2.1      | 3.2               | 9°                   | 4              | 45                 |
| 08-00133-00220 | 2.2      | 3.3               | 9°                   | 4              | 45                 |
| 08-00133-00230 | 2.3      | 3.5               | 9°                   | 4              | 45                 |
| 08-00133-00240 | 2.4      | 3.6               | 9°                   | 4              | 45                 |
| 08-00133-00250 | 2.5      | 3.8               | 9°                   | 4              | 45                 |
| 08-00133-00260 | 2.6      | 3.9               | 9°                   | 4              | 45                 |
| 08-00133-00270 | 2.7      | 4.1               | 9°                   | 4              | 45                 |
| 08-00133-00280 | 2.8      | 4.2               | 9°                   | 4              | 45                 |
| 08-00133-00290 | 2.9      | 4.5               | 9°                   | 4              | 45                 |
| 08-00133-00300 | 3        | 6                 | 9°                   | 6              | 50                 |
| 08-00133-00310 | 3.1      | 6.2               | 9°                   | 6              | 50                 |
| 08-00133-00320 | 3.2      | 6.4               | 9°                   | 6              | 50                 |
| 08-00133-00330 | 3.3      | 6.6               | 9°                   | 6              | 50                 |
| 08-00133-00340 | 3.4      | 6.8               | 9°                   | 6              | 50                 |
| 08-00133-00350 | 3.5      | 7                 | 9°                   | 6              | 50                 |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00133-00360 | 3.6      | 7.2               | 9°                   | 6              | 50                 |
| 08-00133-00370 | 3.7      | 7.4               | 9°                   | 6              | 50                 |
| 08-00133-00380 | 3.8      | 7.6               | 9°                   | 6              | 50                 |
| 08-00133-00390 | 3.9      | 7.8               | 9°                   | 6              | 50                 |
| 08-00133-00400 | 4        | 8                 | 9°                   | 6              | 50                 |
| 08-00133-00410 | 4.1      | 8.2               | 9°                   | 6              | 50                 |
| 08-00133-00420 | 4.2      | 8.4               | 9°                   | 6              | 50                 |
| 08-00133-00430 | 4.3      | 8.6               | 9°                   | 6              | 50                 |
| 08-00133-00440 | 4.4      | 8.8               | 9°                   | 6              | 50                 |
| 08-00133-00450 | 4.5      | 9                 | 9°                   | 6              | 50                 |
| 08-00133-00460 | 4.6      | 9.2               | 9°                   | 6              | 50                 |
| 08-00133-00470 | 4.7      | 9.4               | 9°                   | 6              | 50                 |
| 08-00133-00480 | 4.8      | 9.6               | 9°                   | 6              | 50                 |
| 08-00133-00490 | 4.9      | 9.8               | 9°                   | 6              | 50                 |
| 08-00133-00500 | 5        | 10                | 9°                   | 6              | 50                 |
| 08-00133-00510 | 5.1      | 10.2              | 9°                   | 6              | 55                 |
| 08-00133-00520 | 5.2      | 10.4              | 9°                   | 6              | 55                 |
| 08-00133-00530 | 5.3      | 10.6              | 9°                   | 6              | 55                 |
| 08-00133-00540 | 5.4      | 10.8              | 9°                   | 6              | 55                 |
| 08-00133-00550 | 5.5      | 11.2              | 9°                   | 6              | 55                 |
| 08-00133-00560 | 5.6      | 11.4              | 9°                   | 6              | 55                 |
| 08-00133-00570 | 5.7      | 11.6              | 9°                   | 6              | 55                 |
| 08-00133-00580 | 5.8      | 12                | 9°                   | 6              | 55                 |
| 08-00133-00590 | 5.9      | 12.4              | 9°                   | 6              | 55                 |
| 08-00133-00600 | 6        | 13                | —                    | 6              | 55                 |

How to Order

When you order, indicate MSZ345 (D).

※(γ) is reference value.

● : Semi-standard item, please inquire for price and delivery.

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00133-00610 | 6.1      | 13                | 9°                   | 8              | 65                 |
| 08-00133-00620 | 6.2      | 13                | 9°                   | 8              | 65                 |
| 08-00133-00630 | 6.3      | 13.5              | 9°                   | 8              | 65                 |
| 08-00133-00640 | 6.4      | 13.5              | 9°                   | 8              | 65                 |
| 08-00133-00650 | 6.5      | 13.5              | 9°                   | 8              | 65                 |
| 08-00133-00660 | 6.6      | 14                | 9°                   | 8              | 65                 |
| 08-00133-00670 | 6.7      | 14                | 9°                   | 8              | 65                 |
| 08-00133-00680 | 6.8      | 15                | 9°                   | 8              | 65                 |
| 08-00133-00690 | 6.9      | 15                | 9°                   | 8              | 65                 |
| 08-00133-00700 | 7        | 16                | 9°                   | 8              | 65                 |
| 08-00133-00710 | 7.1      | 16                | 9°                   | 8              | 65                 |
| 08-00133-00720 | 7.2      | 16                | 9°                   | 8              | 65                 |
| 08-00133-00730 | 7.3      | 16                | 9°                   | 8              | 65                 |
| 08-00133-00740 | 7.4      | 16                | 9°                   | 8              | 65                 |
| 08-00133-00750 | 7.5      | 16                | 9°                   | 8              | 65                 |
| 08-00133-00760 | 7.6      | 17                | 9°                   | 8              | 65                 |
| 08-00133-00770 | 7.7      | 17                | 9°                   | 8              | 65                 |
| 08-00133-00780 | 7.8      | 17                | 9°                   | 8              | 65                 |
| 08-00133-00790 | 7.9      | 17                | 9°                   | 8              | 65                 |
| 08-00133-00800 | 8        | 19                | —                    | 8              | 65                 |
| 08-00133-00810 | 8.1      | 18                | 9°                   | 10             | 75                 |
| 08-00133-00820 | 8.2      | 18                | 9°                   | 10             | 75                 |
| 08-00133-00830 | 8.3      | 18                | 9°                   | 10             | 75                 |
| 08-00133-00840 | 8.4      | 18                | 9°                   | 10             | 75                 |
| 08-00133-00850 | 8.5      | 18                | 9°                   | 10             | 75                 |
| 08-00133-00860 | 8.6      | 19                | 9°                   | 10             | 75                 |
| 08-00133-00870 | 8.7      | 19                | 9°                   | 10             | 75                 |
| 08-00133-00880 | 8.8      | 19                | 9°                   | 10             | 75                 |
| 08-00133-00890 | 8.9      | 19                | 9°                   | 10             | 75                 |
| 08-00133-00900 | 9        | 19                | 9°                   | 10             | 75                 |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 08-00133-00910 | 9.1      | 20                | 9°                   | 10             | 75                 |
| 08-00133-00920 | 9.2      | 20                | 9°                   | 10             | 75                 |
| 08-00133-00930 | 9.3      | 20                | 9°                   | 10             | 75                 |
| 08-00133-00940 | 9.4      | 20                | 9°                   | 10             | 75                 |
| 08-00133-00950 | 9.5      | 20                | 9°                   | 10             | 75                 |
| 08-00133-00960 | 9.6      | 21                | 9°                   | 10             | 75                 |
| 08-00133-00970 | 9.7      | 21                | 9°                   | 10             | 75                 |
| 08-00133-00980 | 9.8      | 21                | 9°                   | 10             | 75                 |
| 08-00133-00990 | 9.9      | 21                | 9°                   | 10             | 75                 |
| 08-00133-01000 | 10       | 22                | —                    | 10             | 75                 |
| 08-00133-01010 | 10.1     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01020 | 10.2     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01030 | 10.3     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01040 | 10.4     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01050 | 10.5     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01060 | 10.6     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01070 | 10.7     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01080 | 10.8     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01090 | 10.9     | 22                | 9°                   | 12             | 80                 |
| 08-00133-01100 | 11       | 22                | 9°                   | 12             | 80                 |
| 08-00133-01110 | 11.1     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01120 | 11.2     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01130 | 11.3     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01140 | 11.4     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01150 | 11.5     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01160 | 11.6     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01170 | 11.7     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01180 | 11.8     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01190 | 11.9     | 25                | 9°                   | 12             | 80                 |
| 08-00133-01200 | 12       | 26                | —                    | 12             | 80                 |



MSZ345

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |          |                 | Alloy Steels<br>SKD・SCM |          |          |                 | Stainless Steels<br>SUS304 |          |          |                 | Prehardened Steels<br>HPM・NAK (～40HRC) |          |          |                 |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------|-------------------------|----------|----------|-----------------|----------------------------|----------|----------|-----------------|----------------------------------------|----------|----------|-----------------|
| Cutting Speed                 | 90m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          |          |                 | 50m/min                 |          |          |                 | 35m/min                    |          |          |                 | 55m/min                                |          |          |                 |
| Dia.                          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Feed     |          |                 | Spindle<br>Speed        | Feed     |          |                 | Spindle<br>Speed           | Feed     |          |                 | Spindle<br>Speed                       | Feed     |          |                 |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Plunging | Slotting | Side<br>Milling |                         | Plunging | Slotting | Side<br>Milling |                            | Plunging | Slotting | Side<br>Milling |                                        | Plunging | Slotting | Side<br>Milling |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | mm/min   |          |                 | min <sup>-1</sup>       | mm/min   |          |                 | min <sup>-1</sup>          | mm/min   |          |                 | min <sup>-1</sup>                      | mm/min   |          |                 |
| 1                             | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 70       | 200      | 400             | 15,000                  | 40       | 100      | 210             | 10,000                     | 20       | 70       | 200             | 15,000                                 | 50       | 100      | 200             |
| 1.5                           | 13,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 70       | 250      | 500             | 13,000                  | 40       | 120      | 270             | 7,000                      | 20       | 70       | 250             | 13,000                                 | 50       | 130      | 250             |
| 2                             | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100      | 300      | 600             | 8,000                   | 50       | 140      | 290             | 5,000                      | 20       | 75       | 250             | 10,000                                 | 70       | 150      | 300             |
| 2.5                           | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100      | 400      | 700             | 7,000                   | 60       | 160      | 330             | 4,000                      | 20       | 75       | 250             | 8,000                                  | 90       | 170      | 350             |
| 3                             | 9,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 200      | 550      | 800             | 5,300                   | 80       | 200      | 400             | 3,600                      | 20       | 100      | 250             | 5,800                                  | 100      | 250      | 400             |
| 4                             | 7,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 210      | 650      | 900             | 4,000                   | 100      | 250      | 400             | 2,800                      | 30       | 100      | 250             | 4,400                                  | 110      | 250      | 400             |
| 5                             | 5,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 260      | 700      | 1,000           | 3,200                   | 100      | 250      | 450             | 2,200                      | 40       | 120      | 300             | 3,500                                  | 120      | 300      | 500             |
| 6                             | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300      | 720      | 1,200           | 2,700                   | 130      | 300      | 450             | 1,800                      | 40       | 120      | 300             | 3,000                                  | 130      | 330      | 600             |
| 7                             | 4,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300      | 740      | 1,100           | 2,300                   | 120      | 300      | 450             | 1,600                      | 40       | 120      | 300             | 2,500                                  | 110      | 330      | 600             |
| 8                             | 3,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300      | 760      | 1,000           | 2,000                   | 100      | 300      | 400             | 1,400                      | 30       | 120      | 300             | 2,200                                  | 100      | 330      | 600             |
| 9                             | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300      | 770      | 900             | 1,800                   | 80       | 250      | 380             | 1,200                      | 20       | 100      | 300             | 1,900                                  | 90       | 250      | 500             |
| 10                            | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300      | 800      | 900             | 1,600                   | 80       | 200      | 350             | 1,100                      | 20       | 100      | 300             | 1,700                                  | 80       | 200      | 400             |
| 11                            | 2,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 300      | 760      | 850             | 1,500                   | 80       | 200      | 350             | 1,000                      | 20       | 100      | 280             | 1,600                                  | 80       | 200      | 400             |
| 12                            | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 280      | 740      | 850             | 1,400                   | 70       | 180      | 340             | 900                        | 20       | 100      | 270             | 1,500                                  | 70       | 180      | 340             |
| Depth of Cut<br><br>(D: Dia.) | <div><div><div>Side Milling</div><div><div><div></div><div>1.5D</div></div><div><div></div><div>0.3D (SUS304=0.2D)</div></div></div></div><div><div>Slotting</div><div><div></div><div>D</div></div><div><div></div><div>a<sub>p</sub></div></div></div><div><div>a<sub>p</sub></div><div>φ 1～2.9=0.5D (SKD・SCM・SUS304=0.25D)</div><div>φ 3～12=1D (SKD・SCM・SUS304=0.5D)</div></div></div>                                                                                                                                                                                                                                                                                                  |          |          |                 |                         |          |          |                 |                            |          |          |                 |                                        |          |          |                 |
| Notes                         | ※1 Adjust Depth of Cut according to machine rigidity.<br>Final milling conditions are subject to machining profile, purpose and machine status.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Air blow is recommended.<br>※4 Water-insoluble fluid is recommended for cutting stainless steels.<br>※5 Adjust milling condition with caution for chip evacuation and smoke generation when milling with water-insoluble fluid.<br>※6 Step machining is recommended for plunging stainless steels.<br>※7 Chip disposal is important.<br>※8 Use a rigid and precise machine and chuck holder.<br>※9 Overhang of end mill should be as short as possible from spindle nose. |          |          |                 |                         |          |          |                 |                            |          |          |                 |                                        |          |          |                 |

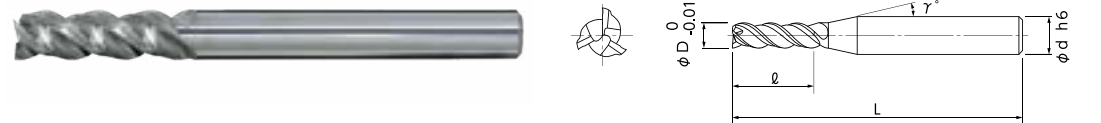
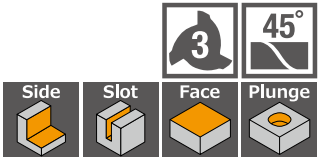




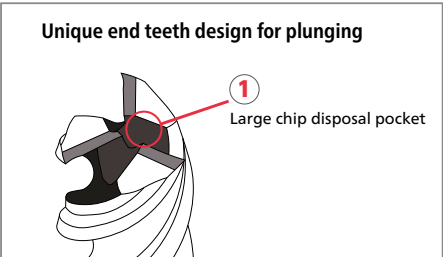
High efficient 3-Flute End Mill for Aluminium L/D=3 ※Listed at “Aluminium Milling” as well (Page L-020)

Recommended Milling Conditions

For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting



- AL-series realized a stable and high efficient machining.
- It exhibits stable excellent surface on a wide area and no chattering occurs even during high speed cutting.
- Realized high efficiency machining by adopting 3 flutes.



Square

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 01-00639-00100 | 1           | 3                    | 12°                              | 4                 | 60                    |
| 01-00639-00200 | 2           | 6                    | 12°                              | 4                 | 60                    |
| 01-00639-00300 | 3           | 9                    | 12°                              | 6                 | 60                    |
| 01-00639-00400 | 4           | 12                   | 12°                              | 6                 | 70                    |
| 01-00639-00500 | 5           | 15                   | 12°                              | 6                 | 80                    |
| 01-00639-00600 | 6           | 18                   | —                                | 6                 | 80                    |
| 01-00639-00800 | 8           | 24                   | —                                | 8                 | 90                    |
| 01-00639-01000 | 10          | 30                   | —                                | 10                | 100                   |
| 01-00639-01200 | 12          | 36                   | —                                | 12                | 110                   |

How to Order

When you order, indicate AL3D-345 (D). ※( $\gamma$ ) is reference value.

Machining case

W-020

| Work Material             | Aluminium A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                   |        |                   |        | Aluminium Alloy A2017・A5052・A7075 |        |                   |        |                   |        | Aluminium Cast AC8C |        |                   |        |                   |        |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|-----------------------------------|--------|-------------------|--------|-------------------|--------|---------------------|--------|-------------------|--------|-------------------|--------|
| Cutting Speed             | 300m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        | 220m/min          |        | 220m/min          |        | 330m/min                          |        | 240m/min          |        | 240m/min          |        | 250m/min            |        | 160m/min          |        | 160m/min          |        |
| Dia.                      | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        | Slotting          |        | Plunging          |        | Side Milling                      |        | Slotting          |        | Plunging          |        | Side Milling        |        | Slotting          |        | Plunging          |        |
|                           | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   | Spindle Speed                     | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   | Spindle Speed       | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   |
|                           | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                              | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                 | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>   | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 1                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,200  | 20,000            | 500    | 20,000            | 100    | 20,000                            | 1,200  | 20,000            | 500    | 20,000            | 100    | 20,000              | 1,200  | 20,000            | 500    | 20,000            | 80     |
| 2                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,800  | 20,000            | 700    | 20,000            | 150    | 20,000                            | 1,800  | 20,000            | 700    | 20,000            | 150    | 20,000              | 1,800  | 20,000            | 700    | 20,000            | 130    |
| 3                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,000  | 20,000            | 1,000  | 20,000            | 150    | 20,000                            | 2,000  | 20,000            | 1,000  | 20,000            | 150    | 20,000              | 2,000  | 17,000            | 850    | 17,000            | 130    |
| 4                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 17,500            | 1,100  | 17,500            | 150    | 20,000                            | 2,200  | 19,000            | 1,100  | 19,000            | 200    | 20,000              | 2,200  | 13,000            | 850    | 13,000            | 100    |
| 5                         | 19,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 14,000            | 1,100  | 14,000            | 150    | 20,000                            | 2,700  | 15,500            | 1,200  | 15,500            | 200    | 16,000              | 2,200  | 10,000            | 850    | 10,000            | 80     |
| 6                         | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 11,500            | 1,100  | 11,500            | 150    | 17,500                            | 3,000  | 12,500            | 1,300  | 12,500            | 200    | 13,500              | 2,200  | 8,500             | 850    | 8,500             | 80     |
| 8                         | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 9,000             | 1,200  | 9,000             | 100    | 13,000                            | 3,000  | 9,500             | 1,400  | 9,500             | 200    | 10,000              | 2,300  | 6,500             | 850    | 6,500             | 60     |
| 10                        | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,200  | 7,000             | 1,300  | 7,000             | 70     | 10,500                            | 3,250  | 7,500             | 1,500  | 7,500             | 150    | 8,000               | 2,500  | 5,000             | 900    | 5,000             | 50     |
| 12                        | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,400  | 6,000             | 1,400  | 6,000             | 70     | 9,000                             | 3,350  | 6,500             | 1,600  | 6,500             | 150    | 6,500               | 2,600  | 4,000             | 1,000  | 4,000             | 50     |
| Depth of Cut<br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                          |        |                   |        |                   |        |                                   |        |                   |        |                   |        |                     |        |                   |        |                   |        |
| Notes                     | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 When tending to have chip packing during plunging, step milling is recommended.<br>※ 5 Water-soluble fluid is recommended. |        |                   |        |                   |        |                                   |        |                   |        |                   |        |                     |        |                   |        |                   |        |



Square





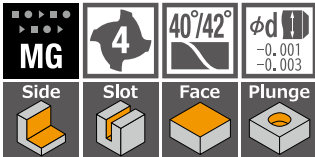
# MSCZ440-LN New

Size  $\phi 1 \sim \phi 6$

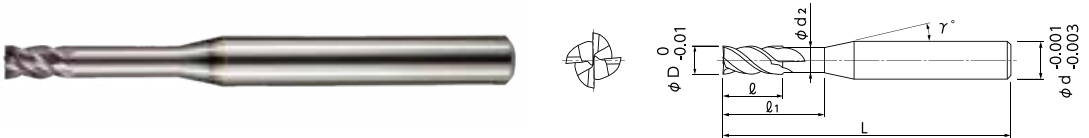


MUGEN COATING 4-Flute Long Neck High Efficient "Z" End Mill for Carbon Steels

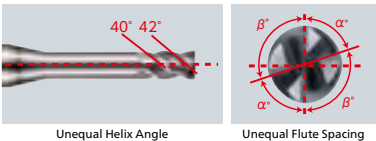
High efficient machining on carbon steels.  
Continuous machining from plunging approach to slotting.  
Long neck type to prevent interference



※ Plunge depth is referred to recommended milling conditions



- Unequal flute spacing, unequal helix angle and high rigid end profile design to minimize chatter realize high efficient machining.
- New developed special edge profile realized multi-functional performance of side milling, slot milling and plunging approaches on carbon steels.
- Long time stable machining is realized by adopting MUGEN COATING.
- Long neck type prevent interference with work material, the Under neck length lined up with L/D=3 to 5.



| Unit : mm      |          |                   |                                     |                             |                      |                |                    |
|----------------|----------|-------------------|-------------------------------------|-----------------------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Length of Cut (ℓ) | Under Neck Length (ℓ <sub>1</sub> ) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 08-00136-01013 | 1        | 1.5               | 3                                   | 0.95                        | 12°                  | 4              | 50                 |
| 08-00136-01014 |          |                   | 4                                   | 0.95                        | 12°                  | 4              | 50                 |
| 08-00136-01015 |          |                   | 5                                   | 0.95                        | 12°                  | 4              | 50                 |
| 08-00136-01513 | 1.5      | 2.3               | 4.5                                 | 1.45                        | 12°                  | 4              | 50                 |
| 08-00136-01514 |          |                   | 6                                   | 1.45                        | 12°                  | 4              | 50                 |
| 08-00136-01515 |          |                   | 7.5                                 | 1.45                        | 12°                  | 4              | 50                 |
| 08-00136-02013 | 2        | 3                 | 6                                   | 1.94                        | 12°                  | 6              | 50                 |
| 08-00136-02014 |          |                   | 8                                   | 1.94                        | 12°                  | 6              | 50                 |
| 08-00136-02015 |          |                   | 10                                  | 1.94                        | 12°                  | 6              | 50                 |
| 08-00136-02513 | 2.5      | 3.8               | 7.5                                 | 2.4                         | 12°                  | 6              | 50                 |
| 08-00136-02514 |          |                   | 10                                  | 2.4                         | 12°                  | 6              | 50                 |
| 08-00136-02515 |          |                   | 12.5                                | 2.4                         | 12°                  | 6              | 60                 |
| 08-00136-03013 | 3        | 4.5               | 9                                   | 2.85                        | 12°                  | 6              | 50                 |
| 08-00136-03014 |          |                   | 12                                  | 2.85                        | 12°                  | 6              | 50                 |
| 08-00136-03015 |          |                   | 15                                  | 2.85                        | 12°                  | 6              | 60                 |
| 08-00136-03513 | 3.5      | 5.3               | 10.5                                | 3.35                        | 12°                  | 6              | 50                 |
| 08-00136-03514 |          |                   | 14                                  | 3.35                        | 12°                  | 6              | 60                 |
| 08-00136-03515 |          |                   | 17.5                                | 3.35                        | 12°                  | 6              | 60                 |
| 08-00136-04013 | 4        | 6                 | 12                                  | 3.8                         | 12°                  | 6              | 50                 |
| 08-00136-04014 |          |                   | 16                                  | 3.8                         | 12°                  | 6              | 60                 |
| 08-00136-04015 |          |                   | 20                                  | 3.8                         | 12°                  | 6              | 60                 |
| 08-00136-04513 | 4.5      | 6.8               | 13.5                                | 4.3                         | 12°                  | 6              | 50                 |
| 08-00136-04514 |          |                   | 18                                  | 4.3                         | 12°                  | 6              | 60                 |
| 08-00136-04515 |          |                   | 22.5                                | 4.3                         | 12°                  | 6              | 60                 |
| 08-00136-05013 | 5        | 7.5               | 15                                  | 4.8                         | 12°                  | 6              | 50                 |
| 08-00136-05014 |          |                   | 20                                  | 4.8                         | 12°                  | 6              | 60                 |
| 08-00136-05015 |          |                   | 25                                  | 4.8                         | 12°                  | 6              | 60                 |
| 08-00136-05513 | 5.5      | 8.3               | 16.5                                | 5.3                         | 12°                  | 6              | 50                 |
| 08-00136-05514 |          |                   | 22                                  | 5.3                         | 12°                  | 6              | 60                 |
| 08-00136-05515 |          |                   | 27.5                                | 5.3                         | 12°                  | 6              | 60                 |
| 08-00136-06013 | 6        | 9                 | 18                                  | 5.8                         | —                    | 6              | 60                 |
| 08-00136-06014 |          |                   | 24                                  | 5.8                         | —                    | 6              | 60                 |
| 08-00136-06015 |          |                   | 30                                  | 5.8                         | —                    | 6              | 70                 |

## How to Order

When you order, indicate MSCZ440-LN (D)×(ℓ)×(ℓ<sub>1</sub>).

※(γ) is reference value.

# MSCZ440-LN

Recommended Milling Conditions

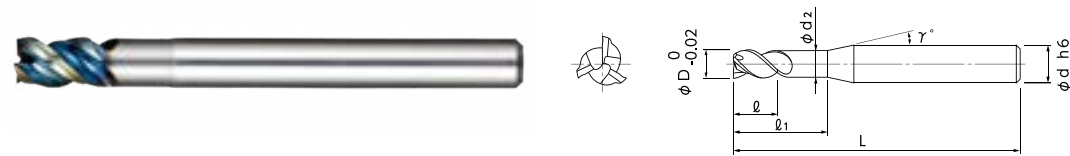
| Work Material              |                   |     | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |                   |        |                   |        | Alloy Steels<br>SCM・SKD                                                                                                |        |                   |        |                   |        | Prehardened Steels<br>(～40HRC)                                                                                         |        |                   |        |                   |        |
|----------------------------|-------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|
| Dia.                       | Under Neck Length | L/D | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        | Slotting          |        | Plunging          |        | Side Milling                                                                                                           |        | Slotting          |        | Plunging          |        | Side Milling                                                                                                           |        | Slotting          |        | Plunging          |        |
|                            |                   |     | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                          | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   | Spindle Speed                                                                                                          | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   |
|                            |                   |     | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                      | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                                                                                                      | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 1                          | 3                 | 3   | 18,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 760    | 17,000            | 400    | 17,000            | 100    | 18,100                                                                                                                 | 650    | 15,300            | 300    | 15,300            | 50     | 15,400                                                                                                                 | 470    | 12,300            | 240    | 12,300            | 50     |
|                            | 4                 | 4   | 16,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 600    | 15,000            | 320    | 15,000            | 70     | 16,200                                                                                                                 | 520    | 13,500            | 220    | 13,500            | 40     | 13,800                                                                                                                 | 400    | 10,800            | 170    | 10,800            | 40     |
|                            | 5                 | 5   | 13,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 400    | 12,000            | 200    | 12,000            | 50     | 12,900                                                                                                                 | 350    | 10,900            | 130    | 10,900            | 30     | 11,000                                                                                                                 | 180    | 8,800             | 100    | 8,800             | 30     |
| 1.5                        | 4.5               | 3   | 14,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 860    | 12,500            | 480    | 12,500            | 120    | 13,000                                                                                                                 | 750    | 11,300            | 360    | 11,300            | 100    | 11,100                                                                                                                 | 560    | 9,100             | 290    | 9,100             | 100    |
|                            | 6                 | 4   | 12,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 660    | 11,000            | 380    | 11,000            | 100    | 11,600                                                                                                                 | 580    | 9,500             | 260    | 9,500             | 70     | 9,900                                                                                                                  | 430    | 7,600             | 210    | 7,600             | 70     |
|                            | 7.5               | 5   | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 450    | 9,000             | 240    | 9,000             | 70     | 9,600                                                                                                                  | 400    | 7,600             | 160    | 7,600             | 50     | 8,200                                                                                                                  | 200    | 6,100             | 130    | 6,100             | 50     |
| 2                          | 6                 | 3   | 11,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,000  | 10,600            | 580    | 10,600            | 150    | 10,400                                                                                                                 | 870    | 8,900             | 440    | 8,900             | 100    | 8,900                                                                                                                  | 680    | 7,200             | 350    | 7,200             | 100    |
|                            | 8                 | 4   | 10,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 810    | 9,400             | 460    | 9,400             | 120    | 9,100                                                                                                                  | 660    | 8,000             | 310    | 8,000             | 70     | 7,700                                                                                                                  | 460    | 6,400             | 250    | 6,400             | 70     |
|                            | 10                | 5   | 8,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 560    | 7,600             | 290    | 7,600             | 100    | 8,000                                                                                                                  | 480    | 6,500             | 190    | 6,500             | 50     | 6,800                                                                                                                  | 230    | 5,200             | 150    | 5,200             | 50     |
| 2.5                        | 7.5               | 3   | 10,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,200  | 8,600             | 770    | 8,600             | 200    | 8,400                                                                                                                  | 1,000  | 7,600             | 580    | 7,600             | 150    | 7,200                                                                                                                  | 780    | 6,100             | 460    | 6,100             | 150    |
|                            | 10                | 4   | 8,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 900    | 7,400             | 530    | 7,400             | 150    | 7,400                                                                                                                  | 780    | 6,600             | 360    | 6,600             | 100    | 6,300                                                                                                                  | 500    | 5,300             | 290    | 5,300             | 100    |
|                            | 12.5              | 5   | 7,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 650    | 6,200             | 370    | 6,200             | 120    | 6,800                                                                                                                  | 560    | 5,400             | 240    | 5,400             | 70     | 5,800                                                                                                                  | 270    | 4,300             | 190    | 4,300             | 70     |
| 3                          | 9                 | 3   | 9,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,500  | 8,300             | 840    | 8,300             | 250    | 7,100                                                                                                                  | 1,150  | 7,200             | 620    | 7,200             | 150    | 6,200                                                                                                                  | 800    | 5,800             | 500    | 5,800             | 150    |
|                            | 12                | 4   | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,150  | 6,900             | 640    | 6,900             | 200    | 6,200                                                                                                                  | 900    | 6,000             | 440    | 6,000             | 120    | 5,300                                                                                                                  | 530    | 4,800             | 350    | 4,800             | 120    |
|                            | 15                | 5   | 6,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 740    | 5,900             | 420    | 5,900             | 150    | 5,800                                                                                                                  | 620    | 5,100             | 270    | 5,100             | 100    | 4,900                                                                                                                  | 300    | 4,100             | 220    | 4,100             | 100    |
| 3.5                        | 10.5              | 3   | 8,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,540  | 7,500             | 920    | 7,500             | 250    | 6,800                                                                                                                  | 1,200  | 6,600             | 690    | 6,600             | 150    | 5,800                                                                                                                  | 840    | 5,200             | 530    | 5,200             | 150    |
|                            | 14                | 4   | 7,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,180  | 6,400             | 720    | 6,400             | 200    | 5,600                                                                                                                  | 950    | 5,400             | 490    | 5,400             | 120    | 4,800                                                                                                                  | 540    | 4,300             | 380    | 4,300             | 120    |
|                            | 17.5              | 5   | 6,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 820    | 5,400             | 460    | 5,400             | 150    | 5,200                                                                                                                  | 650    | 4,700             | 300    | 4,700             | 100    | 4,400                                                                                                                  | 300    | 3,600             | 230    | 3,600             | 100    |
| 4                          | 12                | 3   | 8,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,600  | 6,800             | 1,000  | 6,800             | 250    | 6,600                                                                                                                  | 1,250  | 5,900             | 750    | 5,900             | 150    | 5,600                                                                                                                  | 860    | 4,700             | 600    | 4,700             | 150    |
|                            | 16                | 4   | 6,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,200  | 5,600             | 760    | 5,600             | 200    | 5,500                                                                                                                  | 950    | 5,000             | 520    | 5,000             | 120    | 4,700                                                                                                                  | 560    | 3,900             | 400    | 3,900             | 120    |
|                            | 20                | 5   | 5,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 850    | 4,800             | 500    | 4,800             | 150    | 4,800                                                                                                                  | 700    | 4,200             | 320    | 4,200             | 100    | 4,100                                                                                                                  | 320    | 3,300             | 250    | 3,300             | 100    |
| 4.5                        | 13.5              | 3   | 7,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,640  | 6,100             | 1,000  | 6,100             | 250    | 6,400                                                                                                                  | 1,300  | 5,300             | 750    | 5,300             | 150    | 5,400                                                                                                                  | 900    | 4,300             | 600    | 4,300             | 150    |
|                            | 18                | 4   | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,200  | 5,100             | 800    | 5,100             | 200    | 5,400                                                                                                                  | 950    | 4,500             | 550    | 4,500             | 120    | 4,600                                                                                                                  | 600    | 3,600             | 400    | 3,600             | 120    |
|                            | 22.5              | 5   | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 850    | 4,300             | 520    | 4,300             | 150    | 4,600                                                                                                                  | 700    | 3,800             | 340    | 3,800             | 100    | 3,900                                                                                                                  | 320    | 3,000             | 270    | 3,000             | 100    |
| 5                          | 15                | 3   | 6,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,840  | 5,500             | 1,000  | 5,500             | 250    | 6,100                                                                                                                  | 1,400  | 4,800             | 750    | 4,800             | 150    | 5,200                                                                                                                  | 950    | 3,900             | 600    | 3,900             | 150    |
|                            | 20                | 4   | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,250  | 4,800             | 800    | 4,800             | 200    | 5,200                                                                                                                  | 1,000  | 4,200             | 550    | 4,200             | 120    | 4,400                                                                                                                  | 600    | 3,300             | 400    | 3,300             | 120    |
|                            | 25                | 5   | 4,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 850    | 3,900             | 520    | 3,900             | 150    | 4,400                                                                                                                  | 700    | 3,500             | 340    | 3,500             | 100    | 3,700                                                                                                                  | 340    | 2,800             | 270    | 2,800             | 100    |
| 5.5                        | 16.5              | 3   | 6,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,900  | 5,100             | 1,000  | 5,100             | 250    | 5,900                                                                                                                  | 1,400  | 4,400             | 750    | 4,400             | 150    | 5,000                                                                                                                  | 950    | 3,600             | 600    | 3,600             | 150    |
|                            | 22                | 4   | 5,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,250  | 4,400             | 800    | 4,400             | 200    | 4,900                                                                                                                  | 1,000  | 3,900             | 550    | 3,900             | 120    | 4,200                                                                                                                  | 620    | 3,100             | 400    | 3,100             | 120    |
|                            | 27.5              | 5   | 4,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 850    | 3,700             | 550    | 3,700             | 150    | 4,200                                                                                                                  | 700    | 3,200             | 340    | 3,200             | 100    | 3,600                                                                                                                  | 350    | 2,600             | 270    | 2,600             | 100    |
| 6                          | 18                | 3   | 5,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,900  | 4,700             | 1,000  | 4,700             | 250    | 5,500                                                                                                                  | 1,400  | 4,100             | 750    | 4,100             | 150    | 4,700                                                                                                                  | 950    | 3,400             | 600    | 3,400             | 150    |
|                            | 24                | 4   | 5,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,250  | 4,100             | 800    | 4,100             | 200    | 4,600                                                                                                                  | 1,000  | 3,700             | 550    | 3,700             | 120    | 3,900                                                                                                                  | 620    | 2,900             | 400    | 2,900             | 120    |
|                            | 30                | 5   | 4,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 850    | 3,400             | 550    | 3,400             | 150    | 4,000                                                                                                                  | 700    | 3,000             | 340    | 3,000             | 100    | 3,400                                                                                                                  | 350    | 2,400             | 270    | 2,400             | 100    |
| Depth of Cut<br>(D : Dia.) |                   |     | <div>Side Milling</div> <div></div> <div><div>Slotting</div><div></div><div><div>Plunging</div><div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                   |        |                   |        | <div>Side Milling</div> <div></div> <div><div>Slotting</div><div></div><div><div>Plunging</div><div></div></div></div> |        |                   |        |                   |        | <div>Side Milling</div> <div></div> <div><div>Slotting</div><div></div><div><div>Plunging</div><div></div></div></div> |        |                   |        |                   |        |
| Notes                      |                   |     | ※1 Please choose the short end tooth when measure the tool length.<br>※2 Adjust milling condition conforming with machine rigidity and clamping condition.<br>Final milling conditions are subject to machining profile, purpose and machine status.<br>※3 Adjust both Spindle Speed and Feed at the same rate.<br>※4 Please increasing the coolant flow rate and pressure as much as possible, and supply it sufficiently to the machining point and flute.<br>※5 Please change the Depth of Cut or Feed when chips could not remove smoothly during plunging.<br>※6 Please be noted there would be a possible tool chipping or breakage when the chip removal is insufficient.<br>※7 Use a rigid and precise machine and chuck holder.<br>※8 Overhang of end mill should be as short as possible from spindle nose. |        |                   |        |                   |        |                                                                                                                        |        |                   |        |                   |        |                                                                                                                        |        |                   |        |                   |        |

DLC COATING high efficient 3-Flute End Mill  
for Aluminium L/D=1.5

※Listed at “Aluminium Milling” as well (Page L-028)

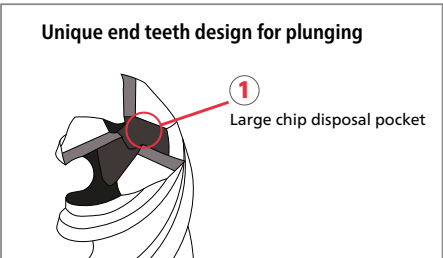
Recommended Milling Conditions

For machining on aluminium alloy.  
Continuous machining from plunging without guide-hole and  
stepping to slotting.DLC coating applied for longer tool life



- Aluminium Alloy **N**
- Copper **N**
- Resin **N**

● Adopted NS TOOL original DLC COATING that suitable for  
long time machining.



| Unit : mm      |             |                             |                                      |                        |                                     |                   |                       |
|----------------|-------------|-----------------------------|--------------------------------------|------------------------|-------------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>( $\ell$ ) | Under Neck<br>Length<br>( $\ell_1$ ) | Neck Dia.<br>( $d_2$ ) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00666-00100 | 1           | 1.5                         | 3                                    | 0.95                   | 12°                                 | 4                 | 45                    |
| 01-00666-00150 | 1.5         | 2.3                         | 4.5                                  | 1.45                   | 12°                                 | 4                 | 45                    |
| 01-00666-00200 | 2           | 3                           | 6                                    | 1.94                   | 12°                                 | 4                 | 45                    |
| 01-00666-00250 | 2.5         | 3.8                         | 7.5                                  | 2.4                    | 12°                                 | 4                 | 45                    |
| 01-00666-00300 | 3           | 4.5                         | 9                                    | 2.85                   | 12°                                 | 6                 | 55                    |
| 01-00666-00350 | 3.5         | 5.3                         | 10.5                                 | 3.35                   | 12°                                 | 6                 | 55                    |
| 01-00666-00400 | 4           | 6                           | 12                                   | 3.8                    | 12°                                 | 6                 | 55                    |
| 01-00666-00450 | 4.5         | 6.8                         | 13.5                                 | 4.3                    | 12°                                 | 6                 | 55                    |
| 01-00666-00500 | 5           | 7.5                         | 15                                   | 4.8                    | 12°                                 | 6                 | 55                    |
| 01-00666-00550 | 5.5         | 8.3                         | 16.5                                 | 5.3                    | 12°                                 | 6                 | 55                    |
| 01-00666-00600 | 6           | 9                           | 18                                   | 5.8                    | —                                   | 6                 | 60                    |
| 01-00666-00700 | 7           | 10.5                        | 21                                   | 6.8                    | 12°                                 | 8                 | 70                    |
| 01-00666-00800 | 8           | 12                          | 24                                   | 7.8                    | —                                   | 8                 | 70                    |
| 01-00666-00900 | 9           | 13.5                        | 27                                   | 8.8                    | 12°                                 | 10                | 75                    |
| 01-00666-01000 | 10          | 15                          | 30                                   | 9.8                    | —                                   | 10                | 75                    |
| 01-00666-01100 | 11          | 16.5                        | 33                                   | 10.8                   | 12°                                 | 12                | 80                    |
| 01-00666-01200 | 12          | 18                          | 36                                   | 11.8                   | —                                   | 12                | 80                    |

How to Order

When you order, indicate ALZ345-DLC (D).

※( $\gamma$ ) is reference value.

| Work Material                 | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |          |                 | Aluminium Alloy<br>A2017・A5052・A7075 |          |          |                 | Aluminium Cast<br>AC8C |          |          |                 |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------|--------------------------------------|----------|----------|-----------------|------------------------|----------|----------|-----------------|
| Cutting Speed                 | 310m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |          |                 | 350m/min                             |          |          |                 | 230m/min               |          |          |                 |
| Dia.                          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Feed     |          |                 | Spindle<br>Speed                     | Feed     |          |                 | Spindle<br>Speed       | Feed     |          |                 |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Plunging | Slotting | Side<br>Milling |                                      | Plunging | Slotting | Side<br>Milling |                        | Plunging | Slotting | Side<br>Milling |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                            | mm/min   |          |                 | min <sup>-1</sup>                    | mm/min   |          |                 | min <sup>-1</sup>      | mm/min   |          |                 |
| 1                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 600      | 1,100           | 20,000                               | 200      | 600      | 1,100           | 20,000                 | 150      | 600      | 1,100           |
| 2                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 900      | 1,500           | 20,000                               | 300      | 900      | 1,500           | 20,000                 | 250      | 900      | 1,500           |
| 3                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,200    | 2,000           | 20,000                               | 300      | 1,400    | 2,200           | 20,000                 | 250      | 1,200    | 2,200           |
| 4                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,400    | 2,200           | 20,000                               | 400      | 1,800    | 2,500           | 18,300                 | 200      | 1,400    | 2,300           |
| 5                             | 19,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,500    | 2,500           | 20,000                               | 400      | 2,200    | 3,100           | 14,600                 | 150      | 1,400    | 2,100           |
| 6                             | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,600    | 2,500           | 18,600                               | 400      | 2,500    | 3,500           | 12,200                 | 150      | 1,400    | 2,100           |
| 7                             | 14,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,600    | 2,500           | 15,900                               | 400      | 2,500    | 3,500           | 10,500                 | 140      | 1,400    | 2,100           |
| 8                             | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,700    | 2,500           | 13,900                               | 400      | 2,600    | 3,500           | 9,200                  | 120      | 1,400    | 2,200           |
| 9                             | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,700    | 2,500           | 12,400                               | 300      | 2,600    | 3,500           | 8,100                  | 120      | 1,400    | 2,200           |
| 10                            | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,700    | 2,500           | 11,100                               | 300      | 2,600    | 3,800           | 7,300                  | 80       | 1,400    | 2,200           |
| 11                            | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,800    | 2,600           | 10,100                               | 300      | 2,600    | 4,100           | 6,700                  | 80       | 1,400    | 2,200           |
| 12                            | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,900    | 2,700           | 9,300                                | 300      | 2,600    | 4,100           | 6,100                  | 60       | 1,500    | 2,200           |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div>Slotting</div>                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |          |                 |                                      |          |          |                 |                        |          |          |                 |
| Notes                         | ※1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※2 Use a rigid and precise machine and chuck holder.<br>※3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder<br>and work clamping.<br>※4 When tending to have chip packing during plunging, step milling is recommended.<br>※5 Water-soluble fluid is recommended. |          |          |                 |                                      |          |          |                 |                        |          |          |                 |

- Aluminium Alloy **N**
- Copper **N**
- Resin **N**



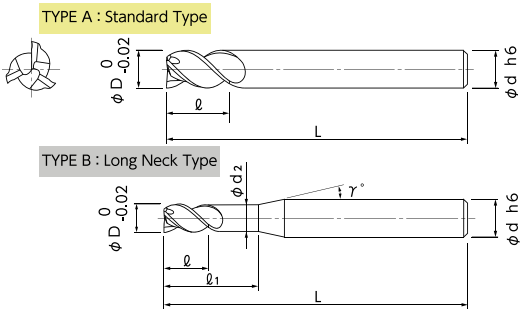
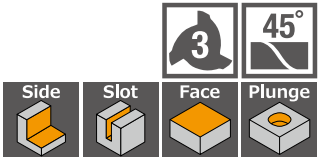




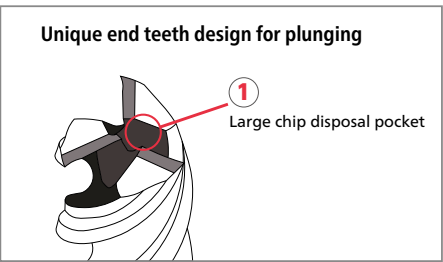
High efficient 3-Flute End Mill for Aluminium L/D=1.5 ※Listed at “Aluminium Milling” as well (Page L-024)

High efficient 3-Flute End Mill for Aluminium L/D=1.5

For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting



- AL-series realized a stable and high efficient machining.
- Improved plunging capacity!
- High performance with better chip disposal.
- Add new 5D Under neck length type and long shank type to become 124 sizes.



Aluminium Alloy **N**

Copper **N**

Resin **N**

Square

Long Neck

| Code No.       | Dia. (D) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Type | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------------------------|-------------------|------|-----------------------------|----------------------|----------------|--------------------|
| 01-00636-00100 | 1        | 3                                   | 1.5               | B    | 0.95                        | 12°                  | 4              | 45                 |
| 01-00636-00102 | 1        | 5                                   | 1.5               |      | 0.95                        | 12°                  | 4              | 60                 |
| 01-00636-00110 | 1.1      | 3.3                                 | 1.7               |      | 1.05                        | 12°                  | 4              | 45                 |
| 01-00636-00120 | 1.2      | 3.6                                 | 1.8               |      | 1.15                        | 12°                  | 4              | 45                 |
| 01-00636-00130 | 1.3      | 3.9                                 | 2                 |      | 1.25                        | 12°                  | 4              | 45                 |
| 01-00636-00140 | 1.4      | 4.2                                 | 2.1               |      | 1.35                        | 12°                  | 4              | 45                 |
| 01-00636-00150 | 1.5      | 4.5                                 | 2.3               |      | 1.45                        | 12°                  | 4              | 45                 |
| 01-00636-00160 | 1.6      | 4.8                                 | 2.4               |      | 1.55                        | 12°                  | 4              | 45                 |
| 01-00636-00170 | 1.7      | 5.1                                 | 2.6               |      | 1.65                        | 12°                  | 4              | 45                 |
| 01-00636-00180 | 1.8      | 5.4                                 | 2.7               |      | 1.74                        | 12°                  | 4              | 45                 |
| 01-00636-00190 | 1.9      | 5.7                                 | 2.9               |      | 1.84                        | 12°                  | 4              | 45                 |
| 01-00636-00200 | 2        | 6                                   | 3                 |      | 1.94                        | 12°                  | 4              | 45                 |
| 01-00636-00202 | 2        | 10                                  | 3                 |      | 1.94                        | 12°                  | 4              | 60                 |
| 01-00636-00210 | 2.1      | 6.3                                 | 3.2               |      | 2                           | 12°                  | 4              | 45                 |
| 01-00636-00220 | 2.2      | 6.6                                 | 3.3               |      | 2.1                         | 12°                  | 4              | 45                 |
| 01-00636-00230 | 2.3      | 6.9                                 | 3.5               |      | 2.2                         | 12°                  | 4              | 45                 |
| 01-00636-00240 | 2.4      | 7.2                                 | 3.6               |      | 2.3                         | 12°                  | 4              | 45                 |
| 01-00636-00250 | 2.5      | 7.5                                 | 3.8               |      | 2.4                         | 12°                  | 4              | 45                 |
| 01-00636-00260 | 2.6      | 7.8                                 | 3.9               |      | 2.45                        | 12°                  | 6              | 55                 |
| 01-00636-00270 | 2.7      | 8.1                                 | 4.1               |      | 2.55                        | 12°                  | 6              | 55                 |
| 01-00636-00280 | 2.8      | 8.4                                 | 4.2               |      | 2.65                        | 12°                  | 6              | 55                 |
| 01-00636-00290 | 2.9      | 8.7                                 | 4.4               |      | 2.75                        | 12°                  | 6              | 55                 |
| 01-00636-00300 | 3        | 9                                   | 4.5               |      | 2.85                        | 12°                  | 6              | 55                 |
| 01-00636-00302 | 3        | 15                                  | 4.5               |      | 2.85                        | 12°                  | 6              | 60                 |
| 01-00636-00310 | 3.1      | 9.3                                 | 4.7               |      | 2.95                        | 12°                  | 6              | 55                 |
| 01-00636-00320 | 3.2      | 9.6                                 | 4.8               |      | 3.05                        | 12°                  | 6              | 55                 |

How to Order

When you order, indicate ALZ345 (D) [x(ℓ<sub>1</sub>)]. Indicate (L) for Type A. ※(γ) is reference value.

● I : Semi-standard item, please inquire for price and delivery.

| Code No.         | Dia. (D) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Type | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|-------------------------------------|-------------------|------|-----------------------------|----------------------|----------------|--------------------|
| I 01-00636-00330 | 3.3      | 9.9                                 | 5                 | B    | 3.15                        | 12°                  | 6              | 55                 |
| I 01-00636-00340 | 3.4      | 10.2                                | 5.1               |      | 3.25                        | 12°                  | 6              | 55                 |
| 01-00636-00350   | 3.5      | 10.5                                | 5.3               |      | 3.35                        | 12°                  | 6              | 55                 |
| I 01-00636-00360 | 3.6      | 10.8                                | 5.4               |      | 3.45                        | 12°                  | 6              | 55                 |
| I 01-00636-00370 | 3.7      | 11.1                                | 5.6               |      | 3.55                        | 12°                  | 6              | 55                 |
| I 01-00636-00380 | 3.8      | 11.4                                | 5.7               |      | 3.65                        | 12°                  | 6              | 55                 |
| I 01-00636-00390 | 3.9      | 11.7                                | 5.9               |      | 3.75                        | 12°                  | 6              | 55                 |
| 01-00636-00400   | 4        | 12                                  | 6                 |      | 3.8                         | 12°                  | 6              | 55                 |
| 01-00636-00402   | 4        | 20                                  | 6                 |      | 3.8                         | 12°                  | 6              | 70                 |
| I 01-00636-00410 | 4.1      | 12.3                                | 6.2               |      | 3.9                         | 12°                  | 6              | 55                 |
| I 01-00636-00420 | 4.2      | 12.6                                | 6.3               |      | 4                           | 12°                  | 6              | 55                 |
| I 01-00636-00430 | 4.3      | 12.9                                | 6.5               |      | 4.1                         | 12°                  | 6              | 55                 |
| I 01-00636-00440 | 4.4      | 13.2                                | 6.6               |      | 4.2                         | 12°                  | 6              | 55                 |
| 01-00636-00450   | 4.5      | 13.5                                | 6.8               |      | 4.3                         | 12°                  | 6              | 55                 |
| I 01-00636-00460 | 4.6      | 13.8                                | 6.9               |      | 4.4                         | 12°                  | 6              | 55                 |
| I 01-00636-00470 | 4.7      | 14.1                                | 7.1               |      | 4.5                         | 12°                  | 6              | 55                 |
| I 01-00636-00480 | 4.8      | 14.4                                | 7.2               |      | 4.6                         | 12°                  | 6              | 55                 |
| I 01-00636-00490 | 4.9      | 14.7                                | 7.4               |      | 4.7                         | 12°                  | 6              | 55                 |
| 01-00636-00500   | 5        | 15                                  | 7.5               |      | 4.8                         | 12°                  | 6              | 55                 |
| 01-00636-00502   | 5        | 25                                  | 7.5               |      | 4.8                         | 12°                  | 6              | 80                 |
| I 01-00636-00510 | 5.1      | 15.3                                | 7.7               |      | 4.9                         | 12°                  | 6              | 55                 |
| I 01-00636-00520 | 5.2      | 15.6                                | 7.8               |      | 5                           | 12°                  | 6              | 55                 |
| I 01-00636-00530 | 5.3      | 15.9                                | 8                 |      | 5.1                         | 12°                  | 6              | 55                 |
| I 01-00636-00540 | 5.4      | 16.2                                | 8.1               |      | 5.2                         | 12°                  | 6              | 55                 |
| 01-00636-00550   | 5.5      | 16.5                                | 8.3               |      | 5.3                         | 12°                  | 6              | 55                 |
| I 01-00636-00560 | 5.6      | 16.8                                | 8.4               |      | 5.4                         | 12°                  | 6              | 55                 |
| I 01-00636-00570 | 5.7      | 17.1                                | 8.6               |      | 5.5                         | 12°                  | 6              | 55                 |
| I 01-00636-00580 | 5.8      | 17.4                                | 8.7               |      | 5.6                         | 12°                  | 6              | 55                 |
| I 01-00636-00590 | 5.9      | 17.7                                | 8.9               |      | 5.7                         | 12°                  | 6              | 55                 |
| 01-00636-00603   | 6        | —                                   | 9                 | A    | —                           | —                    | 6              | 110                |
| 01-00636-00600   | 6        | 18                                  | 9                 | B    | 5.8                         | —                    | 6              | 60                 |
| 01-00636-00602   | 6        | 30                                  | 9                 |      | 5.8                         | —                    | 6              | 80                 |
| I 01-00636-00610 | 6.1      | 18.3                                | 9.2               |      | 5.9                         | 12°                  | 8              | 70                 |
| I 01-00636-00620 | 6.2      | 18.6                                | 9.3               |      | 6                           | 12°                  | 8              | 70                 |
| I 01-00636-00630 | 6.3      | 18.9                                | 9.5               |      | 6.1                         | 12°                  | 8              | 70                 |
| I 01-00636-00640 | 6.4      | 19.2                                | 9.6               |      | 6.2                         | 12°                  | 8              | 70                 |
| I 01-00636-00650 | 6.5      | 19.5                                | 9.8               |      | 6.3                         | 12°                  | 8              | 70                 |
| I 01-00636-00660 | 6.6      | 19.8                                | 9.9               |      | 6.4                         | 12°                  | 8              | 70                 |
| I 01-00636-00670 | 6.7      | 20.1                                | 10.1              |      | 6.5                         | 12°                  | 8              | 70                 |
| I 01-00636-00680 | 6.8      | 20.4                                | 10.2              |      | 6.6                         | 12°                  | 8              | 70                 |
| I 01-00636-00690 | 6.9      | 20.7                                | 10.4              |      | 6.7                         | 12°                  | 8              | 70                 |
| 01-00636-00700   | 7        | 21                                  | 10.5              |      | 6.8                         | 12°                  | 8              | 70                 |
| I 01-00636-00710 | 7.1      | 21.3                                | 10.7              |      | 6.9                         | 12°                  | 8              | 70                 |
| I 01-00636-00720 | 7.2      | 21.6                                | 10.8              |      | 7                           | 12°                  | 8              | 70                 |
| I 01-00636-00730 | 7.3      | 21.9                                | 11                |      | 7.1                         | 12°                  | 8              | 70                 |
| I 01-00636-00740 | 7.4      | 22.2                                | 11.1              |      | 7.2                         | 12°                  | 8              | 70                 |
| I 01-00636-00750 | 7.5      | 22.5                                | 11.3              |      | 7.3                         | 12°                  | 8              | 70                 |
| I 01-00636-00760 | 7.6      | 22.8                                | 11.4              |      | 7.4                         | 12°                  | 8              | 70                 |
| I 01-00636-00770 | 7.7      | 23.1                                | 11.6              |      | 7.5                         | 12°                  | 8              | 70                 |
| I 01-00636-00780 | 7.8      | 23.4                                | 11.7              |      | 7.6                         | 12°                  | 8              | 70                 |

Aluminium Alloy **N**

Copper **N**

Resin **N**

Square

Long Neck

Unit : mm

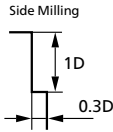
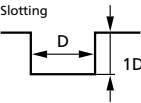
| Code No.       | Dia.<br>(D) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length of<br>Cut<br>(ℓ) | Type | Neck Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------------------------|-------------------------|------|--------------------------------|----------------------------|-------------------|--------------------------|
| 01-00636-00790 | 7.9         | 23.7                                      | 11.9                    | B    | 7.7                            | 12°                        | 8                 | 70                       |
| 01-00636-00803 | 8           | —                                         | 12                      | A    | —                              | —                          | 8                 | 120                      |
| 01-00636-00800 | 8           | 24                                        | 12                      | B    | 7.8                            | —                          | 8                 | 70                       |
| 01-00636-00802 | 8           | 40                                        | 12                      |      | 7.8                            | —                          | 8                 | 90                       |
| 01-00636-00810 | 8.1         | 24.3                                      | 12.2                    |      | 7.9                            | 12°                        | 10                | 75                       |
| 01-00636-00820 | 8.2         | 24.6                                      | 12.3                    |      | 8                              | 12°                        | 10                | 75                       |
| 01-00636-00830 | 8.3         | 24.9                                      | 12.5                    |      | 8.1                            | 12°                        | 10                | 75                       |
| 01-00636-00840 | 8.4         | 25.2                                      | 12.6                    |      | 8.2                            | 12°                        | 10                | 75                       |
| 01-00636-00850 | 8.5         | 25.5                                      | 12.8                    |      | 8.3                            | 12°                        | 10                | 75                       |
| 01-00636-00860 | 8.6         | 25.8                                      | 12.9                    |      | 8.4                            | 12°                        | 10                | 75                       |
| 01-00636-00870 | 8.7         | 26.1                                      | 13.1                    |      | 8.5                            | 12°                        | 10                | 75                       |
| 01-00636-00880 | 8.8         | 26.4                                      | 13.2                    |      | 8.6                            | 12°                        | 10                | 75                       |
| 01-00636-00890 | 8.9         | 26.7                                      | 13.4                    |      | 8.7                            | 12°                        | 10                | 75                       |
| 01-00636-00900 | 9           | 27                                        | 13.5                    |      | 8.8                            | 12°                        | 10                | 75                       |
| 01-00636-00910 | 9.1         | 27.3                                      | 13.7                    |      | 8.9                            | 12°                        | 10                | 75                       |
| 01-00636-00920 | 9.2         | 27.6                                      | 13.8                    |      | 9                              | 12°                        | 10                | 75                       |
| 01-00636-00930 | 9.3         | 27.9                                      | 14                      |      | 9.1                            | 12°                        | 10                | 75                       |
| 01-00636-00940 | 9.4         | 28.2                                      | 14.1                    |      | 9.2                            | 12°                        | 10                | 75                       |
| 01-00636-00950 | 9.5         | 28.5                                      | 14.3                    |      | 9.3                            | 12°                        | 10                | 75                       |
| 01-00636-00960 | 9.6         | 28.8                                      | 14.4                    |      | 9.4                            | 12°                        | 10                | 75                       |
| 01-00636-00970 | 9.7         | 29.1                                      | 14.6                    |      | 9.5                            | 12°                        | 10                | 75                       |
| 01-00636-00980 | 9.8         | 29.4                                      | 14.7                    |      | 9.6                            | 12°                        | 10                | 75                       |
| 01-00636-00990 | 9.9         | 29.7                                      | 14.9                    |      | 9.7                            | 12°                        | 10                | 75                       |
| 01-00636-01003 | 10          | —                                         | 15                      | A    | —                              | —                          | 10                | 130                      |
| 01-00636-01000 | 10          | 30                                        | 15                      | B    | 9.8                            | —                          | 10                | 75                       |
| 01-00636-01002 | 10          | 50                                        | 15                      |      | 9.8                            | —                          | 10                | 100                      |
| 01-00636-01010 | 10.1        | 30.3                                      | 15.2                    |      | 9.9                            | 12°                        | 12                | 80                       |
| 01-00636-01020 | 10.2        | 30.6                                      | 15.3                    |      | 10                             | 12°                        | 12                | 80                       |
| 01-00636-01030 | 10.3        | 30.9                                      | 15.5                    |      | 10.1                           | 12°                        | 12                | 80                       |
| 01-00636-01040 | 10.4        | 31.2                                      | 15.6                    |      | 10.2                           | 12°                        | 12                | 80                       |
| 01-00636-01050 | 10.5        | 31.5                                      | 15.8                    |      | 10.3                           | 12°                        | 12                | 80                       |
| 01-00636-01060 | 10.6        | 31.8                                      | 15.9                    |      | 10.4                           | 12°                        | 12                | 80                       |
| 01-00636-01070 | 10.7        | 32.1                                      | 16.1                    |      | 10.5                           | 12°                        | 12                | 80                       |
| 01-00636-01080 | 10.8        | 32.4                                      | 16.2                    |      | 10.6                           | 12°                        | 12                | 80                       |
| 01-00636-01090 | 10.9        | 32.7                                      | 16.4                    |      | 10.7                           | 12°                        | 12                | 80                       |
| 01-00636-01100 | 11          | 33                                        | 16.5                    |      | 10.8                           | 12°                        | 12                | 80                       |
| 01-00636-01110 | 11.1        | 33.3                                      | 16.7                    |      | 10.9                           | 12°                        | 12                | 80                       |
| 01-00636-01120 | 11.2        | 33.6                                      | 16.8                    |      | 11                             | 12°                        | 12                | 80                       |
| 01-00636-01130 | 11.3        | 33.9                                      | 17                      |      | 11.1                           | 12°                        | 12                | 80                       |
| 01-00636-01140 | 11.4        | 34.2                                      | 17.1                    |      | 11.2                           | 12°                        | 12                | 80                       |
| 01-00636-01150 | 11.5        | 34.5                                      | 17.3                    |      | 11.3                           | 12°                        | 12                | 80                       |
| 01-00636-01160 | 11.6        | 34.8                                      | 17.4                    |      | 11.4                           | 12°                        | 12                | 80                       |
| 01-00636-01170 | 11.7        | 35.1                                      | 17.6                    |      | 11.5                           | 12°                        | 12                | 80                       |
| 01-00636-01180 | 11.8        | 35.4                                      | 17.7                    |      | 11.6                           | 12°                        | 12                | 80                       |
| 01-00636-01190 | 11.9        | 35.7                                      | 17.9                    |      | 11.7                           | 12°                        | 12                | 80                       |
| 01-00636-01203 | 12          | —                                         | 18                      | A    | —                              | —                          | 12                | 150                      |
| 01-00636-01200 | 12          | 36                                        | 18                      | B    | 11.8                           | —                          | 12                | 80                       |
| 01-00636-01202 | 12          | 60                                        | 18                      |      | 11.8                           | —                          | 12                | 110                      |

How to Order

When you order, indicate ALZ345 (D) [x(ℓ<sub>1</sub>)]. Indicate (L) for TypeA.

※(γ) is reference value.

● I :Semi-standard item, please inquire for price and delivery.

| Work Material                 |                         | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |          |                 | Aluminium Alloy<br>A2017・A5052・A7075 |          |          |                 | Aluminium Cast<br>AC8C |          |          |                 |
|-------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------|--------------------------------------|----------|----------|-----------------|------------------------|----------|----------|-----------------|
| Cutting Speed                 |                         | 310m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |          |                 | 350m/min                             |          |          |                 | 230m/min               |          |          |                 |
| Dia.                          | Under<br>neck<br>Length | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Feed     |          |                 | Spindle<br>Speed                     | Feed     |          |                 | Spindle<br>Speed       | Feed     |          |                 |
|                               |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Plunging | Slotting | Side<br>Milling |                                      | Plunging | Slotting | Side<br>Milling |                        | Plunging | Slotting | Side<br>Milling |
|                               |                         | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | mm/min   |          |                 | min <sup>-1</sup>                    | mm/min   |          |                 | min <sup>-1</sup>      | mm/min   |          |                 |
| 1                             | 3                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200      | 600      | 1,100           | 20,000                               | 200      | 600      | 1,100           | 20,000                 | 150      | 600      | 1,100           |
|                               | 5                       | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 160      | 500      | 900             | 16,000                               | 160      | 500      | 900             | 16,000                 | 120      | 500      | 900             |
| 2                             | 6                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 300      | 900      | 1,500           | 20,000                               | 300      | 900      | 1,500           | 20,000                 | 250      | 900      | 1,500           |
|                               | 10                      | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 240      | 800      | 1,200           | 16,000                               | 240      | 800      | 1,200           | 16,000                 | 200      | 800      | 1,200           |
| 3                             | 9                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 300      | 1,200    | 2,000           | 20,000                               | 300      | 1,400    | 2,200           | 20,000                 | 250      | 1,200    | 2,200           |
|                               | 15                      | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 240      | 1,000    | 1,600           | 16,000                               | 240      | 1,200    | 1,800           | 16,000                 | 200      | 1,000    | 1,800           |
| 4                             | 12                      | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 300      | 1,400    | 2,200           | 20,000                               | 400      | 1,800    | 2,500           | 18,300                 | 200      | 1,400    | 2,300           |
|                               | 20                      | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 240      | 1,200    | 1,800           | 16,000                               | 320      | 1,500    | 2,000           | 14,600                 | 160      | 1,200    | 1,900           |
| 5                             | 15                      | 19,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 300      | 1,500    | 2,500           | 20,000                               | 400      | 2,200    | 3,100           | 14,600                 | 150      | 1,400    | 2,100           |
|                               | 25                      | 15,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 240      | 1,200    | 2,000           | 16,000                               | 320      | 1,800    | 2,500           | 11,700                 | 120      | 1,200    | 1,700           |
| 6                             | —                       | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 300      | 1,600    | 2,500           | 18,600                               | 400      | 2,500    | 3,500           | 12,200                 | 150      | 1,400    | 2,100           |
|                               | 18                      | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 300      | 1,600    | 2,500           | 18,600                               | 400      | 2,500    | 3,500           | 12,200                 | 150      | 1,400    | 2,100           |
|                               | 30                      | 13,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 240      | 1,300    | 2,000           | 14,800                               | 320      | 2,000    | 2,800           | 9,700                  | 120      | 1,200    | 1,700           |
| 7                             | 21                      | 14,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200      | 1,600    | 2,500           | 15,900                               | 400      | 2,500    | 3,500           | 10,500                 | 140      | 1,400    | 2,100           |
| 8                             | —                       | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200      | 1,700    | 2,500           | 13,900                               | 400      | 2,600    | 3,500           | 9,200                  | 120      | 1,400    | 2,200           |
|                               | 24                      | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200      | 1,700    | 2,500           | 13,900                               | 400      | 2,600    | 3,500           | 9,200                  | 120      | 1,400    | 2,200           |
|                               | 40                      | 9,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 160      | 1,400    | 2,000           | 11,100                               | 320      | 2,100    | 2,800           | 7,300                  | 100      | 1,200    | 1,800           |
| 9                             | 27                      | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200      | 1,700    | 2,500           | 12,400                               | 300      | 2,600    | 3,500           | 8,100                  | 120      | 1,400    | 2,200           |
| 10                            | —                       | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100      | 1,700    | 2,500           | 11,100                               | 300      | 2,600    | 3,800           | 7,300                  | 80       | 1,400    | 2,200           |
|                               | 30                      | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100      | 1,700    | 2,500           | 11,100                               | 300      | 2,600    | 3,800           | 7,300                  | 80       | 1,400    | 2,200           |
|                               | 50                      | 7,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 80       | 1,400    | 2,000           | 8,800                                | 240      | 2,100    | 3,000           | 5,800                  | 70       | 1,200    | 1,800           |
| 11                            | 33                      | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100      | 1,800    | 2,600           | 10,100                               | 300      | 2,600    | 4,100           | 6,700                  | 80       | 1,400    | 2,200           |
| 12                            | —                       | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100      | 1,900    | 2,700           | 9,300                                | 300      | 2,600    | 4,100           | 6,100                  | 60       | 1,500    | 2,200           |
|                               | 36                      | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100      | 1,900    | 2,700           | 9,300                                | 300      | 2,600    | 4,100           | 6,100                  | 60       | 1,500    | 2,200           |
|                               | 60                      | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 80       | 1,500    | 2,200           | 7,400                                | 240      | 2,100    | 3,200           | 4,800                  | 50       | 1,200    | 1,800           |
| Depth of Cut<br><br>(D: Dia.) |                         | <div><div><div>Side Milling</div></div><div><div>Slotting</div></div></div>                                                                                                                                                                                                                                                                                                                                                                                              |          |          |                 |                                      |          |          |                 |                        |          |          |                 |
| Notes                         |                         | ※1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※2 TYPE A : Recommended milling conditions for full length of cut type are at overhang 3D. Adjust spindle speed and feed rate at 80% for overhang 5D, and 50% for 7D.<br>※3 Use a rigid and precise machine and chuck holder.<br>※4 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※5 When tending to have chip packing during plunging, step milling is recommended.<br>※6 Water-soluble fluid is recommended. |          |          |                 |                                      |          |          |                 |                        |          |          |                 |

N Aluminium Alloy

N Copper

N Resin

Square  
Long Neck  
Square

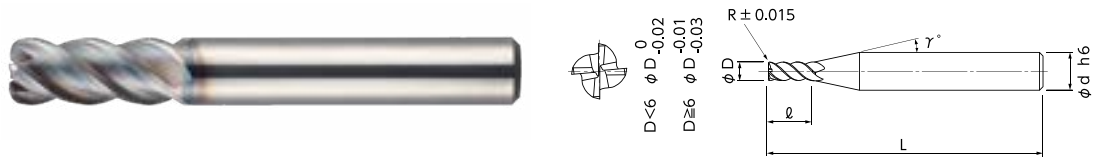
# MSXH440R

Size  $\phi 3 \times R0.3 \sim \phi 12 \times R2$

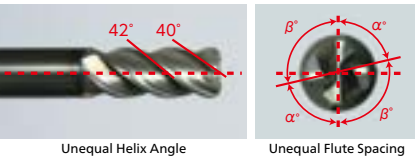


MUGEN COATING PREMIUM Power Radius End Mill

For machining on stainless steels and heat resistant alloy.  
High efficient machining with unequal flute spacing and unequal helix angle  
design to suppress chattering



- Improved designs of unequal helix angle and flute spacing. Suppression from chattering to realize stable milling progression.
- Original spiral design at corner radius flutes improves cutting edge performance!
- Designed for high rigidity to suppress corner radius flute breakage even on rough milling stresses.
- Adopted MUGEN COATING PREMIUM for improvement heat resistance and cutting edge strength to protect from milling heat influence.



| Unit : mm      |             |                      |                      |                         |                   |                       |
|----------------|-------------|----------------------|----------------------|-------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Corner Radius<br>(R) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 08-00150-03003 | 3           | R0.3                 | 8                    | 12°                     | 6                 | 60                    |
| 08-00150-03005 |             | R0.5                 | 8                    | 12°                     | 6                 | 60                    |
| 08-00150-04003 | 4           | R0.3                 | 11                   | 12°                     | 6                 | 60                    |
| 08-00150-04005 |             | R0.5                 | 11                   | 12°                     | 6                 | 60                    |
| 08-00150-04010 |             | R1                   | 11                   | 12°                     | 6                 | 60                    |
| 08-00150-05003 | 5           | R0.3                 | 13                   | 12°                     | 6                 | 60                    |
| 08-00150-05005 |             | R0.5                 | 13                   | 12°                     | 6                 | 60                    |
| 08-00150-05010 |             | R1                   | 13                   | 12°                     | 6                 | 60                    |
| 08-00150-06005 | 6           | R0.5                 | 13                   | —                       | 6                 | 60                    |
| 08-00150-06010 |             | R1                   | 13                   | —                       | 6                 | 60                    |
| 08-00150-08005 | 8           | R0.5                 | 19                   | —                       | 8                 | 65                    |
| 08-00150-08010 |             | R1                   | 19                   | —                       | 8                 | 65                    |
| 08-00150-10005 | 10          | R0.5                 | 22                   | —                       | 10                | 75                    |
| 08-00150-10010 |             | R1                   | 22                   | —                       | 10                | 75                    |
| 08-00150-10020 |             | R2                   | 22                   | —                       | 10                | 75                    |
| 08-00150-10030 |             | R3                   | 22                   | —                       | 10                | 75                    |
| 08-00150-12005 | 12          | R0.5                 | 26                   | —                       | 12                | 80                    |
| 08-00150-12010 |             | R1                   | 26                   | —                       | 12                | 80                    |
| 08-00150-12020 |             | R2                   | 26                   | —                       | 12                | 80                    |

## How to Order

When you order, indicate MSXH440R (D)×(R). ※(γ) is reference value.

# MSXH440R

Recommended Milling Conditions

| Work Material             |               | Alloy Steels SKD・SCM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |                                                                                       |        | Stainless Steels SUS304                                                               |        |                                                                                       |        | Titanium Alloy Ti-6Al-4V                                                              |        |                                                                                       |        | Heat Resistance Alloy Inconel®718                                                     |        |                                                                                       |        |
|---------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------|--------|
| Dia.                      | Corner Radius | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        | Slotting                                                                              |        | Side Milling                                                                          |        | Slotting                                                                              |        | Side Milling                                                                          |        | Slotting                                                                              |        | Side Milling                                                                          |        | Slotting                                                                              |        |
|                           |               | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Feed   | Spindle Speed                                                                         | Feed   | Spindle Speed                                                                         | Feed   | Spindle Speed                                                                         | Feed   | Spindle Speed                                                                         | Feed   | Spindle Speed                                                                         | Feed   | Spindle Speed                                                                         | Feed   | Spindle Speed                                                                         | Feed   |
|                           |               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | mm/min | min <sup>-1</sup>                                                                     | mm/min | min <sup>-1</sup>                                                                     | mm/min | min <sup>-1</sup>                                                                     | mm/min | min <sup>-1</sup>                                                                     | mm/min | min <sup>-1</sup>                                                                     | mm/min | min <sup>-1</sup>                                                                     | mm/min | min <sup>-1</sup>                                                                     | mm/min |
| 3                         | 0.3           | 17,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,430  | 8,600                                                                                 | 700    | 6,000                                                                                 | 750    | 6,000                                                                                 | 600    | 5,600                                                                                 | 750    | 5,600                                                                                 | 600    | 3,600                                                                                 | 250    | 2,500                                                                                 | 140    |
|                           | 0.5           | 17,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,430  | 8,600                                                                                 | 700    | 6,000                                                                                 | 750    | 6,000                                                                                 | 550    | 5,600                                                                                 | 750    | 5,600                                                                                 | 550    | 3,600                                                                                 | 250    | 2,500                                                                                 | 140    |
| 4                         | 0.3           | 13,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,540  | 6,500                                                                                 | 780    | 5,200                                                                                 | 800    | 5,200                                                                                 | 650    | 4,800                                                                                 | 800    | 4,800                                                                                 | 650    | 3,100                                                                                 | 250    | 2,200                                                                                 | 150    |
|                           | 0.5           | 13,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,540  | 6,500                                                                                 | 780    | 5,200                                                                                 | 800    | 5,200                                                                                 | 600    | 4,800                                                                                 | 800    | 4,800                                                                                 | 600    | 3,100                                                                                 | 250    | 2,200                                                                                 | 150    |
|                           | 1             | 13,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,540  | 6,500                                                                                 | 780    | 5,200                                                                                 | 800    | 5,200                                                                                 | 550    | 4,800                                                                                 | 800    | 4,800                                                                                 | 550    | 3,100                                                                                 | 250    | 2,200                                                                                 | 150    |
| 5                         | 0.3           | 10,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,650  | 5,500                                                                                 | 760    | 4,600                                                                                 | 900    | 4,600                                                                                 | 700    | 4,200                                                                                 | 900    | 4,200                                                                                 | 700    | 2,600                                                                                 | 300    | 1,900                                                                                 | 160    |
|                           | 0.5           | 10,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,650  | 5,500                                                                                 | 760    | 4,600                                                                                 | 900    | 4,600                                                                                 | 650    | 4,200                                                                                 | 900    | 4,200                                                                                 | 650    | 2,600                                                                                 | 300    | 1,900                                                                                 | 160    |
|                           | 1             | 10,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,650  | 5,500                                                                                 | 760    | 4,600                                                                                 | 900    | 4,600                                                                                 | 600    | 4,200                                                                                 | 900    | 4,200                                                                                 | 600    | 2,600                                                                                 | 300    | 1,900                                                                                 | 160    |
| 6                         | 0.5           | 8,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2,420  | 4,300                                                                                 | 630    | 4,200                                                                                 | 1,000  | 4,000                                                                                 | 400    | 3,800                                                                                 | 1,000  | 3,600                                                                                 | 400    | 2,100                                                                                 | 300    | 1,300                                                                                 | 170    |
|                           | 1             | 8,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2,420  | 4,300                                                                                 | 630    | 4,200                                                                                 | 1,000  | 4,000                                                                                 | 350    | 3,800                                                                                 | 1,000  | 3,600                                                                                 | 350    | 2,100                                                                                 | 300    | 1,300                                                                                 | 170    |
| 8                         | 0.5           | 6,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,980  | 3,300                                                                                 | 560    | 3,600                                                                                 | 850    | 3,200                                                                                 | 350    | 3,200                                                                                 | 850    | 2,800                                                                                 | 350    | 1,700                                                                                 | 300    | 1,100                                                                                 | 170    |
|                           | 1             | 6,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,980  | 3,300                                                                                 | 560    | 3,600                                                                                 | 850    | 3,200                                                                                 | 300    | 3,200                                                                                 | 850    | 2,800                                                                                 | 300    | 1,700                                                                                 | 300    | 1,100                                                                                 | 170    |
| 10                        | 0.5           | 5,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,430  | 2,600                                                                                 | 550    | 3,000                                                                                 | 600    | 2,500                                                                                 | 300    | 2,600                                                                                 | 600    | 2,100                                                                                 | 300    | 1,300                                                                                 | 250    | 900                                                                                   | 160    |
|                           | 1             | 5,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,430  | 2,600                                                                                 | 550    | 3,000                                                                                 | 600    | 2,500                                                                                 | 300    | 2,600                                                                                 | 600    | 2,100                                                                                 | 300    | 1,300                                                                                 | 250    | 900                                                                                   | 160    |
|                           | 2             | 5,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,430  | 2,600                                                                                 | 550    | 3,000                                                                                 | 600    | 2,500                                                                                 | 250    | 2,600                                                                                 | 600    | 2,100                                                                                 | 250    | 1,300                                                                                 | 250    | 900                                                                                   | 160    |
|                           | 3             | 5,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,430  | 2,600                                                                                 | 550    | 3,000                                                                                 | 600    | 2,500                                                                                 | 200    | 2,600                                                                                 | 600    | 2,100                                                                                 | 200    | 1,300                                                                                 | 250    | 900                                                                                   | 160    |
| 12                        | 0.5           | 4,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,100  | 2,200                                                                                 | 480    | 2,500                                                                                 | 500    | 2,000                                                                                 | 200    | 2,100                                                                                 | 500    | 1,600                                                                                 | 200    | 900                                                                                   | 200    | 700                                                                                   | 150    |
|                           | 1             | 4,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,100  | 2,200                                                                                 | 480    | 2,500                                                                                 | 500    | 2,000                                                                                 | 200    | 2,100                                                                                 | 500    | 1,600                                                                                 | 200    | 900                                                                                   | 200    | 700                                                                                   | 150    |
|                           | 2             | 4,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1,100  | 2,200                                                                                 | 480    | 2,500                                                                                 | 500    | 2,000                                                                                 | 150    | 2,100                                                                                 | 500    | 1,600                                                                                 | 150    | 900                                                                                   | 200    | 700                                                                                   | 150    |
| Depth of Cut<br>(D: Dia.) |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |  |        |  |        |  |        |  |        |  |        |  |        |  |        |
| Notes                     |               | ※1 Adjust milling condition conforming with machine rigidity and clamping condition.<br>※2 The recommended milling conditions are based on milling with water-soluble fluid.<br>※3 Adjust milling condition with caution for chip evacuation and smoke generation when milling with water-insoluble fluid.<br>※4 Use a rigid machine and holder.<br>※5 Overhang of end mill should be as short as possible from spindle nose.<br>(The recommended milling conditions are reference values under the overhang L/D: 5D(φ3~5), 4D(φ6~8), 3D(φ10~12)) |        |                                                                                       |        |                                                                                       |        |                                                                                       |        |                                                                                       |        |                                                                                       |        |                                                                                       |        |                                                                                       |        |

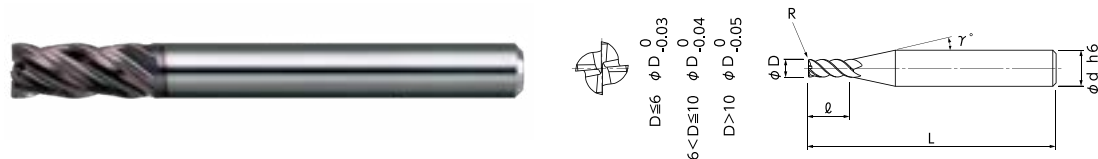
# MSX440

Size  $\phi 3 \times R0.2 \sim \phi 20 \times R1$

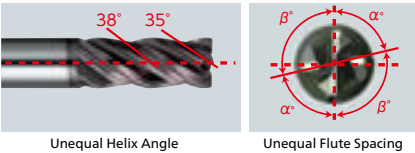


MUGEN COATING Power Radius End Mill

Unequal helix angle and flute spacing to minimize chattering  
Suitable for steels to stainless steels



- It is very suitable for roughing and semi-finishing on stainless steels and tough materials by unequal flute design.
- High performance for reducing roughing time.
- ▲: The sizes will no longer be on sale after the stock runs out.



## ▲ Discontinued Products

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Corner Radius<br>(R) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------|----------------------------------|-------------------|-----------------------|
| 08-00144-00300 | 3           | 8                    | R0.2                 | 12°                              | 6                 | 55                    |
| 08-00144-00400 | 4           | 11                   | R0.2                 | 12°                              | 6                 | 55                    |
| 08-00144-00500 | 5           | 13                   | R0.2                 | 12°                              | 6                 | 55                    |
| 08-00144-00600 | 6           | 13                   | R0.3                 | —                                | 6                 | 55                    |
| 08-00144-00700 | 7           | 19                   | R0.3                 | 12°                              | 8                 | 60                    |
| 08-00144-00800 | 8           | 19                   | R0.3                 | —                                | 8                 | 60                    |
| 08-00144-00900 | 9           | 22                   | R0.3                 | 12°                              | 10                | 70                    |
| 08-00144-01000 | 10          | 22                   | R0.3                 | —                                | 10                | 70                    |
| 08-00144-01100 | 11          | 26                   | R0.3                 | 12°                              | 12                | 80                    |
| 08-00144-01200 | 12          | 26                   | R0.3                 | —                                | 12                | 80                    |
| 08-00144-01300 | 13          | 26                   | R0.7                 | 12°                              | 16                | 90                    |
| 08-00144-01400 | 14          | 26                   | R0.7                 | 12°                              | 16                | 90                    |
| 08-00144-01500 | 15          | 32                   | R1                   | 12°                              | 16                | 90                    |
| 08-00144-01600 | 16          | 32                   | R1                   | —                                | 16                | 90                    |
| 08-00144-01800 | 18          | 32                   | R1                   | 12°                              | 20                | 105                   |
| 08-00144-02000 | 20          | 38                   | R1                   | —                                | 20                | 105                   |

## How to Order

When you order, indicate MSX440 (D). ※( $\gamma$ ) is reference value.

# MSX440

Recommended Milling Conditions

| Work Material             | Carbon Steels・Prehardened Steels<br>S50C・NAK55・NAK80・HPM-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |        |                   |        | Stainless Steels<br>SUS304 |        |                   |        |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|----------------------------|--------|-------------------|--------|
| Cutting Speed             | 100~150m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        | 50~70m/min        |        | 50~70m/min                 |        | 30~55m/min        |        |
| Dia.                      | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        | Slotting          |        | Side Milling               |        | Slotting          |        |
|                           | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Feed   | Spindle Speed     | Feed   | Spindle Speed              | Feed   | Spindle Speed     | Feed   |
|                           | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>          | mm/min | min <sup>-1</sup> | mm/min |
| 3                         | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,300  | 7,000             | 300    | 8,500                      | 680    | 5,600             | 100    |
| 4                         | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,400  | 5,300             | 300    | 6,400                      | 770    | 4,000             | 100    |
| 5                         | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,500  | 4,200             | 300    | 5,000                      | 800    | 3,000             | 100    |
| 6                         | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2,200  | 3,500             | 400    | 4,200                      | 840    | 2,800             | 100    |
| 8                         | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,800  | 2,600             | 400    | 3,200                      | 630    | 1,800             | 150    |
| 10                        | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,300  | 2,000             | 400    | 2,500                      | 560    | 1,600             | 150    |
| 12                        | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1,000  | 1,700             | 400    | 2,100                      | 470    | 1,200             | 150    |
| 14                        | 3,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 900    | 1,500             | 300    | 1,800                      | 400    | 1,000             | 120    |
| 16                        | 3,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 800    | 1,400             | 300    | 1,600                      | 390    | 800               | 120    |
| 18                        | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 700    | 950               | 250    | 1,400                      | 350    | 800               | 100    |
| 20                        | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 650    | 950               | 250    | 1,200                      | 330    | 700               | 100    |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling</div> <div>Slotting</div> <div><math>a_p</math><br/><math>\phi 3 \sim 5 = 0.5D</math> (SUS: <math>\phi 3 \sim 6 = 0.5D</math>)<br/><math>\phi 6 \sim 12 = 1D</math> (SUS: <math>\phi 8 \sim 12 = 1D</math>)<br/><math>\phi 13 \sim 16 = 0.5D</math><br/><math>\phi 18 \sim 20 = 0.3D</math></div>                                                                                                                                                                                                                                                                                   |        |                   |        |                            |        |                   |        |
| Notes                     | ※1 Adjust Depth of Cut according to machine rigidity.<br>Final milling conditions are subject to machining profile, purpose and machine status.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Water-insoluble fluid is recommended for cutting stainless steels.<br>※4 Adjust milling condition with caution for chip evacuation and smoke generation when milling with water-insoluble fluid.<br>※5 Chip disposal is important for slotting.<br>※6 Use a rigid and precise machine and chuck holder.<br>※7 Overhang of end mill should be as short as possible from spindle nose. |        |                   |        |                            |        |                   |        |

## Aluminium Milling

## Sharp cutting to realize high speed machining without chattering

| Model | Size | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunging Milling | Work Material |             |                 |                |        |       |          |                       |                          |                |  |  |  | Number of Sizes | Page |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
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|       |      |               |         |                 |             |              |              |              |                  | P             | P           | M               | N              | N      | N     | N        | N                     | S                        | H              |  |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|       |      |               |         |                 |             |              |              |              |                  | Carbon Steel  | Alloy Steel | Stainless Steel | Aluminum Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |  |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |
|       |      |               |         |                 |             |              |              |              |                  |               |             |                 |                |        |       |          |                       |                          |                |  |  |  |                 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | </ |

# Aluminium Milling

## Sharp cutting to realize high speed machining without chattering

| Model                                                                                                                                                                         | Size      | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | Plunging Milling | 3D Milling | Work Material |             |                 |                 |        |       |          |                       |                          |                | Number of Sizes | Page  |        |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------|---------|-----------------|-------------|--------------|--------------|--------------|------------------|------------|---------------|-------------|-----------------|-----------------|--------|-------|----------|-----------------------|--------------------------|----------------|-----------------|-------|--------|--------|
|                                                                                                                                                                               |           |               |         |                 |             |              |              |              |                  |            | P             | P           | M               | N               | N      | N     | N        | S                     | H                        |                |                 |       |        |        |
|                                                                                                                                                                               |           |               |         |                 |             |              |              |              |                  |            | Carbon Steel  | Alloy Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |                 |       |        |        |
|                                                                                                                                                                               |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          | 55 HRC         |                 |       | 65 HRC | 70 HRC |
| Square                                                                                                                                                                        |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
|  AL-3LS                                                                                    | φ5 ~ φ12  | 1.5D          | -       | 3               | 45°         | Side         | Slot         | Face         | -                | -          | -             | -           | -               | ○               | ○      | ○     | -        | -                     | -                        | -              | 5               | L-022 |        |        |
| 3-flute long shank end mill for aluminium for deeper area milling                                                                                                             |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| Square • Long Neck Square                                                                                                                                                     |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
|  ALZ345                                                                                    | φ1 ~ φ12  | 1.5D          | -       | 3               | 45°         | Side         | Slot         | Face         | Plunge           | -          | -             | -           | -               | ○               | ○      | ○     | -        | -                     | -                        | -              | 124             | L-024 |        |        |
| For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting<br>※ Listed at "High Efficient Milling" as well (Page K-020) |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| Long Neck Square                                                                                                                                                              |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
|  ALZ345-DLC                                                                               | φ1 ~ φ12  | 1.5D          | DLC     | 3               | 45°         | Side         | Slot         | Face         | Plunge           | -          | -             | -           | -               | ○               | ○      | ○     | -        | -                     | -                        | -              | 17              | L-028 |        |        |
| For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting<br>※ Listed at "High Efficient Milling" as well (Page K-018) |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| Ball • Long Neck Ball                                                                                                                                                         |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
|  ALB225                                                                                  | R0.3 ~ R6 | ≒2D           | -       | 2               | 25°         | -            | -            | -            | -                | 3D         | -             | -           | -               | ○               | ○      | ○     | -        | -                     | -                        | -              | 26              | L-030 |        |        |
| Ball end mill for aluminium. Reducing chattering even for milling at corner and curved surface                                                                                |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
|  ALB225-DLC                                                                              | R0.3 ~ R6 | ≒2D           | DLC     | 2               | 25°         | -            | -            | -            | -                | 3D         | -             | -           | -               | ○               | ○      | ○     | -        | -                     | -                        | -              | 26              | L-032 |        |        |
| Ball end mill for aluminium. DLC coating applied for longer tool life                                                                                                         |           |               |         |                 |             |              |              |              |                  |            |               |             |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |

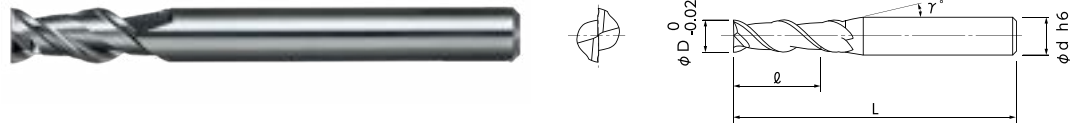
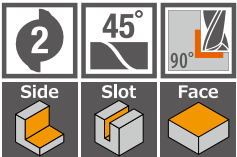




2-Flute L/D=2 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=2  
Reducing chatter and burr by specialized cutting edge design for aluminium



- AL-series realized a stable and high efficient machining.
- L/D=2 to increase rigidity and realize best cost performance.

Unit : mm

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 01-00631-00050 | 0.5         | 1                       | 9°                                  | 4                    | 45                       |
| 01-00631-00060 | 0.6         | 1.2                     | 9°                                  | 4                    | 45                       |
| 01-00631-00070 | 0.7         | 1.4                     | 9°                                  | 4                    | 45                       |
| 01-00631-00080 | 0.8         | 1.6                     | 9°                                  | 4                    | 45                       |
| 01-00631-00090 | 0.9         | 1.8                     | 9°                                  | 4                    | 45                       |
| 01-00631-00100 | 1           | 2                       | 9°                                  | 4                    | 45                       |
| 01-00631-00110 | 1.1         | 2.2                     | 9°                                  | 4                    | 45                       |
| 01-00631-00120 | 1.2         | 2.4                     | 9°                                  | 4                    | 45                       |
| 01-00631-00130 | 1.3         | 2.6                     | 9°                                  | 4                    | 45                       |
| 01-00631-00140 | 1.4         | 2.8                     | 9°                                  | 4                    | 45                       |
| 01-00631-00150 | 1.5         | 3                       | 9°                                  | 4                    | 45                       |
| 01-00631-00160 | 1.6         | 3.2                     | 9°                                  | 4                    | 45                       |
| 01-00631-00170 | 1.7         | 3.4                     | 9°                                  | 4                    | 45                       |
| 01-00631-00180 | 1.8         | 3.6                     | 9°                                  | 4                    | 45                       |
| 01-00631-00190 | 1.9         | 3.8                     | 9°                                  | 4                    | 45                       |
| 01-00631-00200 | 2           | 4                       | 9°                                  | 4                    | 45                       |
| 01-00631-00210 | 2.1         | 4.2                     | 9°                                  | 4                    | 45                       |
| 01-00631-00220 | 2.2         | 4.4                     | 9°                                  | 4                    | 45                       |
| 01-00631-00230 | 2.3         | 4.6                     | 9°                                  | 4                    | 45                       |
| 01-00631-00240 | 2.4         | 4.8                     | 9°                                  | 4                    | 45                       |
| 01-00631-00250 | 2.5         | 5                       | 9°                                  | 4                    | 45                       |
| 01-00631-00260 | 2.6         | 5.2                     | 9°                                  | 4                    | 45                       |
| 01-00631-00270 | 2.7         | 5.4                     | 9°                                  | 4                    | 45                       |
| 01-00631-00280 | 2.8         | 5.6                     | 9°                                  | 4                    | 45                       |
| 01-00631-00290 | 2.9         | 5.8                     | 9°                                  | 6                    | 50                       |
| 01-00631-00300 | 3           | 6                       | 9°                                  | 6                    | 50                       |
| 01-00631-00350 | 3.5         | 7                       | 9°                                  | 6                    | 50                       |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 01-00631-00400 | 4           | 8                       | 9°                                  | 6                    | 50                       |
| 01-00631-00450 | 4.5         | 9                       | 9°                                  | 6                    | 55                       |
| 01-00631-00500 | 5           | 10                      | 9°                                  | 6                    | 55                       |
| 01-00631-00550 | 5.5         | 11                      | 9°                                  | 6                    | 55                       |
| 01-00631-00600 | 6           | 12                      | —                                   | 6                    | 55                       |
| 01-00631-00700 | 7           | 14                      | 9°                                  | 8                    | 70                       |
| 01-00631-00800 | 8           | 16                      | —                                   | 8                    | 70                       |
| 01-00631-00900 | 9           | 18                      | 9°                                  | 10                   | 75                       |
| 01-00631-01000 | 10          | 20                      | —                                   | 10                   | 75                       |
| 01-00631-01100 | 11          | 22                      | 9°                                  | 12                   | 80                       |
| 01-00631-01200 | 12          | 24                      | —                                   | 12                   | 80                       |

How to Order

When you order, indicate AL2D-2 (D).

※( $\gamma$ ) is reference value.

| Work Material                 | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                                                   |        |                   |        | Aluminium Alloy<br>A2017・A5052・A7075 |        |                   |        | Aluminium Cast<br>AC8C |        |                   |        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|--------------------------------------|--------|-------------------|--------|------------------------|--------|-------------------|--------|
| Cutting Speed                 | 340m/min                                                                                                                                                                                                                                                                                                                                                                                                             |        | 270m/min          |        | 380m/min                             |        | 300m/min          |        | 280m/min               |        | 200m/min          |        |
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                         |        | Slotting          |        | Side Milling                         |        | Slotting          |        | Side Milling           |        | Slotting          |        |
|                               | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                     | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed                     | Feed   | Spindle<br>Speed  | Feed   | Spindle<br>Speed       | Feed   | Spindle<br>Speed  | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>      | mm/min | min <sup>-1</sup> | mm/min |
| 0.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 400    | 20,000            | 200    | 20,000                               | 400    | 20,000            | 300    | 20,000                 | 400    | 20,000            | 300    |
| 1                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 700    | 20,000            | 400    | 20,000                               | 700    | 20,000            | 400    | 20,000                 | 700    | 20,000            | 400    |
| 1.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 800    | 20,000            | 500    | 20,000                               | 800    | 20,000            | 500    | 20,000                 | 800    | 20,000            | 500    |
| 2                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,000  | 20,000            | 600    | 20,000                               | 1,000  | 20,000            | 600    | 20,000                 | 1,000  | 20,000            | 600    |
| 2.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,200  | 20,000            | 700    | 20,000                               | 1,200  | 20,000            | 700    | 20,000                 | 1,200  | 20,000            | 700    |
| 3                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,300  | 20,000            | 800    | 20,000                               | 1,500  | 20,000            | 900    | 20,000                 | 1,500  | 20,000            | 800    |
| 4                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,500  | 20,000            | 900    | 20,000                               | 1,700  | 20,000            | 1,100  | 20,000                 | 1,700  | 15,900            | 800    |
| 5                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,700  | 17,200            | 900    | 20,000                               | 2,000  | 19,100            | 1,300  | 17,800                 | 1,700  | 12,700            | 800    |
| 6                             | 18,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 14,300            | 900    | 20,000                               | 2,200  | 15,900            | 1,300  | 14,900                 | 1,700  | 10,600            | 800    |
| 7                             | 15,500                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 12,300            | 900    | 17,300                               | 2,300  | 13,600            | 1,300  | 12,700                 | 1,700  | 9,100             | 800    |
| 8                             | 13,500                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 10,700            | 1,000  | 15,100                               | 2,400  | 11,900            | 1,300  | 11,100                 | 1,800  | 8,000             | 800    |
| 9                             | 12,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 9,600             | 1,000  | 13,400                               | 2,400  | 10,600            | 1,300  | 9,900                  | 1,800  | 7,100             | 800    |
| 10                            | 10,800                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 8,600             | 1,000  | 12,100                               | 2,400  | 9,600             | 1,300  | 8,900                  | 1,800  | 6,400             | 800    |
| 11                            | 9,800                                                                                                                                                                                                                                                                                                                                                                                                                | 1,900  | 7,800             | 1,000  | 11,000                               | 2,500  | 8,700             | 1,300  | 8,100                  | 1,800  | 5,800             | 800    |
| 12                            | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                | 2,000  | 7,200             | 1,100  | 10,100                               | 2,500  | 8,000             | 1,400  | 7,400                  | 1,800  | 5,300             | 900    |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                                                                                                                                                                |        |                   |        |                                      |        |                   |        |                        |        |                   |        |
| Notes                         | ※ 1 Adjust both the spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur according to the rigidity of the machine and the chuck holder, or work clamping condition.<br>※ 4 Water-soluble fluid is recommended. |        |                   |        |                                      |        |                   |        |                        |        |                   |        |

N Aluminium Alloy

N Copper

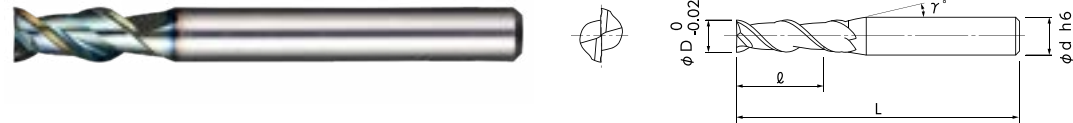
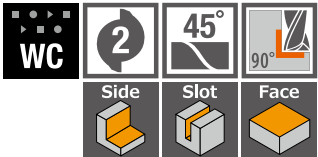
N Resin



DLC COATING 2-Flute L/D=2 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=2  
DLC coating applied for longer tool life



● Adopted NS TOOL original DLC COATING that suitable for long time machining.



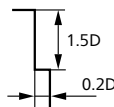
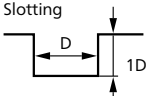
Coating

- Aluminium Alloy **N**
- Copper **N**
- Resin **N**

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| 01-00661-00050 | 0.5         | 1                    | 9°                      | 4                 | 45                    |
| 01-00661-00060 | 0.6         | 1.2                  | 9°                      | 4                 | 45                    |
| 01-00661-00070 | 0.7         | 1.4                  | 9°                      | 4                 | 45                    |
| 01-00661-00080 | 0.8         | 1.6                  | 9°                      | 4                 | 45                    |
| 01-00661-00090 | 0.9         | 1.8                  | 9°                      | 4                 | 45                    |
| 01-00661-00100 | 1           | 2                    | 9°                      | 4                 | 45                    |
| 01-00661-00150 | 1.5         | 3                    | 9°                      | 4                 | 45                    |
| 01-00661-00200 | 2           | 4                    | 9°                      | 4                 | 45                    |
| 01-00661-00250 | 2.5         | 5                    | 9°                      | 4                 | 45                    |
| 01-00661-00300 | 3           | 6                    | 9°                      | 6                 | 50                    |
| 01-00661-00350 | 3.5         | 7                    | 9°                      | 6                 | 50                    |
| 01-00661-00400 | 4           | 8                    | 9°                      | 6                 | 50                    |
| 01-00661-00450 | 4.5         | 9                    | 9°                      | 6                 | 55                    |
| 01-00661-00500 | 5           | 10                   | 9°                      | 6                 | 55                    |
| 01-00661-00550 | 5.5         | 11                   | 9°                      | 6                 | 55                    |
| 01-00661-00600 | 6           | 12                   | —                       | 6                 | 55                    |
| 01-00661-00700 | 7           | 14                   | 9°                      | 8                 | 70                    |
| 01-00661-00800 | 8           | 16                   | —                       | 8                 | 70                    |
| 01-00661-00900 | 9           | 18                   | 9°                      | 10                | 75                    |
| 01-00661-01000 | 10          | 20                   | —                       | 10                | 75                    |
| 01-00661-01100 | 11          | 22                   | 9°                      | 12                | 80                    |
| 01-00661-01200 | 12          | 24                   | —                       | 12                | 80                    |

How to Order

When you order, indicate AL2D-2DLC (D). ※ (γ) is reference value.

| Work Material                 | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                                                   |        |                   |        | Aluminium Alloy<br>A2017・A5052・A7075 |        |                   |        | Aluminium Cast<br>AC8C |        |                   |        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|--------------------------------------|--------|-------------------|--------|------------------------|--------|-------------------|--------|
| Cutting Speed                 | 340m/min                                                                                                                                                                                                                                                                                                                                                                                                             |        | 270m/min          |        | 380m/min                             |        | 300m/min          |        | 280m/min               |        | 200m/min          |        |
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                         |        | Slotting          |        | Side Milling                         |        | Slotting          |        | Side Milling           |        | Slotting          |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                        | Feed   | Spindle Speed     | Feed   | Spindle Speed                        | Feed   | Spindle Speed     | Feed   | Spindle Speed          | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>      | mm/min | min <sup>-1</sup> | mm/min |
| 0.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 400    | 20,000            | 200    | 20,000                               | 400    | 20,000            | 300    | 20,000                 | 400    | 20,000            | 300    |
| 1                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 700    | 20,000            | 400    | 20,000                               | 700    | 20,000            | 400    | 20,000                 | 700    | 20,000            | 400    |
| 1.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 800    | 20,000            | 500    | 20,000                               | 800    | 20,000            | 500    | 20,000                 | 800    | 20,000            | 500    |
| 2                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,000  | 20,000            | 600    | 20,000                               | 1,000  | 20,000            | 600    | 20,000                 | 1,000  | 20,000            | 600    |
| 2.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,200  | 20,000            | 700    | 20,000                               | 1,200  | 20,000            | 700    | 20,000                 | 1,200  | 20,000            | 700    |
| 3                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,300  | 20,000            | 800    | 20,000                               | 1,500  | 20,000            | 900    | 20,000                 | 1,500  | 20,000            | 800    |
| 4                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,500  | 20,000            | 900    | 20,000                               | 1,700  | 20,000            | 1,100  | 20,000                 | 1,700  | 15,900            | 800    |
| 5                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,700  | 17,200            | 900    | 20,000                               | 2,000  | 19,100            | 1,300  | 17,800                 | 1,700  | 12,700            | 800    |
| 6                             | 18,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 14,300            | 900    | 20,000                               | 2,200  | 15,900            | 1,300  | 14,900                 | 1,700  | 10,600            | 800    |
| 7                             | 15,500                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 12,300            | 900    | 17,300                               | 2,300  | 13,600            | 1,300  | 12,700                 | 1,700  | 9,100             | 800    |
| 8                             | 13,500                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 10,700            | 1,000  | 15,100                               | 2,400  | 11,900            | 1,300  | 11,100                 | 1,800  | 8,000             | 800    |
| 9                             | 12,000                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 9,600             | 1,000  | 13,400                               | 2,400  | 10,600            | 1,300  | 9,900                  | 1,800  | 7,100             | 800    |
| 10                            | 10,800                                                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 8,600             | 1,000  | 12,100                               | 2,400  | 9,600             | 1,300  | 8,900                  | 1,800  | 6,400             | 800    |
| 11                            | 9,800                                                                                                                                                                                                                                                                                                                                                                                                                | 1,900  | 7,800             | 1,000  | 11,000                               | 2,500  | 8,700             | 1,300  | 8,100                  | 1,800  | 5,800             | 800    |
| 12                            | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                | 2,000  | 7,200             | 1,100  | 10,100                               | 2,500  | 8,000             | 1,400  | 7,400                  | 1,800  | 5,300             | 900    |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div></div></div> <div><div>Slotting</div><div></div></div>                                                                                                                                                    |        |                   |        |                                      |        |                   |        |                        |        |                   |        |
| Notes                         | ※ 1 Adjust both the spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur according to the rigidity of the machine and the chuck holder, or work clamping condition.<br>※ 4 Water-soluble fluid is recommended. |        |                   |        |                                      |        |                   |        |                        |        |                   |        |

- Aluminium Alloy **N**
- Copper **N**
- Resin **N**

Coating

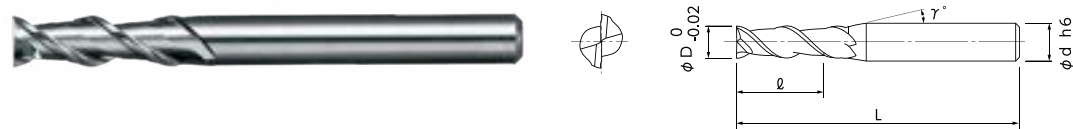
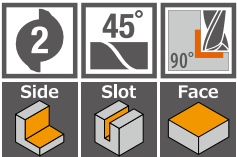




2-Flute L/D=3 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=3  
Reducing chattering and burr cutting edge design for aluminium



- AL-series realized a stable and high efficient machining.
- It exhibits stable excellent surface on a wide area and no chattering occurs even during high speed cutting.



Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| 01-00632-00100 | 1           | 3                    | 9°                               | 4                 | 45                    |
| 01-00632-00150 | 1.5         | 4.5                  | 9°                               | 4                 | 45                    |
| 01-00632-00200 | 2           | 6                    | 9°                               | 4                 | 45                    |
| 01-00632-00250 | 2.5         | 7.5                  | 9°                               | 4                 | 45                    |
| 01-00632-00300 | 3           | 9                    | 9°                               | 6                 | 50                    |
| 01-00632-00400 | 4           | 12                   | 9°                               | 6                 | 50                    |
| 01-00632-00500 | 5           | 15                   | 9°                               | 6                 | 55                    |
| 01-00632-00600 | 6           | 18                   | —                                | 6                 | 60                    |
| 01-00632-00700 | 7           | 21                   | 9°                               | 8                 | 70                    |
| 01-00632-00800 | 8           | 24                   | —                                | 8                 | 70                    |
| 01-00632-00900 | 9           | 27                   | 9°                               | 10                | 75                    |
| 01-00632-01000 | 10          | 30                   | —                                | 10                | 75                    |
| 01-00632-01100 | 11          | 33                   | 9°                               | 12                | 90                    |
| 01-00632-01200 | 12          | 36                   | —                                | 12                | 90                    |

How to Order

When you order, indicate AL3D-2 (D). ※( $\gamma$ ) is reference value.

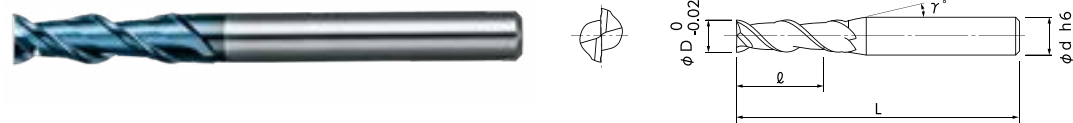
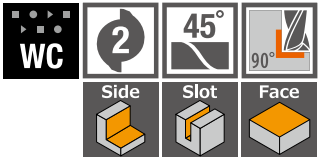
| Work Material                 | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                      |        |                   |        | Aluminium Alloy<br>A2017・A5052・A7075 |        |                   |        | Aluminium Cast<br>AC8C |        |                   |        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|--------------------------------------|--------|-------------------|--------|------------------------|--------|-------------------|--------|
| Cutting Speed                 | 300m/min                                                                                                                                                                                                                                                                                                                                                                                |        | 220m/min          |        | 330m/min                             |        | 240m/min          |        | 250m/min               |        | 160m/min          |        |
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                                                                                                                            |        | Slotting          |        | Side Milling                         |        | Slotting          |        | Side Milling           |        | Slotting          |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed     | Feed   | Spindle Speed                        | Feed   | Spindle Speed     | Feed   | Spindle Speed          | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>      | mm/min | min <sup>-1</sup> | mm/min |
| 1                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 400    | 20,000            | 300    | 20,000                               | 400    | 20,000            | 300    | 20,000                 | 400    | 20,000            | 300    |
| 1.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 500    | 20,000            | 400    | 20,000                               | 500    | 20,000            | 400    | 20,000                 | 500    | 20,000            | 400    |
| 2                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 600    | 20,000            | 400    | 20,000                               | 600    | 20,000            | 400    | 20,000                 | 600    | 20,000            | 400    |
| 2.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 700    | 20,000            | 500    | 20,000                               | 700    | 20,000            | 500    | 20,000                 | 700    | 20,000            | 500    |
| 3                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 900    | 20,000            | 600    | 20,000                               | 900    | 20,000            | 600    | 20,000                 | 900    | 17,000            | 500    |
| 4                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 17,500            | 700    | 20,000                               | 1,000  | 19,000            | 750    | 20,000                 | 1,000  | 13,000            | 500    |
| 5                             | 19,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 14,000            | 700    | 20,000                               | 1,200  | 15,500            | 750    | 16,000                 | 1,000  | 10,000            | 500    |
| 6                             | 16,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 11,500            | 700    | 17,500                               | 1,400  | 12,500            | 750    | 13,500                 | 1,000  | 8,500             | 500    |
| 7                             | 13,500                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 10,000            | 750    | 15,000                               | 1,500  | 11,000            | 800    | 11,500                 | 1,100  | 7,300             | 500    |
| 8                             | 12,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 8,800             | 750    | 13,000                               | 1,600  | 9,600             | 800    | 9,900                  | 1,200  | 6,400             | 500    |
| 9                             | 11,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 7,800             | 750    | 11,700                               | 1,600  | 8,500             | 800    | 8,800                  | 1,200  | 5,700             | 500    |
| 10                            | 9,600                                                                                                                                                                                                                                                                                                                                                                                   | 1,100  | 7,000             | 800    | 10,500                               | 1,700  | 7,600             | 850    | 8,000                  | 1,300  | 5,100             | 550    |
| 11                            | 8,700                                                                                                                                                                                                                                                                                                                                                                                   | 1,100  | 6,400             | 800    | 9,600                                | 1,700  | 6,900             | 850    | 7,200                  | 1,300  | 4,600             | 550    |
| 12                            | 8,000                                                                                                                                                                                                                                                                                                                                                                                   | 1,200  | 5,800             | 800    | 8,800                                | 1,700  | 6,400             | 900    | 6,600                  | 1,300  | 4,200             | 600    |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                                                                                                                                   |        |                   |        |                                      |        |                   |        |                        |        |                   |        |
| Notes                         | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 Water-soluble fluid is recommended. |        |                   |        |                                      |        |                   |        |                        |        |                   |        |



DLC COATING 2-Flute L/D=3 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=3  
DLC coating applied for longer tool life



- AL-series realized a stable and high efficient machining.
- Adopted NS TOOL original DLC COATING that suitable for long time machining.



| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00635-00100 | 1           | 3                    | 9°                               | 4                 | 45                    |
| 01-00635-00150 | 1.5         | 4.5                  | 9°                               | 4                 | 45                    |
| 01-00635-00200 | 2           | 6                    | 9°                               | 4                 | 45                    |
| 01-00635-00250 | 2.5         | 7.5                  | 9°                               | 4                 | 45                    |
| 01-00635-00300 | 3           | 9                    | 9°                               | 6                 | 50                    |
| 01-00635-00400 | 4           | 12                   | 9°                               | 6                 | 50                    |
| 01-00635-00500 | 5           | 15                   | 9°                               | 6                 | 55                    |
| 01-00635-00600 | 6           | 18                   | —                                | 6                 | 60                    |
| 01-00635-00700 | 7           | 21                   | 9°                               | 8                 | 70                    |
| 01-00635-00800 | 8           | 24                   | —                                | 8                 | 70                    |
| 01-00635-00900 | 9           | 27                   | 9°                               | 10                | 75                    |
| 01-00635-01000 | 10          | 30                   | —                                | 10                | 75                    |
| 01-00635-01100 | 11          | 33                   | 9°                               | 12                | 90                    |
| 01-00635-01200 | 12          | 36                   | —                                | 12                | 90                    |

How to Order

When you order, indicate AL3D-2DLC (D). ※ (  $\gamma$  ) is reference value.

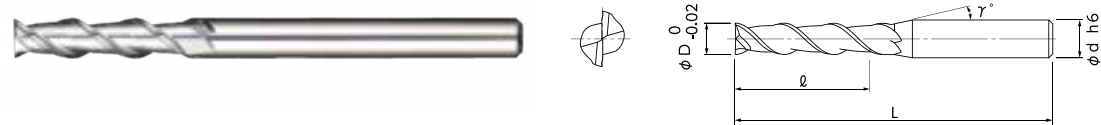
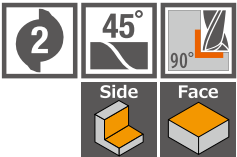
| Work Material              | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                      |        |                   |        | Aluminium Alloy<br>A2017·A5052·A7075 |        |                   |        | Aluminium Cast<br>AC8C |        |                   |        |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|--------------------------------------|--------|-------------------|--------|------------------------|--------|-------------------|--------|
| Cutting Speed              | 300m/min                                                                                                                                                                                                                                                                                                                                                                                |        | 220m/min          |        | 330m/min                             |        | 240m/min          |        | 250m/min               |        | 160m/min          |        |
| Dia.                       | Side Milling                                                                                                                                                                                                                                                                                                                                                                            |        | Slotting          |        | Side Milling                         |        | Slotting          |        | Side Milling           |        | Slotting          |        |
|                            | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed     | Feed   | Spindle Speed                        | Feed   | Spindle Speed     | Feed   | Spindle Speed          | Feed   | Spindle Speed     | Feed   |
|                            | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>      | mm/min | min <sup>-1</sup> | mm/min |
| 1                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 400    | 20,000            | 300    | 20,000                               | 400    | 20,000            | 300    | 20,000                 | 400    | 20,000            | 300    |
| 1.5                        | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 500    | 20,000            | 400    | 20,000                               | 500    | 20,000            | 400    | 20,000                 | 500    | 20,000            | 400    |
| 2                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 600    | 20,000            | 400    | 20,000                               | 600    | 20,000            | 400    | 20,000                 | 600    | 20,000            | 400    |
| 2.5                        | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 700    | 20,000            | 500    | 20,000                               | 700    | 20,000            | 500    | 20,000                 | 700    | 20,000            | 500    |
| 3                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 900    | 20,000            | 600    | 20,000                               | 900    | 20,000            | 600    | 20,000                 | 900    | 17,000            | 500    |
| 4                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 17,500            | 700    | 20,000                               | 1,000  | 19,000            | 750    | 20,000                 | 1,000  | 13,000            | 500    |
| 5                          | 19,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 14,000            | 700    | 20,000                               | 1,200  | 15,500            | 750    | 16,000                 | 1,000  | 10,000            | 500    |
| 6                          | 16,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 11,500            | 700    | 17,500                               | 1,400  | 12,500            | 750    | 13,500                 | 1,000  | 8,500             | 500    |
| 7                          | 13,500                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 10,000            | 750    | 15,000                               | 1,500  | 11,000            | 800    | 11,500                 | 1,100  | 7,300             | 500    |
| 8                          | 12,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 8,800             | 750    | 13,000                               | 1,600  | 9,600             | 800    | 9,900                  | 1,200  | 6,400             | 500    |
| 9                          | 11,000                                                                                                                                                                                                                                                                                                                                                                                  | 1,100  | 7,800             | 750    | 11,700                               | 1,600  | 8,500             | 800    | 8,800                  | 1,200  | 5,700             | 500    |
| 10                         | 9,600                                                                                                                                                                                                                                                                                                                                                                                   | 1,100  | 7,000             | 800    | 10,500                               | 1,700  | 7,600             | 850    | 8,000                  | 1,300  | 5,100             | 550    |
| 11                         | 8,700                                                                                                                                                                                                                                                                                                                                                                                   | 1,100  | 6,400             | 800    | 9,600                                | 1,700  | 6,900             | 850    | 7,200                  | 1,300  | 4,600             | 550    |
| 12                         | 8,000                                                                                                                                                                                                                                                                                                                                                                                   | 1,200  | 5,800             | 800    | 8,800                                | 1,700  | 6,400             | 900    | 6,600                  | 1,300  | 4,200             | 600    |
| Depth of Cut<br>(D : Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                                                                                                                                   |        |                   |        |                                      |        |                   |        |                        |        |                   |        |
| Notes                      | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 Water-soluble fluid is recommended. |        |                   |        |                                      |        |                   |        |                        |        |                   |        |



2-Flute L/D=4 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=4  
Reducing chatter and burr by cutting edge design for aluminium



- It exhibits stable excellent surface on a wide area and no chatter occurs even during high speed cutting.



Square

| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00633-00100 | 1           | 4                    | 9°                               | 4                 | 50                    |
| 01-00633-00150 | 1.5         | 6                    | 9°                               | 4                 | 50                    |
| 01-00633-00200 | 2           | 8                    | 9°                               | 4                 | 50                    |
| 01-00633-00250 | 2.5         | 10                   | 9°                               | 4                 | 50                    |
| 01-00633-00300 | 3           | 12                   | 9°                               | 6                 | 55                    |
| 01-00633-00400 | 4           | 16                   | 9°                               | 6                 | 60                    |
| 01-00633-00500 | 5           | 20                   | 9°                               | 6                 | 65                    |
| 01-00633-00600 | 6           | 24                   | —                                | 6                 | 75                    |
| 01-00633-00700 | 7           | 28                   | 9°                               | 8                 | 90                    |
| 01-00633-00800 | 8           | 32                   | —                                | 8                 | 90                    |
| 01-00633-00900 | 9           | 36                   | 9°                               | 10                | 100                   |
| 01-00633-01000 | 10          | 40                   | —                                | 10                | 100                   |
| 01-00633-01100 | 11          | 44                   | 9°                               | 12                | 110                   |
| 01-00633-01200 | 12          | 48                   | —                                | 12                | 110                   |

How to Order

When you order, indicate AL4D-2 (D).   ※( $\gamma$ ) is reference value.

| Work Material              | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                      |        | Aluminium Alloy<br>A2017·A5052·A7075 |        | Aluminium Cast<br>AC8C |        |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------|--------|------------------------|--------|
| Cutting Speed              | 190m/min                                                                                                                                                                                                                                                                                                                                                                                |        | 280m/min                             |        | 150m/min               |        |
| Dia.                       | Side Milling                                                                                                                                                                                                                                                                                                                                                                            |        | Side Milling                         |        | Side Milling           |        |
|                            | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed                        | Feed   | Spindle Speed          | Feed   |
|                            | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup>      | mm/min |
| 1                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 220    | 20,000                               | 220    | 20,000                 | 220    |
| 1.5                        | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 270    | 20,000                               | 270    | 20,000                 | 320    |
| 2                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 320    | 20,000                               | 320    | 20,000                 | 340    |
| 2.5                        | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 430    | 20,000                               | 430    | 18,500                 | 400    |
| 3                          | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 570    | 20,000                               | 570    | 15,000                 | 520    |
| 4                          | 15,500                                                                                                                                                                                                                                                                                                                                                                                  | 650    | 20,000                               | 840    | 11,500                 | 520    |
| 5                          | 12,000                                                                                                                                                                                                                                                                                                                                                                                  | 840    | 17,500                               | 900    | 9,100                  | 520    |
| 6                          | 10,200                                                                                                                                                                                                                                                                                                                                                                                  | 840    | 14,500                               | 1,050  | 7,700                  | 520    |
| 7                          | 8,800                                                                                                                                                                                                                                                                                                                                                                                   | 840    | 12,600                               | 1,150  | 6,600                  | 580    |
| 8                          | 7,700                                                                                                                                                                                                                                                                                                                                                                                   | 840    | 11,000                               | 1,150  | 5,800                  | 650    |
| 9                          | 6,800                                                                                                                                                                                                                                                                                                                                                                                   | 900    | 9,700                                | 1,300  | 5,200                  | 720    |
| 10                         | 6,100                                                                                                                                                                                                                                                                                                                                                                                   | 900    | 8,800                                | 1,300  | 4,600                  | 720    |
| 11                         | 5,500                                                                                                                                                                                                                                                                                                                                                                                   | 980    | 8,000                                | 1,450  | 4,200                  | 720    |
| 12                         | 5,200                                                                                                                                                                                                                                                                                                                                                                                   | 1,050  | 7,300                                | 1,450  | 3,800                  | 780    |
| Depth of Cut<br>(D : Dia.) | <div>Side Milling</div>                                                                                                                                                                                                                                                                                                                                                                 |        |                                      |        |                        |        |
| Notes                      | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 Water-soluble fluid is recommended. |        |                                      |        |                        |        |



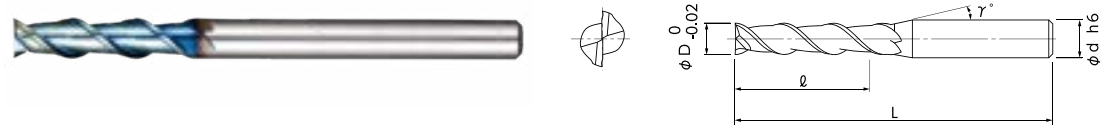
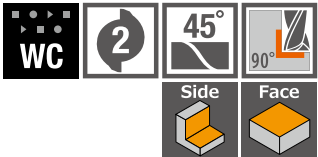
Square



DLC COATING 2-Flute L/D=4 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium.  
L/D=4. DLC coating applied for longer tool life



● Adopted NS TOOL original DLC COATING that suitable for long time machining.



| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00663-00100 | 1           | 4                    | 9°                               | 4                 | 50                    |
| 01-00663-00150 | 1.5         | 6                    | 9°                               | 4                 | 50                    |
| 01-00663-00200 | 2           | 8                    | 9°                               | 4                 | 50                    |
| 01-00663-00250 | 2.5         | 10                   | 9°                               | 4                 | 50                    |
| 01-00663-00300 | 3           | 12                   | 9°                               | 6                 | 55                    |
| 01-00663-00400 | 4           | 16                   | 9°                               | 6                 | 60                    |
| 01-00663-00500 | 5           | 20                   | 9°                               | 6                 | 65                    |
| 01-00663-00600 | 6           | 24                   | —                                | 6                 | 75                    |
| 01-00663-00700 | 7           | 28                   | 9°                               | 8                 | 90                    |
| 01-00663-00800 | 8           | 32                   | —                                | 8                 | 90                    |
| 01-00663-00900 | 9           | 36                   | 9°                               | 10                | 100                   |
| 01-00663-01000 | 10          | 40                   | —                                | 10                | 100                   |
| 01-00663-01100 | 11          | 44                   | 9°                               | 12                | 110                   |
| 01-00663-01200 | 12          | 48                   | —                                | 12                | 110                   |

How to Order

When you order, indicate AL4D-2DLC (D).    ※( $\gamma$ ) is reference value.

| Work Material                  | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                      |        | Aluminium Alloy<br>A2017·A5052·A7075 |        | Aluminium Cast<br>AC8C |        |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------|--------|------------------------|--------|
| Cutting Speed                  | 190m/min                                                                                                                                                                                                                                                                                                                                                                                |        | 280m/min                             |        | 150m/min               |        |
| Dia.                           | Side Milling                                                                                                                                                                                                                                                                                                                                                                            |        | Side Milling                         |        | Side Milling           |        |
|                                | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed                        | Feed   | Spindle Speed          | Feed   |
|                                | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup>      | mm/min |
| 1                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 220    | 20,000                               | 220    | 20,000                 | 220    |
| 1.5                            | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 270    | 20,000                               | 270    | 20,000                 | 320    |
| 2                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 320    | 20,000                               | 320    | 20,000                 | 340    |
| 2.5                            | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 430    | 20,000                               | 430    | 18,500                 | 400    |
| 3                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 570    | 20,000                               | 570    | 15,000                 | 520    |
| 4                              | 15,500                                                                                                                                                                                                                                                                                                                                                                                  | 650    | 20,000                               | 840    | 11,500                 | 520    |
| 5                              | 12,000                                                                                                                                                                                                                                                                                                                                                                                  | 840    | 17,500                               | 900    | 9,100                  | 520    |
| 6                              | 10,200                                                                                                                                                                                                                                                                                                                                                                                  | 840    | 14,500                               | 1,050  | 7,700                  | 520    |
| 7                              | 8,800                                                                                                                                                                                                                                                                                                                                                                                   | 840    | 12,600                               | 1,150  | 6,600                  | 580    |
| 8                              | 7,700                                                                                                                                                                                                                                                                                                                                                                                   | 840    | 11,000                               | 1,150  | 5,800                  | 650    |
| 9                              | 6,800                                                                                                                                                                                                                                                                                                                                                                                   | 900    | 9,700                                | 1,300  | 5,200                  | 720    |
| 10                             | 6,100                                                                                                                                                                                                                                                                                                                                                                                   | 900    | 8,800                                | 1,300  | 4,600                  | 720    |
| 11                             | 5,500                                                                                                                                                                                                                                                                                                                                                                                   | 980    | 8,000                                | 1,450  | 4,200                  | 720    |
| 12                             | 5,200                                                                                                                                                                                                                                                                                                                                                                                   | 1,050  | 7,300                                | 1,450  | 3,800                  | 780    |
| Depth of Cut<br><br>(D : Dia.) | <div>Side Milling</div>                                                                                                                                                                                                                                                                                                                                                                 |        |                                      |        |                        |        |
| Notes                          | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 Water-soluble fluid is recommended. |        |                                      |        |                        |        |

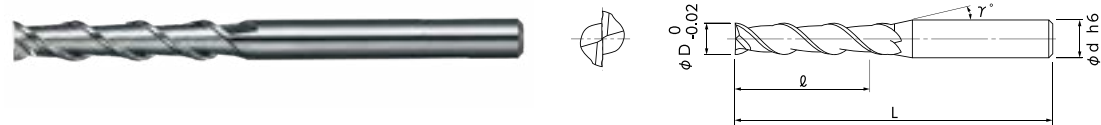
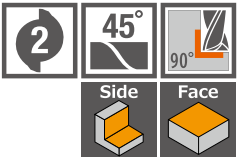




2-Flute L/D=5 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=5  
Reducing chattering and burr by cutting edge design for aluminium



- AL-series realized a stable and high efficient machining.
- It exhibits stable excellent surface on a wide area and no chattering occurs even during high speed cutting.

Aluminium Alloy **N**

Copper **N**

Resin **N**

Aluminium Alloy **N**

Copper **N**

Resin **N**



Square



Square

| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00634-00100 | 1           | 5                    | 9°                               | 4                 | 50                    |
| 01-00634-00150 | 1.5         | 7.5                  | 9°                               | 4                 | 50                    |
| 01-00634-00200 | 2           | 10                   | 9°                               | 4                 | 50                    |
| 01-00634-00250 | 2.5         | 12.5                 | 9°                               | 4                 | 50                    |
| 01-00634-00300 | 3           | 15                   | 9°                               | 6                 | 55                    |
| 01-00634-00400 | 4           | 20                   | 9°                               | 6                 | 60                    |
| 01-00634-00500 | 5           | 25                   | 9°                               | 6                 | 65                    |
| 01-00634-00600 | 6           | 30                   | —                                | 6                 | 75                    |
| 01-00634-00700 | 7           | 35                   | 9°                               | 8                 | 90                    |
| 01-00634-00800 | 8           | 40                   | —                                | 8                 | 90                    |
| 01-00634-00900 | 9           | 45                   | 9°                               | 10                | 100                   |
| 01-00634-01000 | 10          | 50                   | —                                | 10                | 100                   |
| 01-00634-01100 | 11          | 55                   | 9°                               | 12                | 110                   |
| 01-00634-01200 | 12          | 60                   | —                                | 12                | 110                   |

How to Order

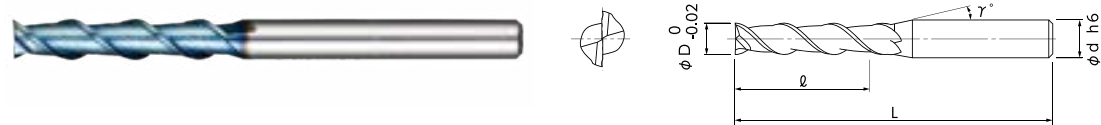
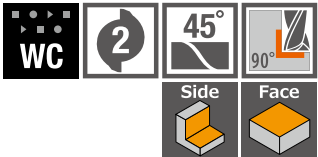
When you order, indicate AL5D-2 (D).    ※ (  $\gamma$  ) is reference value.

| Work Material                  | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                      |        | Aluminium Alloy<br>A2017・A5052・A7075 |        | Aluminium Cast<br>AC8C |        |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------|--------|------------------------|--------|
| Cutting Speed                  | 160m/min                                                                                                                                                                                                                                                                                                                                                                                |        | 230m/min                             |        | 120m/min               |        |
| Dia.                           | Side Milling                                                                                                                                                                                                                                                                                                                                                                            |        | Side Milling                         |        | Side Milling           |        |
|                                | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed                        | Feed   | Spindle Speed          | Feed   |
|                                | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup>      | mm/min |
| 1                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 200    | 20,000                               | 200    | 20,000                 | 200    |
| 1.5                            | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 250    | 20,000                               | 250    | 20,000                 | 300    |
| 2                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 300    | 20,000                               | 300    | 19,000                 | 300    |
| 2.5                            | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 400    | 20,000                               | 400    | 15,300                 | 300    |
| 3                              | 17,000                                                                                                                                                                                                                                                                                                                                                                                  | 450    | 20,000                               | 450    | 12,700                 | 400    |
| 4                              | 12,700                                                                                                                                                                                                                                                                                                                                                                                  | 500    | 18,000                               | 700    | 9,600                  | 400    |
| 5                              | 10,000                                                                                                                                                                                                                                                                                                                                                                                  | 650    | 14,600                               | 700    | 7,600                  | 400    |
| 6                              | 8,500                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 12,000                               | 800    | 6,400                  | 400    |
| 7                              | 7,300                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 10,500                               | 900    | 5,500                  | 450    |
| 8                              | 6,400                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 9,100                                | 900    | 4,800                  | 500    |
| 9                              | 5,700                                                                                                                                                                                                                                                                                                                                                                                   | 700    | 8,100                                | 1,000  | 4,300                  | 550    |
| 10                             | 5,100                                                                                                                                                                                                                                                                                                                                                                                   | 700    | 7,300                                | 1,000  | 3,800                  | 550    |
| 11                             | 4,600                                                                                                                                                                                                                                                                                                                                                                                   | 750    | 6,700                                | 1,100  | 3,500                  | 550    |
| 12                             | 4,300                                                                                                                                                                                                                                                                                                                                                                                   | 800    | 6,100                                | 1,100  | 3,200                  | 600    |
| Depth of Cut<br><br>(D : Dia.) | <div>Side Milling</div>                                                                                                                                                                                                                                                                                                                                                                 |        |                                      |        |                        |        |
| Notes                          | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 Water-soluble fluid is recommended. |        |                                      |        |                        |        |

DLC COATING 2-Flute L/D=5 End Mill for Aluminium

Recommended Milling Conditions

2-flute end mill for aluminium. L/D=5.  
DLC coating applied for longer tool life



● Adopted NS TOOL original DLC COATING that suitable for long time machining.



| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00664-00100 | 1           | 5                    | 9°                               | 4                 | 50                    |
| 01-00664-00150 | 1.5         | 7.5                  | 9°                               | 4                 | 50                    |
| 01-00664-00200 | 2           | 10                   | 9°                               | 4                 | 50                    |
| 01-00664-00250 | 2.5         | 12.5                 | 9°                               | 4                 | 50                    |
| 01-00664-00300 | 3           | 15                   | 9°                               | 6                 | 55                    |
| 01-00664-00400 | 4           | 20                   | 9°                               | 6                 | 60                    |
| 01-00664-00500 | 5           | 25                   | 9°                               | 6                 | 65                    |
| 01-00664-00600 | 6           | 30                   | —                                | 6                 | 75                    |
| 01-00664-00700 | 7           | 35                   | 9°                               | 8                 | 90                    |
| 01-00664-00800 | 8           | 40                   | —                                | 8                 | 90                    |
| 01-00664-00900 | 9           | 45                   | 9°                               | 10                | 100                   |
| 01-00664-01000 | 10          | 50                   | —                                | 10                | 100                   |
| 01-00664-01100 | 11          | 55                   | 9°                               | 12                | 110                   |
| 01-00664-01200 | 12          | 60                   | —                                | 12                | 110                   |

How to Order

When you order, indicate AL5D-2DLC (D). ※( $\gamma$ ) is reference value.

| Work Material                 | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                      |        | Aluminium Alloy<br>A2017·A5052·A7075 |        | Aluminium Cast<br>AC8C |        |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------|--------|------------------------|--------|
| Cutting Speed                 | 160m/min                                                                                                                                                                                                                                                                                                                                                                                |        | 230m/min                             |        | 120m/min               |        |
| Dia.                          | Side Milling                                                                                                                                                                                                                                                                                                                                                                            |        | Side Milling                         |        | Side Milling           |        |
|                               | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Spindle Speed                        | Feed   | Spindle Speed          | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                       | mm/min | min <sup>-1</sup>                    | mm/min | min <sup>-1</sup>      | mm/min |
| 1                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 200    | 20,000                               | 200    | 20,000                 | 200    |
| 1.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 250    | 20,000                               | 250    | 20,000                 | 300    |
| 2                             | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 300    | 20,000                               | 300    | 19,000                 | 300    |
| 2.5                           | 20,000                                                                                                                                                                                                                                                                                                                                                                                  | 400    | 20,000                               | 400    | 15,300                 | 300    |
| 3                             | 17,000                                                                                                                                                                                                                                                                                                                                                                                  | 450    | 20,000                               | 450    | 12,700                 | 400    |
| 4                             | 12,700                                                                                                                                                                                                                                                                                                                                                                                  | 500    | 18,000                               | 700    | 9,600                  | 400    |
| 5                             | 10,000                                                                                                                                                                                                                                                                                                                                                                                  | 650    | 14,600                               | 700    | 7,600                  | 400    |
| 6                             | 8,500                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 12,000                               | 800    | 6,400                  | 400    |
| 7                             | 7,300                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 10,500                               | 900    | 5,500                  | 450    |
| 8                             | 6,400                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 9,100                                | 900    | 4,800                  | 500    |
| 9                             | 5,700                                                                                                                                                                                                                                                                                                                                                                                   | 700    | 8,100                                | 1,000  | 4,300                  | 550    |
| 10                            | 5,100                                                                                                                                                                                                                                                                                                                                                                                   | 700    | 7,300                                | 1,000  | 3,800                  | 550    |
| 11                            | 4,600                                                                                                                                                                                                                                                                                                                                                                                   | 750    | 6,700                                | 1,100  | 3,500                  | 550    |
| 12                            | 4,300                                                                                                                                                                                                                                                                                                                                                                                   | 800    | 6,100                                | 1,100  | 3,200                  | 600    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div>                                                                                                                                                                                                                                                                                                                                                                 |        |                                      |        |                        |        |
| Notes                         | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 Water-soluble fluid is recommended. |        |                                      |        |                        |        |

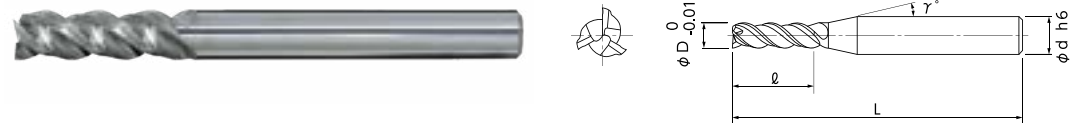
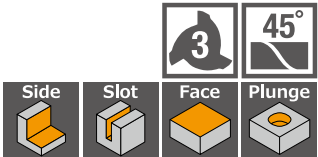




High efficient 3-Flute End Mill for Aluminium L/D=3 ※Listed at “High Efficient Milling” as well (Page K-012)

Recommended Milling Conditions

For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting



- AL-series realized a stable and high efficient machining.
- It exhibits stable excellent surface on a wide area and no chattering occurs even during high speed cutting.
- Realized high efficiency machining by adopting 3 flutes.

| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00639-00100 | 1           | 3                    | 12°                              | 4                 | 60                    |
| 01-00639-00200 | 2           | 6                    | 12°                              | 4                 | 60                    |
| 01-00639-00300 | 3           | 9                    | 12°                              | 6                 | 60                    |
| 01-00639-00400 | 4           | 12                   | 12°                              | 6                 | 70                    |
| 01-00639-00500 | 5           | 15                   | 12°                              | 6                 | 80                    |
| 01-00639-00600 | 6           | 18                   | —                                | 6                 | 80                    |
| 01-00639-00800 | 8           | 24                   | —                                | 8                 | 90                    |
| 01-00639-01000 | 10          | 30                   | —                                | 10                | 100                   |
| 01-00639-01200 | 12          | 36                   | —                                | 12                | 110                   |

How to Order When you order, indicate AL3D-345 (D). ※( $\gamma$ ) is reference value.

Machining case W-020

| Work Material                  | Aluminium A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                   |        |                   |        | Aluminium Alloy A2017・A5052・A7075 |        |                   |        |                   |        | Aluminium Cast AC8C |        |                   |        |                   |        |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|-------------------|--------|-----------------------------------|--------|-------------------|--------|-------------------|--------|---------------------|--------|-------------------|--------|-------------------|--------|
| Cutting Speed                  | 300m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        | 220m/min          |        | 220m/min          |        | 330m/min                          |        | 240m/min          |        | 240m/min          |        | 250m/min            |        | 160m/min          |        | 160m/min          |        |
| Dia.                           | Side Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |        | Slotting          |        | Plunging          |        | Side Milling                      |        | Slotting          |        | Plunging          |        | Side Milling        |        | Slotting          |        | Plunging          |        |
|                                | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   | Spindle Speed                     | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   | Spindle Speed       | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   |
|                                | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                              | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>                 | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup>   | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 1                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,200  | 20,000            | 500    | 20,000            | 100    | 20,000                            | 1,200  | 20,000            | 500    | 20,000            | 100    | 20,000              | 1,200  | 20,000            | 500    | 20,000            | 80     |
| 2                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1,800  | 20,000            | 700    | 20,000            | 150    | 20,000                            | 1,800  | 20,000            | 700    | 20,000            | 150    | 20,000              | 1,800  | 20,000            | 700    | 20,000            | 130    |
| 3                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,000  | 20,000            | 1,000  | 20,000            | 150    | 20,000                            | 2,000  | 20,000            | 1,000  | 20,000            | 150    | 20,000              | 2,000  | 17,000            | 850    | 17,000            | 130    |
| 4                              | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 17,500            | 1,100  | 17,500            | 150    | 20,000                            | 2,200  | 19,000            | 1,100  | 19,000            | 200    | 20,000              | 2,200  | 13,000            | 850    | 13,000            | 100    |
| 5                              | 19,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 14,000            | 1,100  | 14,000            | 150    | 20,000                            | 2,700  | 15,500            | 1,200  | 15,500            | 200    | 16,000              | 2,200  | 10,000            | 850    | 10,000            | 80     |
| 6                              | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 11,500            | 1,100  | 11,500            | 150    | 17,500                            | 3,000  | 12,500            | 1,300  | 12,500            | 200    | 13,500              | 2,200  | 8,500             | 850    | 8,500             | 80     |
| 8                              | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2,200  | 9,000             | 1,200  | 9,000             | 100    | 13,000                            | 3,000  | 9,500             | 1,400  | 9,500             | 200    | 10,000              | 2,300  | 6,500             | 850    | 6,500             | 60     |
| 10                             | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,200  | 7,000             | 1,300  | 7,000             | 70     | 10,500                            | 3,250  | 7,500             | 1,500  | 7,500             | 150    | 8,000               | 2,500  | 5,000             | 900    | 5,000             | 50     |
| 12                             | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,400  | 6,000             | 1,400  | 6,000             | 70     | 9,000                             | 3,350  | 6,500             | 1,600  | 6,500             | 150    | 6,500               | 2,600  | 4,000             | 1,000  | 4,000             | 50     |
| Depth of Cut<br><br>(D : Dia.) | <div>Side Milling</div> <div>Slotting</div>                                                                                                                                                                                                                                                                                                                                                                                                                                    |        |                   |        |                   |        |                                   |        |                   |        |                   |        |                     |        |                   |        |                   |        |
| Notes                          | ※ 1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※ 2 Use a rigid and precise machine and chuck holder.<br>※ 3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※ 4 When tending to have chip packing during plunging, step milling is recommended.<br>※ 5 Water-soluble fluid is recommended. |        |                   |        |                   |        |                                   |        |                   |        |                   |        |                     |        |                   |        |                   |        |

N Aluminium Alloy

N Copper

N Resin

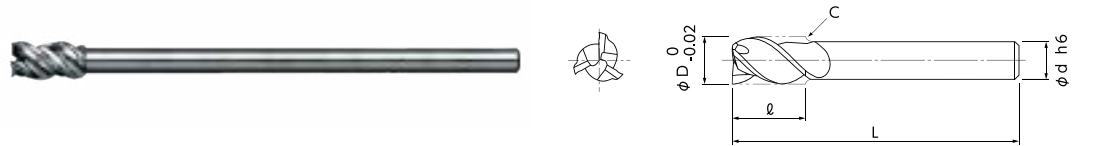




3-Flute Long Shank End Mill for Aluminium

Recommended Milling Conditions

3-flute long shank end mill for aluminium for deeper area milling



- Slimmed shank suits side milling.
- Corner-C at flute end effects an accurate side step milling.

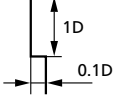
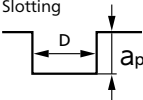
Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|-------------------|-----------------------|
| 01-00637-00500 | 5           | 7.5                  | 4                 | 80                    |
| 01-00637-00600 | 6           | 9                    | 4                 | 80                    |
| 01-00637-00800 | 8           | 12                   | 6                 | 110                   |
| 01-00637-01000 | 10          | 15                   | 8                 | 130                   |
| 01-00637-01200 | 12          | 18                   | 10                | 150                   |

How to Order

When you order, indicate AL-3LS (D).

| Work Material | Aluminium<br>A1070 |          |                   | Aluminium Alloy<br>A2017・A5052・A7075 |          |                   | Aluminium Cast<br>AC8C |          |                   |
|---------------|--------------------|----------|-------------------|--------------------------------------|----------|-------------------|------------------------|----------|-------------------|
| Cutting Speed | 100~250m/min       |          |                   | 150~300m/min                         |          |                   | 100~200m/min           |          |                   |
| Dia.          | Spindle<br>Speed   | Feed     |                   | Spindle<br>Speed                     | Feed     |                   | Spindle<br>Speed       | Feed     |                   |
|               |                    | Slotting | Side Mill-<br>ing |                                      | Slotting | Side Mill-<br>ing |                        | Slotting | Side Mill-<br>ing |
|               | min <sup>-1</sup>  | mm/min   |                   | min <sup>-1</sup>                    | mm/min   |                   | min <sup>-1</sup>      | mm/min   |                   |
| 5             | 16,000             | 1,200    | 1,700             | 19,000                               | 1,700    | 2,300             | 13,000                 | 1,200    | 1,600             |
| 6             | 13,000             | 1,000    | 1,400             | 16,000                               | 1,400    | 1,900             | 10,600                 | 900      | 1,100             |
| 8             | 10,000             | 1,350    | 1,800             | 12,000                               | 2,000    | 2,500             | 8,000                  | 1,200    | 1,500             |
| 10            | 8,000              | 1,450    | 1,900             | 9,500                                | 1,850    | 2,500             | 6,300                  | 1,200    | 1,700             |
| 12            | 6,600              | 1,400    | 1,700             | 7,900                                | 1,750    | 2,800             | 5,300                  | 1,200    | 1,600             |

| Depth of Cut | <div><div>Side Milling</div><div>Slotting</div><div><math>a_p</math><br/><math>\phi 5、6=0.1D</math><br/><math>\phi 8=0.2D</math><br/><math>\phi 10、12=0.3D</math></div></div> | Above recommended milling conditions are based on 4D overhang.<br>In case of more than 4D overhang, refer to the below table.                                                                                                                                                                                                                                                                                                                                                                                                                          |              |                            |              |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------|--------------|--|--------------|--|----------|--------------|----------|--------------|----|-----|-----|-----|---------------------------|----|-----|-----|-----|---------------------------|----|-----|-----|
|              |                                                                                                                                                                                                                                                                                                                                                     | <table><tr><th rowspan="2">Overhang</th><th rowspan="2">Spindle Speed</th><th colspan="2">Feed</th><th colspan="2">Depth of Cut</th></tr><tr><th>Slotting</th><th>Side Milling</th><th>Slotting</th><th>Side Milling</th></tr><tr><td>5D</td><td>70%</td><td>70%</td><td>60%</td><td><math>a_p 1D \times a_e 0.05D</math></td></tr><tr><td>6D</td><td>50%</td><td>50%</td><td>40%</td><td><math>a_p 1D \times a_e 0.03D</math></td></tr><tr><td>7D</td><td>30%</td><td>30%</td><td>20%</td><td><math>a_p 1D \times a_e 0.015D</math></td></tr></table> | Overhang     | Spindle Speed              | Feed         |  | Depth of Cut |  | Slotting | Side Milling | Slotting | Side Milling | 5D | 70% | 70% | 60% | $a_p 1D \times a_e 0.05D$ | 6D | 50% | 50% | 40% | $a_p 1D \times a_e 0.03D$ | 7D | 30% | 30% |
| Overhang     | Spindle Speed                                                                                                                                                                                                                                                                                                                                       | Feed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |                            | Depth of Cut |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
|              |                                                                                                                                                                                                                                                                                                                                                     | Slotting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Side Milling | Slotting                   | Side Milling |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
| 5D           | 70%                                                                                                                                                                                                                                                                                                                                                 | 70%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 60%          | $a_p 1D \times a_e 0.05D$  |              |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
| 6D           | 50%                                                                                                                                                                                                                                                                                                                                                 | 50%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 40%          | $a_p 1D \times a_e 0.03D$  |              |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
| 7D           | 30%                                                                                                                                                                                                                                                                                                                                                 | 30%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 20%          | $a_p 1D \times a_e 0.015D$ |              |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
| (D: Dia.)    |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |              |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |
| Notes        | <div>※1 Adjust both spindle speed and feed at the same rate.</div> <div>※2 Use a rigid and precise machine and chuck holder.</div> <div>※3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.</div> <div>※4 Water-soluble fluid is recommended.</div>             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |                            |              |  |              |  |          |              |          |              |    |     |     |     |                           |    |     |     |     |                           |    |     |     |



Square



Square

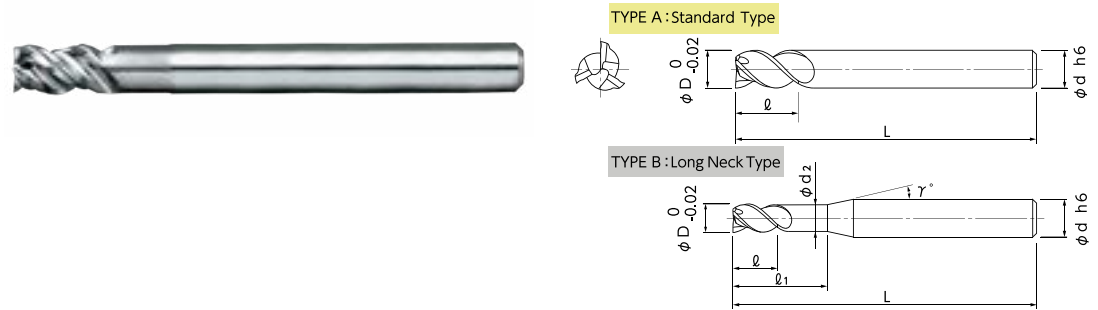
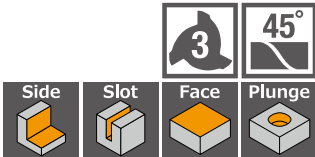




High efficient 3-Flute End Mill for Aluminium L/D=1.5 ※Listed at “High Efficient Milling” as well (Page K-020)

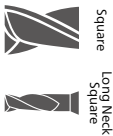
High efficient 3-Flute End Mill for Aluminium L/D=1.5

For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting



- AL-series realized a stable and high efficient machining.
- Improved plunging capacity!
- High performance with better chip disposal.
- Add new 5D Under neck length type and long shank type to become 124 sizes!

- Aluminium Alloy **N**
- Copper **N**
- Resin **N**



| Unit : mm      |          |                        |                   |      |                |                      |                |                    |
|----------------|----------|------------------------|-------------------|------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Under neck Length (ℓ1) | Length of Cut (ℓ) | Type | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00636-00100 | 1        | 3                      | 1.5               | B    | 0.95           | 12°                  | 4              | 45                 |
| 01-00636-00102 | 1        | 5                      | 1.5               |      | 0.95           | 12°                  | 4              | 60                 |
| 01-00636-00110 | 1.1      | 3.3                    | 1.7               |      | 1.05           | 12°                  | 4              | 45                 |
| 01-00636-00120 | 1.2      | 3.6                    | 1.8               |      | 1.15           | 12°                  | 4              | 45                 |
| 01-00636-00130 | 1.3      | 3.9                    | 2                 |      | 1.25           | 12°                  | 4              | 45                 |
| 01-00636-00140 | 1.4      | 4.2                    | 2.1               |      | 1.35           | 12°                  | 4              | 45                 |
| 01-00636-00150 | 1.5      | 4.5                    | 2.3               |      | 1.45           | 12°                  | 4              | 45                 |
| 01-00636-00160 | 1.6      | 4.8                    | 2.4               |      | 1.55           | 12°                  | 4              | 45                 |
| 01-00636-00170 | 1.7      | 5.1                    | 2.6               |      | 1.65           | 12°                  | 4              | 45                 |
| 01-00636-00180 | 1.8      | 5.4                    | 2.7               |      | 1.74           | 12°                  | 4              | 45                 |
| 01-00636-00190 | 1.9      | 5.7                    | 2.9               |      | 1.84           | 12°                  | 4              | 45                 |
| 01-00636-00200 | 2        | 6                      | 3                 |      | 1.94           | 12°                  | 4              | 45                 |
| 01-00636-00202 | 2        | 10                     | 3                 |      | 1.94           | 12°                  | 4              | 60                 |
| 01-00636-00210 | 2.1      | 6.3                    | 3.2               |      | 2              | 12°                  | 4              | 45                 |
| 01-00636-00220 | 2.2      | 6.6                    | 3.3               |      | 2.1            | 12°                  | 4              | 45                 |
| 01-00636-00230 | 2.3      | 6.9                    | 3.5               |      | 2.2            | 12°                  | 4              | 45                 |
| 01-00636-00240 | 2.4      | 7.2                    | 3.6               |      | 2.3            | 12°                  | 4              | 45                 |
| 01-00636-00250 | 2.5      | 7.5                    | 3.8               |      | 2.4            | 12°                  | 4              | 45                 |
| 01-00636-00260 | 2.6      | 7.8                    | 3.9               |      | 2.45           | 12°                  | 6              | 55                 |
| 01-00636-00270 | 2.7      | 8.1                    | 4.1               |      | 2.55           | 12°                  | 6              | 55                 |
| 01-00636-00280 | 2.8      | 8.4                    | 4.2               |      | 2.65           | 12°                  | 6              | 55                 |
| 01-00636-00290 | 2.9      | 8.7                    | 4.4               |      | 2.75           | 12°                  | 6              | 55                 |
| 01-00636-00300 | 3        | 9                      | 4.5               |      | 2.85           | 12°                  | 6              | 55                 |
| 01-00636-00302 | 3        | 15                     | 4.5               |      | 2.85           | 12°                  | 6              | 60                 |
| 01-00636-00310 | 3.1      | 9.3                    | 4.7               |      | 2.95           | 12°                  | 6              | 55                 |
| 01-00636-00320 | 3.2      | 9.6                    | 4.8               |      | 3.05           | 12°                  | 6              | 55                 |

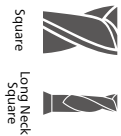
How to Order

When you order, indicate ALZ345 (D) [x(ℓ1)]. Indicate (L) for Type A. ※(γ) is reference value.

- I : Semi-standard item, please inquire for price and delivery.

| Unit : mm      |          |                        |                   |      |                |                      |                |                    |
|----------------|----------|------------------------|-------------------|------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Under neck Length (ℓ1) | Length of Cut (ℓ) | Type | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00636-00330 | 3.3      | 9.9                    | 5                 | B    | 3.15           | 12°                  | 6              | 55                 |
| 01-00636-00340 | 3.4      | 10.2                   | 5.1               |      | 3.25           | 12°                  | 6              | 55                 |
| 01-00636-00350 | 3.5      | 10.5                   | 5.3               |      | 3.35           | 12°                  | 6              | 55                 |
| 01-00636-00360 | 3.6      | 10.8                   | 5.4               |      | 3.45           | 12°                  | 6              | 55                 |
| 01-00636-00370 | 3.7      | 11.1                   | 5.6               |      | 3.55           | 12°                  | 6              | 55                 |
| 01-00636-00380 | 3.8      | 11.4                   | 5.7               |      | 3.65           | 12°                  | 6              | 55                 |
| 01-00636-00390 | 3.9      | 11.7                   | 5.9               |      | 3.75           | 12°                  | 6              | 55                 |
| 01-00636-00400 | 4        | 12                     | 6                 |      | 3.8            | 12°                  | 6              | 55                 |
| 01-00636-00402 | 4        | 20                     | 6                 |      | 3.8            | 12°                  | 6              | 70                 |
| 01-00636-00410 | 4.1      | 12.3                   | 6.2               |      | 3.9            | 12°                  | 6              | 55                 |
| 01-00636-00420 | 4.2      | 12.6                   | 6.3               |      | 4              | 12°                  | 6              | 55                 |
| 01-00636-00430 | 4.3      | 12.9                   | 6.5               |      | 4.1            | 12°                  | 6              | 55                 |
| 01-00636-00440 | 4.4      | 13.2                   | 6.6               |      | 4.2            | 12°                  | 6              | 55                 |
| 01-00636-00450 | 4.5      | 13.5                   | 6.8               |      | 4.3            | 12°                  | 6              | 55                 |
| 01-00636-00460 | 4.6      | 13.8                   | 6.9               |      | 4.4            | 12°                  | 6              | 55                 |
| 01-00636-00470 | 4.7      | 14.1                   | 7.1               |      | 4.5            | 12°                  | 6              | 55                 |
| 01-00636-00480 | 4.8      | 14.4                   | 7.2               |      | 4.6            | 12°                  | 6              | 55                 |
| 01-00636-00490 | 4.9      | 14.7                   | 7.4               |      | 4.7            | 12°                  | 6              | 55                 |
| 01-00636-00500 | 5        | 15                     | 7.5               |      | 4.8            | 12°                  | 6              | 55                 |
| 01-00636-00502 | 5        | 25                     | 7.5               |      | 4.8            | 12°                  | 6              | 80                 |
| 01-00636-00510 | 5.1      | 15.3                   | 7.7               |      | 4.9            | 12°                  | 6              | 55                 |
| 01-00636-00520 | 5.2      | 15.6                   | 7.8               |      | 5              | 12°                  | 6              | 55                 |
| 01-00636-00530 | 5.3      | 15.9                   | 8                 |      | 5.1            | 12°                  | 6              | 55                 |
| 01-00636-00540 | 5.4      | 16.2                   | 8.1               |      | 5.2            | 12°                  | 6              | 55                 |
| 01-00636-00550 | 5.5      | 16.5                   | 8.3               |      | 5.3            | 12°                  | 6              | 55                 |
| 01-00636-00560 | 5.6      | 16.8                   | 8.4               |      | 5.4            | 12°                  | 6              | 55                 |
| 01-00636-00570 | 5.7      | 17.1                   | 8.6               |      | 5.5            | 12°                  | 6              | 55                 |
| 01-00636-00580 | 5.8      | 17.4                   | 8.7               |      | 5.6            | 12°                  | 6              | 55                 |
| 01-00636-00590 | 5.9      | 17.7                   | 8.9               |      | 5.7            | 12°                  | 6              | 55                 |
| 01-00636-00603 | 6        | —                      | 9                 | B    | —              | —                    | 6              | 110                |
| 01-00636-00600 | 6        | 18                     | 9                 |      | 5.8            | —                    | 6              | 60                 |
| 01-00636-00602 | 6        | 30                     | 9                 |      | 5.8            | —                    | 6              | 80                 |
| 01-00636-00610 | 6.1      | 18.3                   | 9.2               |      | 5.9            | 12°                  | 8              | 70                 |
| 01-00636-00620 | 6.2      | 18.6                   | 9.3               |      | 6              | 12°                  | 8              | 70                 |
| 01-00636-00630 | 6.3      | 18.9                   | 9.5               |      | 6.1            | 12°                  | 8              | 70                 |
| 01-00636-00640 | 6.4      | 19.2                   | 9.6               |      | 6.2            | 12°                  | 8              | 70                 |
| 01-00636-00650 | 6.5      | 19.5                   | 9.8               |      | 6.3            | 12°                  | 8              | 70                 |
| 01-00636-00660 | 6.6      | 19.8                   | 9.9               |      | 6.4            | 12°                  | 8              | 70                 |
| 01-00636-00670 | 6.7      | 20.1                   | 10.1              |      | 6.5            | 12°                  | 8              | 70                 |
| 01-00636-00680 | 6.8      | 20.4                   | 10.2              |      | 6.6            | 12°                  | 8              | 70                 |
| 01-00636-00690 | 6.9      | 20.7                   | 10.4              |      | 6.7            | 12°                  | 8              | 70                 |
| 01-00636-00700 | 7        | 21                     | 10.5              |      | 6.8            | 12°                  | 8              | 70                 |
| 01-00636-00710 | 7.1      | 21.3                   | 10.7              |      | 6.9            | 12°                  | 8              | 70                 |
| 01-00636-00720 | 7.2      | 21.6                   | 10.8              |      | 7              | 12°                  | 8              | 70                 |
| 01-00636-00730 | 7.3      | 21.9                   | 11                |      | 7.1            | 12°                  | 8              | 70                 |
| 01-00636-00740 | 7.4      | 22.2                   | 11.1              |      | 7.2            | 12°                  | 8              | 70                 |
| 01-00636-00750 | 7.5      | 22.5                   | 11.3              |      | 7.3            | 12°                  | 8              | 70                 |
| 01-00636-00760 | 7.6      | 22.8                   | 11.4              |      | 7.4            | 12°                  | 8              | 70                 |
| 01-00636-00770 | 7.7      | 23.1                   | 11.6              |      | 7.5            | 12°                  | 8              | 70                 |
| 01-00636-00780 | 7.8      | 23.4                   | 11.7              |      | 7.6            | 12°                  | 8              | 70                 |

- Aluminium Alloy **N**
- Copper **N**
- Resin **N**



Aluminium Milling

ALZ345

High efficient 3-Flute End Mill for Aluminium L/D=1.5

Aluminium Alloy

Copper

Resin

Unit : mm

| Code No.       | Dia. (D) | Under neck Length (ℓ1) | Length of Cut (ℓ) | Type | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|------------------------|-------------------|------|----------------|----------------------|----------------|--------------------|
| 01-00636-00790 | 7.9      | 23.7                   | 11.9              | B    | 7.7            | 12°                  | 8              | 70                 |
| 01-00636-00803 | 8        | —                      | 12                | A    | —              | —                    | 8              | 120                |
| 01-00636-00800 | 8        | 24                     | 12                | B    | 7.8            | —                    | 8              | 70                 |
| 01-00636-00802 | 8        | 40                     | 12                |      | 7.8            | —                    | 8              | 90                 |
| 01-00636-00810 | 8.1      | 24.3                   | 12.2              |      | 7.9            | 12°                  | 10             | 75                 |
| 01-00636-00820 | 8.2      | 24.6                   | 12.3              |      | 8              | 12°                  | 10             | 75                 |
| 01-00636-00830 | 8.3      | 24.9                   | 12.5              |      | 8.1            | 12°                  | 10             | 75                 |
| 01-00636-00840 | 8.4      | 25.2                   | 12.6              |      | 8.2            | 12°                  | 10             | 75                 |
| 01-00636-00850 | 8.5      | 25.5                   | 12.8              |      | 8.3            | 12°                  | 10             | 75                 |
| 01-00636-00860 | 8.6      | 25.8                   | 12.9              |      | 8.4            | 12°                  | 10             | 75                 |
| 01-00636-00870 | 8.7      | 26.1                   | 13.1              |      | 8.5            | 12°                  | 10             | 75                 |
| 01-00636-00880 | 8.8      | 26.4                   | 13.2              |      | 8.6            | 12°                  | 10             | 75                 |
| 01-00636-00890 | 8.9      | 26.7                   | 13.4              |      | 8.7            | 12°                  | 10             | 75                 |
| 01-00636-00900 | 9        | 27                     | 13.5              |      | 8.8            | 12°                  | 10             | 75                 |
| 01-00636-00910 | 9.1      | 27.3                   | 13.7              |      | 8.9            | 12°                  | 10             | 75                 |
| 01-00636-00920 | 9.2      | 27.6                   | 13.8              |      | 9              | 12°                  | 10             | 75                 |
| 01-00636-00930 | 9.3      | 27.9                   | 14                |      | 9.1            | 12°                  | 10             | 75                 |
| 01-00636-00940 | 9.4      | 28.2                   | 14.1              |      | 9.2            | 12°                  | 10             | 75                 |
| 01-00636-00950 | 9.5      | 28.5                   | 14.3              |      | 9.3            | 12°                  | 10             | 75                 |
| 01-00636-00960 | 9.6      | 28.8                   | 14.4              |      | 9.4            | 12°                  | 10             | 75                 |
| 01-00636-00970 | 9.7      | 29.1                   | 14.6              |      | 9.5            | 12°                  | 10             | 75                 |
| 01-00636-00980 | 9.8      | 29.4                   | 14.7              |      | 9.6            | 12°                  | 10             | 75                 |
| 01-00636-00990 | 9.9      | 29.7                   | 14.9              |      | 9.7            | 12°                  | 10             | 75                 |
| 01-00636-01003 | 10       | —                      | 15                | A    | —              | —                    | 10             | 130                |
| 01-00636-01000 | 10       | 30                     | 15                | B    | 9.8            | —                    | 10             | 75                 |
| 01-00636-01002 | 10       | 50                     | 15                |      | 9.8            | —                    | 10             | 100                |
| 01-00636-01010 | 10.1     | 30.3                   | 15.2              |      | 9.9            | 12°                  | 12             | 80                 |
| 01-00636-01020 | 10.2     | 30.6                   | 15.3              |      | 10             | 12°                  | 12             | 80                 |
| 01-00636-01030 | 10.3     | 30.9                   | 15.5              |      | 10.1           | 12°                  | 12             | 80                 |
| 01-00636-01040 | 10.4     | 31.2                   | 15.6              |      | 10.2           | 12°                  | 12             | 80                 |
| 01-00636-01050 | 10.5     | 31.5                   | 15.8              |      | 10.3           | 12°                  | 12             | 80                 |
| 01-00636-01060 | 10.6     | 31.8                   | 15.9              |      | 10.4           | 12°                  | 12             | 80                 |
| 01-00636-01070 | 10.7     | 32.1                   | 16.1              |      | 10.5           | 12°                  | 12             | 80                 |
| 01-00636-01080 | 10.8     | 32.4                   | 16.2              |      | 10.6           | 12°                  | 12             | 80                 |
| 01-00636-01090 | 10.9     | 32.7                   | 16.4              |      | 10.7           | 12°                  | 12             | 80                 |
| 01-00636-01100 | 11       | 33                     | 16.5              |      | 10.8           | 12°                  | 12             | 80                 |
| 01-00636-01110 | 11.1     | 33.3                   | 16.7              |      | 10.9           | 12°                  | 12             | 80                 |
| 01-00636-01120 | 11.2     | 33.6                   | 16.8              |      | 11             | 12°                  | 12             | 80                 |
| 01-00636-01130 | 11.3     | 33.9                   | 17                |      | 11.1           | 12°                  | 12             | 80                 |
| 01-00636-01140 | 11.4     | 34.2                   | 17.1              |      | 11.2           | 12°                  | 12             | 80                 |
| 01-00636-01150 | 11.5     | 34.5                   | 17.3              |      | 11.3           | 12°                  | 12             | 80                 |
| 01-00636-01160 | 11.6     | 34.8                   | 17.4              |      | 11.4           | 12°                  | 12             | 80                 |
| 01-00636-01170 | 11.7     | 35.1                   | 17.6              |      | 11.5           | 12°                  | 12             | 80                 |
| 01-00636-01180 | 11.8     | 35.4                   | 17.7              |      | 11.6           | 12°                  | 12             | 80                 |
| 01-00636-01190 | 11.9     | 35.7                   | 17.9              |      | 11.7           | 12°                  | 12             | 80                 |
| 01-00636-01203 | 12       | —                      | 18                | A    | —              | —                    | 12             | 150                |
| 01-00636-01200 | 12       | 36                     | 18                | B    | 11.8           | —                    | 12             | 80                 |
| 01-00636-01202 | 12       | 60                     | 18                |      | 11.8           | —                    | 12             | 110                |

How to Order

When you order, indicate ALZ345 (D) [x(ℓ1)]. Indicate (L) for TypeA.      ※(γ) is reference value.

Aluminium Alloy

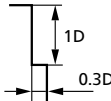
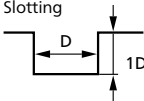
Copper

Resin

ALZ345

Recommended Milling Conditions

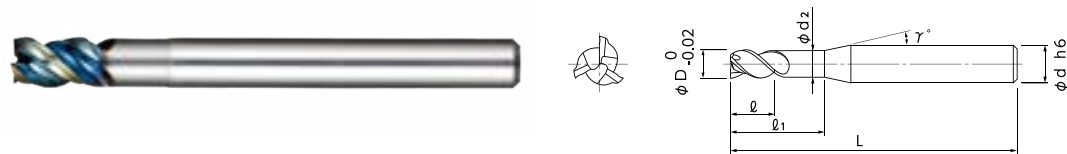
| Work Material          |                   | Aluminium A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |          |              | Aluminium Alloy A2017・A5052・A7075 |          |          |              | Aluminium Cast AC8C |          |          |              |
|------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|--------------|-----------------------------------|----------|----------|--------------|---------------------|----------|----------|--------------|
| Cutting Speed          |                   | 310m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |          |          |              | 350m/min                          |          |          |              | 230m/min            |          |          |              |
| Dia.                   | Under neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Feed     |          |              | Spindle Speed                     | Feed     |          |              | Spindle Speed       | Feed     |          |              |
|                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Plunging | Slotting | Side Milling |                                   | Plunging | Slotting | Side Milling |                     | Plunging | Slotting | Side Milling |
|                        |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mm/min   |          |              | min <sup>-1</sup>                 | mm/min   |          |              | min <sup>-1</sup>   | mm/min   |          |              |
| 1                      | 3                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200      | 600      | 1,100        | 20,000                            | 200      | 600      | 1,100        | 20,000              | 150      | 600      | 1,100        |
|                        | 5                 | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 160      | 500      | 900          | 16,000                            | 160      | 500      | 900          | 16,000              | 120      | 500      | 900          |
| 2                      | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300      | 900      | 1,500        | 20,000                            | 300      | 900      | 1,500        | 20,000              | 250      | 900      | 1,500        |
|                        | 10                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 240      | 800      | 1,200        | 16,000                            | 240      | 800      | 1,200        | 16,000              | 200      | 800      | 1,200        |
| 3                      | 9                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300      | 1,200    | 2,000        | 20,000                            | 300      | 1,400    | 2,200        | 20,000              | 250      | 1,200    | 2,200        |
|                        | 15                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 240      | 1,000    | 1,600        | 16,000                            | 240      | 1,200    | 1,800        | 16,000              | 200      | 1,000    | 1,800        |
| 4                      | 12                | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300      | 1,400    | 2,200        | 20,000                            | 400      | 1,800    | 2,500        | 18,300              | 200      | 1,400    | 2,300        |
|                        | 20                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 240      | 1,200    | 1,800        | 16,000                            | 320      | 1,500    | 2,000        | 14,600              | 160      | 1,200    | 1,900        |
| 5                      | 15                | 19,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300      | 1,500    | 2,500        | 20,000                            | 400      | 2,200    | 3,100        | 14,600              | 150      | 1,400    | 2,100        |
|                        | 25                | 15,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 240      | 1,200    | 2,000        | 16,000                            | 320      | 1,800    | 2,500        | 11,700              | 120      | 1,200    | 1,700        |
| 6                      | —                 | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300      | 1,600    | 2,500        | 18,600                            | 400      | 2,500    | 3,500        | 12,200              | 150      | 1,400    | 2,100        |
|                        | 18                | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300      | 1,600    | 2,500        | 18,600                            | 400      | 2,500    | 3,500        | 12,200              | 150      | 1,400    | 2,100        |
|                        | 30                | 13,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 240      | 1,300    | 2,000        | 14,800                            | 320      | 2,000    | 2,800        | 9,700               | 120      | 1,200    | 1,700        |
| 7                      | 21                | 14,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200      | 1,600    | 2,500        | 15,900                            | 400      | 2,500    | 3,500        | 10,500              | 140      | 1,400    | 2,100        |
| 8                      | —                 | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200      | 1,700    | 2,500        | 13,900                            | 400      | 2,600    | 3,500        | 9,200               | 120      | 1,400    | 2,200        |
|                        | 24                | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200      | 1,700    | 2,500        | 13,900                            | 400      | 2,600    | 3,500        | 9,200               | 120      | 1,400    | 2,200        |
|                        | 40                | 9,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 160      | 1,400    | 2,000        | 11,100                            | 320      | 2,100    | 2,800        | 7,300               | 100      | 1,200    | 1,800        |
| 9                      | 27                | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200      | 1,700    | 2,500        | 12,400                            | 300      | 2,600    | 3,500        | 8,100               | 120      | 1,400    | 2,200        |
| 10                     | —                 | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100      | 1,700    | 2,500        | 11,100                            | 300      | 2,600    | 3,800        | 7,300               | 80       | 1,400    | 2,200        |
|                        | 30                | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100      | 1,700    | 2,500        | 11,100                            | 300      | 2,600    | 3,800        | 7,300               | 80       | 1,400    | 2,200        |
|                        | 50                | 7,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 80       | 1,400    | 2,000        | 8,800                             | 240      | 2,100    | 3,000        | 5,800               | 70       | 1,200    | 1,800        |
| 11                     | 33                | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100      | 1,800    | 2,600        | 10,100                            | 300      | 2,600    | 4,100        | 6,700               | 80       | 1,400    | 2,200        |
| 12                     | —                 | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100      | 1,900    | 2,700        | 9,300                             | 300      | 2,600    | 4,100        | 6,100               | 60       | 1,500    | 2,200        |
|                        | 36                | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100      | 1,900    | 2,700        | 9,300                             | 300      | 2,600    | 4,100        | 6,100               | 60       | 1,500    | 2,200        |
|                        | 60                | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 80       | 1,500    | 2,200        | 7,400                             | 240      | 2,100    | 3,200        | 4,800               | 50       | 1,200    | 1,800        |
| Depth of Cut (D: Dia.) |                   | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |          |              |                                   |          |          |              |                     |          |          |              |
| Notes                  |                   | ※1 Adjust both spindle speed and feed at the same rate. (When using spindle speed 20,000 or more, the same adjustment is required.)<br>※2 TYPE A : Recommended milling conditions for standard type are at overhang 3D. Adjust spindle speed and feed rate at 80% for overhang 5D, and 50% for 7D.<br>※3 Use a rigid and precise machine and chuck holder.<br>※4 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※5 When tending to have chip packing during plunging, step milling is recommended.<br>※6 Water-soluble fluid is recommended. |          |          |              |                                   |          |          |              |                     |          |          |              |

| Work Material                 |                         | Aluminium<br>A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |          |                 | Aluminium Alloy<br>A2017・A5052・A7075 |          |          |                 | Aluminium Cast<br>AC8C |          |          |                 |
|-------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------|--------------------------------------|----------|----------|-----------------|------------------------|----------|----------|-----------------|
| Cutting Speed                 |                         | 310m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |          |                 | 350m/min                             |          |          |                 | 230m/min               |          |          |                 |
| Dia.                          | Under<br>neck<br>Length | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Feed     |          |                 | Spindle<br>Speed                     | Feed     |          |                 | Spindle<br>Speed       | Feed     |          |                 |
|                               |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Plunging | Slotting | Side<br>Milling |                                      | Plunging | Slotting | Side<br>Milling |                        | Plunging | Slotting | Side<br>Milling |
|                               |                         | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | mm/min   |          |                 | min <sup>-1</sup>                    | mm/min   |          |                 | min <sup>-1</sup>      | mm/min   |          |                 |
| 1                             | 3                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 600      | 1,100           | 20,000                               | 200      | 600      | 1,100           | 20,000                 | 150      | 600      | 1,100           |
|                               | 5                       | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 160      | 500      | 900             | 16,000                               | 160      | 500      | 900             | 16,000                 | 120      | 500      | 900             |
| 2                             | 6                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 900      | 1,500           | 20,000                               | 300      | 900      | 1,500           | 20,000                 | 250      | 900      | 1,500           |
|                               | 10                      | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 240      | 800      | 1,200           | 16,000                               | 240      | 800      | 1,200           | 16,000                 | 200      | 800      | 1,200           |
| 3                             | 9                       | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,200    | 2,000           | 20,000                               | 300      | 1,400    | 2,200           | 20,000                 | 250      | 1,200    | 2,200           |
|                               | 15                      | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 240      | 1,000    | 1,600           | 16,000                               | 240      | 1,200    | 1,800           | 16,000                 | 200      | 1,000    | 1,800           |
| 4                             | 12                      | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,400    | 2,200           | 20,000                               | 400      | 1,800    | 2,500           | 18,300                 | 200      | 1,400    | 2,300           |
|                               | 20                      | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 240      | 1,200    | 1,800           | 16,000                               | 320      | 1,500    | 2,000           | 14,600                 | 160      | 1,200    | 1,900           |
| 5                             | 15                      | 19,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,500    | 2,500           | 20,000                               | 400      | 2,200    | 3,100           | 14,600                 | 150      | 1,400    | 2,100           |
|                               | 25                      | 15,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 240      | 1,200    | 2,000           | 16,000                               | 320      | 1,800    | 2,500           | 11,700                 | 120      | 1,200    | 1,700           |
| 6                             | —                       | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,600    | 2,500           | 18,600                               | 400      | 2,500    | 3,500           | 12,200                 | 150      | 1,400    | 2,100           |
|                               | 18                      | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300      | 1,600    | 2,500           | 18,600                               | 400      | 2,500    | 3,500           | 12,200                 | 150      | 1,400    | 2,100           |
|                               | 30                      | 13,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 240      | 1,300    | 2,000           | 14,800                               | 320      | 2,000    | 2,800           | 9,700                  | 120      | 1,200    | 1,700           |
| 7                             | 21                      | 14,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,600    | 2,500           | 15,900                               | 400      | 2,500    | 3,500           | 10,500                 | 140      | 1,400    | 2,100           |
| 8                             | —                       | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,700    | 2,500           | 13,900                               | 400      | 2,600    | 3,500           | 9,200                  | 120      | 1,400    | 2,200           |
|                               | 24                      | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,700    | 2,500           | 13,900                               | 400      | 2,600    | 3,500           | 9,200                  | 120      | 1,400    | 2,200           |
|                               | 40                      | 9,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 160      | 1,400    | 2,000           | 11,100                               | 320      | 2,100    | 2,800           | 7,300                  | 100      | 1,200    | 1,800           |
| 9                             | 27                      | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200      | 1,700    | 2,500           | 12,400                               | 300      | 2,600    | 3,500           | 8,100                  | 120      | 1,400    | 2,200           |
| 10                            | —                       | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,700    | 2,500           | 11,100                               | 300      | 2,600    | 3,800           | 7,300                  | 80       | 1,400    | 2,200           |
|                               | 30                      | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,700    | 2,500           | 11,100                               | 300      | 2,600    | 3,800           | 7,300                  | 80       | 1,400    | 2,200           |
|                               | 50                      | 7,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 80       | 1,400    | 2,000           | 8,800                                | 240      | 2,100    | 3,000           | 5,800                  | 70       | 1,200    | 1,800           |
| 11                            | 33                      | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,800    | 2,600           | 10,100                               | 300      | 2,600    | 4,100           | 6,700                  | 80       | 1,400    | 2,200           |
| 12                            | —                       | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,900    | 2,700           | 9,300                                | 300      | 2,600    | 4,100           | 6,100                  | 60       | 1,500    | 2,200           |
|                               | 36                      | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 100      | 1,900    | 2,700           | 9,300                                | 300      | 2,600    | 4,100           | 6,100                  | 60       | 1,500    | 2,200           |
|                               | 60                      | 6,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 80       | 1,500    | 2,200           | 7,400                                | 240      | 2,100    | 3,200           | 4,800                  | 50       | 1,200    | 1,800           |
| Depth of Cut<br><br>(D: Dia.) |                         | <div><div><div>Side Milling</div></div><div><div>Slotting</div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |          |                 |                                      |          |          |                 |                        |          |          |                 |
| Notes                         |                         | <div>※1 Adjust both spindle speed and feed at the same rate.<br/>(When using spindle speed 20,000 or more, the same adjustment is required.)</div> <div>※2 TYPE A : Recommended milling conditions for standard type are at overhang 3D. Adjust spindle speed and feed rate at 80% for overhang 5D, and 50% for 7D.</div> <div>※3 Use a rigid and precise machine and chuck holder.</div> <div>※4 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.</div> <div>※5 When tending to have chip packing during plunging, step milling is recommended.</div> <div>※6 Water-soluble fluid is recommended.</div> |          |          |                 |                                      |          |          |                 |                        |          |          |                 |

DLC COATING high efficient 3-Flute End Mill for Aluminium L/D=1.5 ※Listed at “High Efficient Milling” as well (Page K-018)

Recommended Milling Conditions

For machining on aluminium alloy. Continuous machining from plunging without guide-hole and stepping to slotting



● Adopted NS TOOL original DLC COATING that suitable for long time machining.

| Work Material             | Aluminium A1070                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |          |              | Aluminium Alloy A2017・A5052・A7075 |          |          |              | Aluminium Cast AC8C |          |          |              |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|--------------|-----------------------------------|----------|----------|--------------|---------------------|----------|----------|--------------|
| Cutting Speed             | 310m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |          |              | 350m/min                          |          |          |              | 230m/min            |          |          |              |
| Dia.                      | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Feed     |          |              | Spindle Speed                     | Feed     |          |              | Spindle Speed       | Feed     |          |              |
|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Plunging | Slotting | Side Milling |                                   | Plunging | Slotting | Side Milling |                     | Plunging | Slotting | Side Milling |
|                           | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                         | mm/min   |          |              | min <sup>-1</sup>                 | mm/min   |          |              | min <sup>-1</sup>   | mm/min   |          |              |
| 1                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 200      | 600      | 1,100        | 20,000                            | 200      | 600      | 1,100        | 20,000              | 150      | 600      | 1,100        |
| 2                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300      | 900      | 1,500        | 20,000                            | 300      | 900      | 1,500        | 20,000              | 250      | 900      | 1,500        |
| 3                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300      | 1,200    | 2,000        | 20,000                            | 300      | 1,400    | 2,200        | 20,000              | 250      | 1,200    | 2,200        |
| 4                         | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300      | 1,400    | 2,200        | 20,000                            | 400      | 1,800    | 2,500        | 18,300              | 200      | 1,400    | 2,300        |
| 5                         | 19,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300      | 1,500    | 2,500        | 20,000                            | 400      | 2,200    | 3,100        | 14,600              | 150      | 1,400    | 2,100        |
| 6                         | 16,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300      | 1,600    | 2,500        | 18,600                            | 400      | 2,500    | 3,500        | 12,200              | 150      | 1,400    | 2,100        |
| 7                         | 14,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 200      | 1,600    | 2,500        | 15,900                            | 400      | 2,500    | 3,500        | 10,500              | 140      | 1,400    | 2,100        |
| 8                         | 12,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 200      | 1,700    | 2,500        | 13,900                            | 400      | 2,600    | 3,500        | 9,200               | 120      | 1,400    | 2,200        |
| 9                         | 11,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 200      | 1,700    | 2,500        | 12,400                            | 300      | 2,600    | 3,500        | 8,100               | 120      | 1,400    | 2,200        |
| 10                        | 9,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100      | 1,700    | 2,500        | 11,100                            | 300      | 2,600    | 3,800        | 7,300               | 80       | 1,400    | 2,200        |
| 11                        | 9,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100      | 1,800    | 2,600        | 10,100                            | 300      | 2,600    | 4,100        | 6,700               | 80       | 1,400    | 2,200        |
| 12                        | 8,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 100      | 1,900    | 2,700        | 9,300                             | 300      | 2,600    | 4,100        | 6,100               | 60       | 1,500    | 2,200        |
| Depth of Cut<br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                     |          |          |              |                                   |          |          |              |                     |          |          |              |
| Notes                     | ※1 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※2 Use a rigid and precise machine and chuck holder.<br>※3 Adjust milling conditions when vibration and abnormal sounds occur by the conditions of the machine, chuck holder and work clamping.<br>※4 When tending to have chip packing during plunging, step milling is recommended.<br>※5 Water-soluble fluid is recommended. |          |          |              |                                   |          |          |              |                     |          |          |              |

| Unit : mm      |          |                        |                   |                |                      |                |                    |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Under neck Length (l1) | Length of Cut (l) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00666-00100 | 1        | 3                      | 1.5               | 0.95           | 12°                  | 4              | 45                 |
| 01-00666-00150 | 1.5      | 4.5                    | 2.3               | 1.45           | 12°                  | 4              | 45                 |
| 01-00666-00200 | 2        | 6                      | 3                 | 1.94           | 12°                  | 4              | 45                 |
| 01-00666-00250 | 2.5      | 7.5                    | 3.8               | 2.4            | 12°                  | 4              | 45                 |
| 01-00666-00300 | 3        | 9                      | 4.5               | 2.85           | 12°                  | 6              | 55                 |
| 01-00666-00350 | 3.5      | 10.5                   | 5.3               | 3.35           | 12°                  | 6              | 55                 |
| 01-00666-00400 | 4        | 12                     | 6                 | 3.8            | 12°                  | 6              | 55                 |
| 01-00666-00450 | 4.5      | 13.5                   | 6.8               | 4.3            | 12°                  | 6              | 55                 |
| 01-00666-00500 | 5        | 15                     | 7.5               | 4.8            | 12°                  | 6              | 55                 |
| 01-00666-00550 | 5.5      | 16.5                   | 8.3               | 5.3            | 12°                  | 6              | 55                 |
| 01-00666-00600 | 6        | 18                     | 9                 | 5.8            | —                    | 6              | 60                 |
| 01-00666-00700 | 7        | 21                     | 10.5              | 6.8            | 12°                  | 8              | 70                 |
| 01-00666-00800 | 8        | 24                     | 12                | 7.8            | —                    | 8              | 70                 |
| 01-00666-00900 | 9        | 27                     | 13.5              | 8.8            | 12°                  | 10             | 75                 |
| 01-00666-01000 | 10       | 30                     | 15                | 9.8            | —                    | 10             | 75                 |
| 01-00666-01100 | 11       | 33                     | 16.5              | 10.8           | 12°                  | 12             | 80                 |
| 01-00666-01200 | 12       | 36                     | 18                | 11.8           | —                    | 12             | 80                 |

How to Order

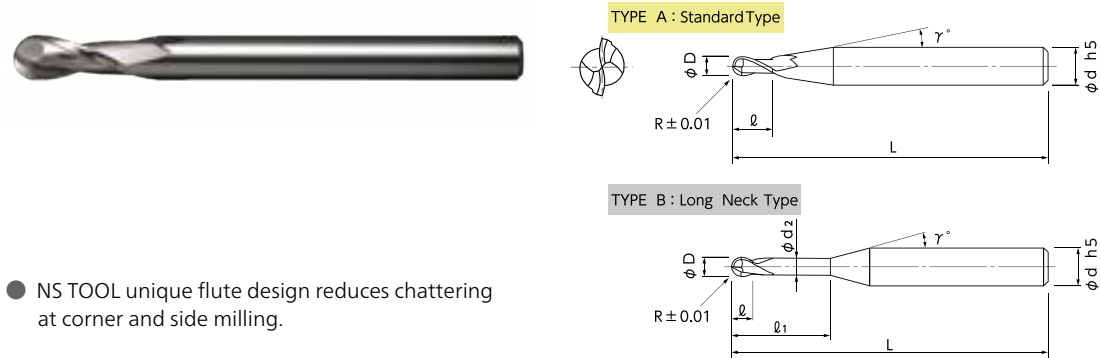
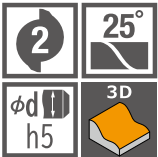
When you order, indicate ALZ345-DLC.    ※(γ) is reference value.



Ball End Mill for Aluminium

Recommended Milling Conditions

Ball end mill for aluminium.  
Reducing chatterting even for milling at corner and curved surface



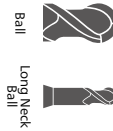
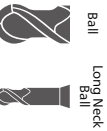
● NS TOOL unique flute design reduces chatterting at corner and side milling.

| Unit : mm      |            |                   |                        |      |          |                |                       |                |                    |
|----------------|------------|-------------------|------------------------|------|----------|----------------|-----------------------|----------------|--------------------|
| Code No.       | Radius (R) | Length of Cut (ℓ) | Under neck Length (ℓ1) | Type | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ°) | Shank Dia. (d) | Overall Length (L) |
| 01-00638-03001 | R0.3       | 0.45              | 3                      | B    | 0.6      | 0.56           | 12°                   | 4              | 60                 |
| 01-00638-04001 | R0.4       | 0.6               | 4                      | B    | 0.8      | 0.76           | 12°                   | 4              | 60                 |
| 01-00638-05001 | R0.5       | 2                 | —                      | A    | 1        | —              | 12°                   | 4              | 60                 |
| 01-00638-05011 |            | 0.75              | 5                      | B    | 1        | 0.95           | 12°                   | 4              | 60                 |
| 01-00638-05013 |            |                   | 10                     | B    | 1        | 0.95           | 12°                   | 4              | 60                 |
| 01-00638-07501 | R0.75      | 3                 | —                      | A    | 1.5      | —              | 12°                   | 4              | 60                 |
| 01-00638-07511 |            | 1.1               | 7.5                    | B    | 1.5      | 1.45           | 12°                   | 4              | 60                 |
| 01-00638-07513 |            |                   | 15                     | B    | 1.5      | 1.45           | 12°                   | 4              | 60                 |
| 01-00638-10001 | R1         | 4                 | —                      | A    | 2        | —              | 12°                   | 4              | 60                 |
| 01-00638-10011 |            | 1.5               | 10                     | B    | 2        | 1.94           | 12°                   | 4              | 60                 |
| 01-00638-10013 |            |                   | 20                     | B    | 2        | 1.94           | 12°                   | 4              | 60                 |
| 01-00638-15001 | R1.5       | 6                 | —                      | A    | 3        | —              | 12°                   | 6              | 60                 |
| 01-00638-15011 |            | 2.5               | 15                     | B    | 3        | 2.85           | 12°                   | 6              | 60                 |
| 01-00638-15013 |            |                   | 30                     | B    | 3        | 2.85           | 12°                   | 6              | 70                 |
| 01-00638-20001 | R2         | 8                 | —                      | A    | 4        | —              | 12°                   | 6              | 70                 |
| 01-00638-20011 |            | 3                 | 20                     | B    | 4        | 3.8            | 12°                   | 6              | 80                 |
| 01-00638-20013 |            |                   | 40                     | B    | 4        | 3.8            | 12°                   | 6              | 90                 |
| 01-00638-25001 | R2.5       | 10                | —                      | A    | 5        | —              | 12°                   | 6              | 80                 |
| 01-00638-25011 |            | 3.5               | 25                     | B    | 5        | 4.8            | 12°                   | 6              | 80                 |
| 01-00638-25013 |            |                   | 50                     | B    | 5        | 4.8            | 12°                   | 6              | 100                |
| 01-00638-30001 | R3         | 12                | —                      | A    | 6        | —              | —                     | 6              | 90                 |
| 01-00638-30011 |            | 6                 | 30                     | B    | 6        | 5.8            | —                     | 6              | 90                 |
| 01-00638-30013 |            |                   | 60                     | B    | 6        | 5.8            | —                     | 6              | 120                |
| 01-00638-40001 | R4         | 16                | —                      | A    | 8        | —              | —                     | 8              | 90                 |
| 01-00638-50001 | R5         | 20                | —                      | A    | 10       | —              | —                     | 10             | 100                |
| 01-00638-60001 | R6         | 24                | —                      | A    | 12       | —              | —                     | 12             | 110                |

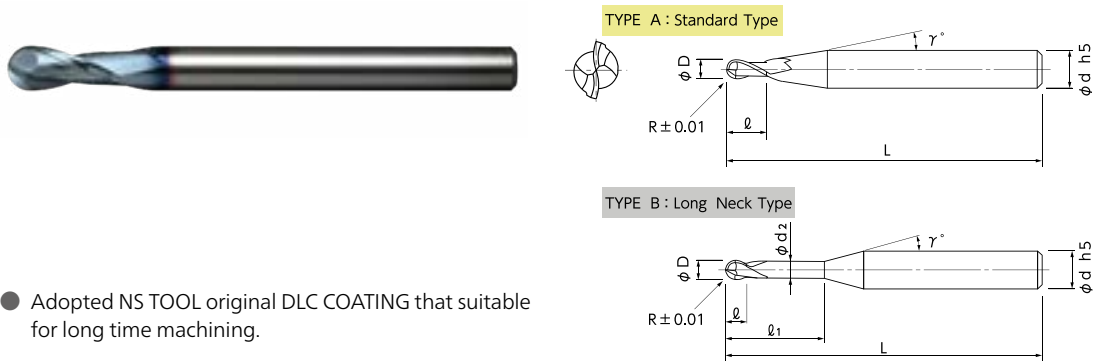
How to Order

When you order, indicate ALB225 (R)×(ℓ) [×(ℓ1)]. ※(γ) is reference value.

| Work Material |               | Aluminium Alloy<br>A2017・A5052・A7075                                                                                                                                                                                                                                                                                                                                                                                                                                             |                   |        |              |            |                   |        |                |
|---------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------|--------------|------------|-------------------|--------|----------------|
|               |               | Normal Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |        |              | High Speed |                   |        |                |
| Tool Overhung |               | L / D ≥ 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |        |              | L / D < 10 |                   |        |                |
| Radius        | Length of Cut | Under neck Length                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Spindle Speed     | Feed   | Depth of Cut |            | Spindle Speed     | Feed   | Depth of Cut   |
|               |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | min <sup>-1</sup> | mm/min | ap mm        | ae mm      | min <sup>-1</sup> | mm/min | ap mm<br>ae mm |
| 0.3           | 0.45          | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20,000            | 1,000  | 0.1          | 0.2        | 40,000            | 2,000  | 0.1<br>0.2     |
| 0.4           | 0.6           | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20,000            | 1,000  | 0.1          | 0.2        | 40,000            | 2,000  | 0.1<br>0.2     |
| 0.5           | 2             | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20,000            | 2,000  | 0.3          | 0.3        | 40,000            | 4,000  | 0.3<br>0.3     |
|               | 0.75          | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20,000            | 1,500  | 0.3          | 0.3        | 30,000            | 3,000  | 0.3<br>0.3     |
| 0.75          | 0.75          | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10,000            | 1,000  | 0.2          | 0.2        | 20,000            | 2,000  | 0.2<br>0.2     |
|               | 3             | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20,000            | 2,000  | 0.3          | 0.5        | 40,000            | 4,000  | 0.3<br>0.5     |
| 1             | 1.1           | 7.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 16,000            | 1,600  | 0.3          | 0.5        | 30,000            | 3,000  | 0.3<br>0.5     |
|               | 1.1           | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10,000            | 1,000  | 0.2          | 0.3        | 20,000            | 2,000  | 0.2<br>0.3     |
|               | 4             | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20,000            | 2,000  | 0.5          | 0.5        | 30,000            | 4,000  | 0.5<br>0.5     |
| 1.5           | 1.5           | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 15,000            | 1,500  | 0.3          | 0.5        | 20,000            | 3,000  | 0.3<br>0.5     |
|               | 1.5           | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 12,000            | 1,200  | 0.2          | 0.5        | 15,000            | 2,000  | 0.2<br>0.5     |
|               | 6             | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 18,000            | 2,000  | 0.6          | 1          | 25,000            | 4,000  | 0.6<br>1       |
| 2             | 2.5           | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 15,000            | 1,600  | 0.6          | 1          | 20,000            | 3,000  | 0.6<br>1       |
|               | 2.5           | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 12,000            | 1,200  | 0.3          | 1          | 15,000            | 2,000  | 0.3<br>1       |
|               | 8             | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 14,000            | 2,000  | 0.5          | 1.5        | 20,000            | 4,000  | 0.5<br>1.5     |
| 2.5           | 3             | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 12,000            | 1,500  | 0.5          | 1.5        | 16,000            | 3,000  | 0.5<br>1.5     |
|               | 3             | 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8,000             | 1,000  | 0.3          | 1.5        | 12,000            | 2,000  | 0.3<br>1.5     |
|               | 10            | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 12,000            | 3,000  | 0.8          | 1.8        | 20,000            | 5,000  | 0.8<br>1.8     |
| 3             | 3.5           | 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8,000             | 2,000  | 0.8          | 1.8        | 15,000            | 3,000  | 0.8<br>1.8     |
|               | 3.5           | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5,000             | 1,500  | 0.5          | 1.8        | 10,000            | 2,000  | 0.5<br>1.8     |
|               | 12            | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 12,000            | 3,000  | 1            | 2          | 20,000            | 5,000  | 1<br>2         |
| 4             | 6             | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8,000             | 2,000  | 1            | 2          | 15,000            | 4,000  | 1<br>2         |
|               | 6             | 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5,000             | 1,200  | 0.6          | 2          | 10,000            | 2,000  | 0.6<br>2       |
| 4             | 16            | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10,000            | 2,000  | 1            | 2          | 15,000            | 3,000  | 1<br>2         |
| 5             | 20            | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8,000             | 2,000  | 2            | 3          | 12,000            | 3,000  | 2<br>3         |
| 6             | 24            | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6,000             | 2,000  | 3            | 4          | 10,000            | 3,000  | 3<br>4         |
| Notes         |               | ※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※3 Use a rigid and precise machine and chuck holder.<br>※4 Adjust milling conditions when vibration and abnormal sounds occur according to the rigidity of the machine and the chuck holder, or work clamping condition.<br>※5 Water-soluble fluid is recommended. |                   |        |              |            |                   |        |                |



Ball end mill for aluminium. DLC coating applied for longer tool life



| Unit : mm      |            |                   |                        |      |          |                |                      |                |                    |
|----------------|------------|-------------------|------------------------|------|----------|----------------|----------------------|----------------|--------------------|
| Code No.       | Radius (R) | Length of Cut (ℓ) | Under neck Length (ℓ1) | Type | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00668-03001 | R0.3       | 0.45              | 3                      | B    | 0.6      | 0.56           | 12°                  | 4              | 60                 |
| 01-00668-04001 | R0.4       | 0.6               | 4                      | B    | 0.8      | 0.76           | 12°                  | 4              | 60                 |
| 01-00668-05001 | R0.5       | 2                 | —                      | A    | 1        | —              | 12°                  | 4              | 60                 |
| 01-00668-05011 |            | 0.75              | 5                      | B    | 1        | 0.95           | 12°                  | 4              | 60                 |
| 01-00668-05013 |            |                   | 10                     | B    | 1        | 0.95           | 12°                  | 4              | 60                 |
| 01-00668-07501 | R0.75      | 3                 | —                      | A    | 1.5      | —              | 12°                  | 4              | 60                 |
| 01-00668-07511 |            | 1.1               | 7.5                    | B    | 1.5      | 1.45           | 12°                  | 4              | 60                 |
| 01-00668-07513 |            |                   | 15                     | B    | 1.5      | 1.45           | 12°                  | 4              | 60                 |
| 01-00668-10001 | R1         | 4                 | —                      | A    | 2        | —              | 12°                  | 4              | 60                 |
| 01-00668-10011 |            | 1.5               | 10                     | B    | 2        | 1.94           | 12°                  | 4              | 60                 |
| 01-00668-10013 |            |                   | 20                     | B    | 2        | 1.94           | 12°                  | 4              | 60                 |
| 01-00668-15001 | R1.5       | 6                 | —                      | A    | 3        | —              | 12°                  | 6              | 60                 |
| 01-00668-15011 |            | 2.5               | 15                     | B    | 3        | 2.85           | 12°                  | 6              | 60                 |
| 01-00668-15013 |            |                   | 30                     | B    | 3        | 2.85           | 12°                  | 6              | 70                 |
| 01-00668-20001 | R2         | 8                 | —                      | A    | 4        | —              | 12°                  | 6              | 70                 |
| 01-00668-20011 |            | 3                 | 20                     | B    | 4        | 3.8            | 12°                  | 6              | 80                 |
| 01-00668-20013 |            |                   | 40                     | B    | 4        | 3.8            | 12°                  | 6              | 90                 |
| 01-00668-25001 | R2.5       | 10                | —                      | A    | 5        | —              | 12°                  | 6              | 80                 |
| 01-00668-25011 |            | 3.5               | 25                     | B    | 5        | 4.8            | 12°                  | 6              | 80                 |
| 01-00668-25013 |            |                   | 50                     | B    | 5        | 4.8            | 12°                  | 6              | 100                |
| 01-00668-30001 | R3         | 12                | —                      | A    | 6        | —              | —                    | 6              | 90                 |
| 01-00668-30011 |            | 6                 | 30                     | B    | 6        | 5.8            | —                    | 6              | 90                 |
| 01-00668-30013 |            |                   | 60                     | B    | 6        | 5.8            | —                    | 6              | 120                |
| 01-00668-40001 | R4         | 16                | —                      | A    | 8        | —              | —                    | 8              | 90                 |
| 01-00668-50001 | R5         | 20                | —                      | A    | 10       | —              | —                    | 10             | 100                |
| 01-00668-60001 | R6         | 24                | —                      | A    | 12       | —              | —                    | 12             | 110                |

How to Order When you order, indicate ALB225-DLC (R)×(ℓ) [×(ℓ1)]. ※(γ) is reference value.

| Work Material |               |                   | Aluminium Alloy<br>A2017・A5052・A7075                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |              |       |                                    |                |              |       |
|---------------|---------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------|-------|------------------------------------|----------------|--------------|-------|
|               |               |                   | Normal Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |              |       | High Speed                         |                |              |       |
| Tool Overhung |               |                   | L / D ≥ 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |              |       | L / D < 10                         |                |              |       |
| Radius        | Length of Cut | Under neck Length | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                               | Feed<br>mm/min | Depth of Cut |       | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min | Depth of Cut |       |
|               |               |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                | ap mm        | ae mm |                                    |                | ap mm        | ae mm |
| 0.3           | 0.45          | 3                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000          | 0.1          | 0.2   | 40,000                             | 2,000          | 0.1          | 0.2   |
| 0.4           | 0.6           | 4                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000          | 0.1          | 0.2   | 40,000                             | 2,000          | 0.1          | 0.2   |
| 0.5           | 2             | —                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,000          | 0.3          | 0.3   | 40,000                             | 4,000          | 0.3          | 0.3   |
|               | 0.75          | 5                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,500          | 0.3          | 0.3   | 30,000                             | 3,000          | 0.3          | 0.3   |
|               | 0.75          | 10                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000          | 0.2          | 0.2   | 20,000                             | 2,000          | 0.2          | 0.2   |
| 0.75          | 3             | —                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,000          | 0.3          | 0.5   | 40,000                             | 4,000          | 0.3          | 0.5   |
|               | 1.1           | 7.5               | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600          | 0.3          | 0.5   | 30,000                             | 3,000          | 0.3          | 0.5   |
|               | 1.1           | 15                | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,000          | 0.2          | 0.3   | 20,000                             | 2,000          | 0.2          | 0.3   |
| 1             | 4             | —                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,000          | 0.5          | 0.5   | 30,000                             | 4,000          | 0.5          | 0.5   |
|               | 1.5           | 10                | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,500          | 0.3          | 0.5   | 20,000                             | 3,000          | 0.3          | 0.5   |
|               | 1.5           | 20                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200          | 0.2          | 0.5   | 15,000                             | 2,000          | 0.2          | 0.5   |
| 1.5           | 6             | —                 | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,000          | 0.6          | 1     | 25,000                             | 4,000          | 0.6          | 1     |
|               | 2.5           | 15                | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600          | 0.6          | 1     | 20,000                             | 3,000          | 0.6          | 1     |
|               | 2.5           | 30                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,200          | 0.3          | 1     | 15,000                             | 2,000          | 0.3          | 1     |
| 2             | 8             | —                 | 14,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,000          | 0.5          | 1.5   | 20,000                             | 4,000          | 0.5          | 1.5   |
|               | 3             | 20                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,500          | 0.5          | 1.5   | 16,000                             | 3,000          | 0.5          | 1.5   |
|               | 3             | 40                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,000          | 0.3          | 1.5   | 12,000                             | 2,000          | 0.3          | 1.5   |
| 2.5           | 10            | —                 | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3,000          | 0.8          | 1.8   | 20,000                             | 5,000          | 0.8          | 1.8   |
|               | 3.5           | 25                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2,000          | 0.8          | 1.8   | 15,000                             | 3,000          | 0.8          | 1.8   |
|               | 3.5           | 50                | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,500          | 0.5          | 1.8   | 10,000                             | 2,000          | 0.5          | 1.8   |
| 3             | 12            | —                 | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3,000          | 1            | 2     | 20,000                             | 5,000          | 1            | 2     |
|               | 6             | 30                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2,000          | 1            | 2     | 15,000                             | 4,000          | 1            | 2     |
|               | 6             | 60                | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,200          | 0.6          | 2     | 10,000                             | 2,000          | 0.6          | 2     |
| 4             | 16            | —                 | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,000          | 1            | 2     | 15,000                             | 3,000          | 1            | 2     |
| 5             | 20            | —                 | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2,000          | 2            | 3     | 12,000                             | 3,000          | 2            | 3     |
| 6             | 24            | —                 | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2,000          | 3            | 4     | 10,000                             | 3,000          | 3            | 4     |
| Notes         |               |                   | ※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※2 Adjust both spindle speed and feed at the same rate.<br>(When using spindle speed 20,000 or more, the same adjustment is required.)<br>※3 Use a rigid and precise machine and chuck holder.<br>※4 Adjust milling conditions when vibration and abnormal sounds occur according to the rigidity of the machine and the chuck holder, or work clamping condition.<br>※5 Water-soluble fluid is recommended. |                |              |       |                                    |                |              |       |

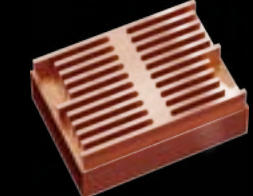
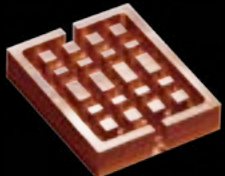


Copper Electrode Milling

Realizes overwhelming long tool life and high quality burrless cutting performance

| Model                                                                                                                                 | Size                   | Maximum Cutting Depth | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        | Number of Sizes | Page |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------|---------|-----------------|-------------|--------------|--------------|--------------|------------|---------------|---|---|---|---|---|---|---|---|---|----------------|-------------|-------------------|-----------------|----------------|--------|-----------------|------|
|                                                                                                                                       |                        |                       |         |                 |             |              |              |              |            | P             | P | P | M | N | N | N | N | N | S | H              |             |                   |                 |                |        |                 |      |
|                                                                                                                                       |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   | Hardened Steel |             |                   |                 |                |        |                 |      |
|                                                                                                                                       |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   | Carbon Steel   | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper |                 |      |
| Long Neck Square                                                                                                                      |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        |                 |      |
| DHR237                                                                                                                                | φ0.1 ~ φ6              | 12D                   | DLC     | 2               | 37.5°       | Side         | Slot         | Face         | -          | -             | - | - | - | ○ | ◎ | ◎ | ○ | - | - | -              | -           | -                 | -               | -              | 74     | M-004           |      |
| Long neck square end mill specialized for machining copper alloy. Sharpe cutting edge makes less burr and high quality surface        |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        |                 |      |
| Long Neck Ball                                                                                                                        |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        |                 |      |
| DRB230                                                                                                                                | R0.05 ~ R3             | 16D                   | DLC     | 2               | 30°         | -            | -            | -            | 3D         | -             | - | - | - | ○ | ◎ | ◎ | ○ | - | - | -              | -           | -                 | -               | -              | 94     | M-008           |      |
| Long neck ball end mill specialized for machining copper alloy. Sharpe cutting edge makes less burr and high quality surface          |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        |                 |      |
| Long Neck Corner Radius                                                                                                               |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        |                 |      |
| DHR237R                                                                                                                               | φ0.2 × R0.02 ~ φ6 × R1 | 13D                   | DLC     | 2               | 37.5°       | Side         | Slot         | Face         | -          | -             | - | - | - | ○ | ◎ | ◎ | ○ | - | - | -              | -           | -                 | -               | -              | 153    | M-014           |      |
| Long neck corner radius end mill specialized for machining copper alloy. Sharpe cutting edge makes less burr and high quality surface |                        |                       |         |                 |             |              |              |              |            |               |   |   |   |   |   |   |   |   |   |                |             |                   |                 |                |        |                 |      |

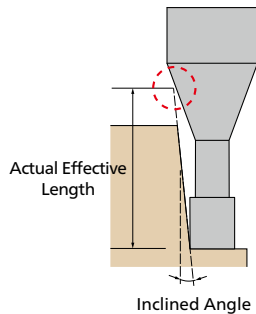
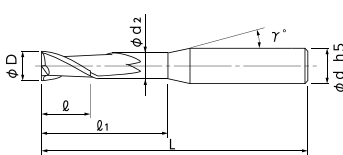
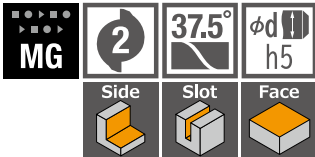
Copper Electrode Milling



Long neck square end mill specialized for machining copper alloy  
Sharpe cutting edge makes less burr and high quality surface



$D \leq 1 \phi D \begin{matrix} 0 \\ -0.006 \end{matrix}$   
 $1 < D < 6 \phi D \begin{matrix} 0 \\ -0.01 \end{matrix}$   
 $D = 6 \phi D \begin{matrix} 0 \\ -0.01 \\ -0.02 \end{matrix}$



- Long neck square end mill specialized for machining copper electrode.
- Helix angle 37.5 degrees to achieve both sharpness and finished surface quality that prevents scratches on cutting surface.
- High quality and stable milling performance with long tool life by optimized design and DLC COATING.
- Machining copper tungsten electrodes is also effective.

◆ New Size

| Code No.         | Dia.<br>(D) | Under Neck<br>Length<br>(l1) | Length<br>of Cut<br>(l) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |      |
|------------------|-------------|------------------------------|-------------------------|----------------------|-------------------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|------|
|                  |             |                              |                         |                      |                                     |                      |                          | 30°                                                                 | 1°   | 1°30' | 2°   | 3°   |
| 07-00100-01003   | 0.1         | 0.3                          | 0.2                     | 0.085                | 12°                                 | 4                    | 45                       | 0.34                                                                | 0.36 | 0.38  | 0.40 | 0.44 |
| 07-00100-01005   |             | 0.5                          | 0.2                     | 0.085                | 12°                                 | 4                    | 45                       | 0.55                                                                | 0.58 | 0.61  | 0.64 | 0.71 |
| ◆ 07-00100-01007 |             | 0.75                         | 0.2                     | 0.085                | 12°                                 | 4                    | 45                       | 0.81                                                                | 0.85 | 0.89  | 0.93 | 1.04 |
| ◆ 07-00100-01010 |             | 1                            | 0.2                     | 0.085                | 12°                                 | 4                    | 45                       | 1.07                                                                | 1.12 | 1.18  | 1.23 | 1.37 |
| 07-00100-02005   | 0.2         | 0.5                          | 0.4                     | 0.18                 | 12°                                 | 4                    | 45                       | 0.57                                                                | 0.59 | 0.62  | 0.65 | 0.72 |
| 07-00100-02010   |             | 1                            | 0.4                     | 0.18                 | 12°                                 | 4                    | 45                       | 1.09                                                                | 1.14 | 1.19  | 1.25 | 1.38 |
| 07-00100-02015   |             | 1.5                          | 0.4                     | 0.18                 | 12°                                 | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.85 | 2.05 |
| ◆ 07-00100-02020 |             | 2                            | 0.4                     | 0.18                 | 12°                                 | 4                    | 45                       | 2.13                                                                | 2.23 | 2.33  | 2.44 | 2.71 |
| 07-00100-03010   | 0.3         | 1                            | 0.6                     | 0.28                 | 12°                                 | 4                    | 45                       | 1.09                                                                | 1.14 | 1.19  | 1.25 | 1.38 |
| 07-00100-03015   |             | 1.5                          | 0.6                     | 0.28                 | 12°                                 | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.85 | 2.05 |
| 07-00100-03020   |             | 2                            | 0.6                     | 0.28                 | 12°                                 | 4                    | 45                       | 2.13                                                                | 2.23 | 2.33  | 2.44 | 2.71 |
| ◆ 07-00100-03030 |             | 3                            | 0.6                     | 0.28                 | 12°                                 | 4                    | 45                       | 3.17                                                                | 3.31 | 3.47  | 3.64 | 4.04 |
| 07-00100-04010   | 0.4         | 1                            | 0.8                     | 0.37                 | 12°                                 | 4                    | 45                       | 1.11                                                                | 1.16 | 1.22  | 1.28 | 1.42 |
| 07-00100-04020   |             | 2                            | 0.8                     | 0.37                 | 12°                                 | 4                    | 45                       | 2.15                                                                | 2.25 | 2.36  | 2.47 | 2.74 |
| 07-00100-04030   |             | 3                            | 0.8                     | 0.37                 | 12°                                 | 4                    | 45                       | 3.20                                                                | 3.34 | 3.50  | 3.67 | 4.07 |
| 07-00100-04040   |             | 4                            | 0.8                     | 0.37                 | 12°                                 | 4                    | 45                       | 4.24                                                                | 4.43 | 4.64  | 4.87 | 5.40 |
| 07-00100-05015   | 0.5         | 1.5                          | 1                       | 0.46                 | 12°                                 | 4                    | 45                       | 1.66                                                                | 1.73 | 1.81  | 1.90 | 2.11 |
| 07-00100-05020   |             | 2                            | 1                       | 0.46                 | 12°                                 | 4                    | 45                       | 2.18                                                                | 2.28 | 2.38  | 2.50 | 2.77 |
| 07-00100-05030   |             | 3                            | 1                       | 0.46                 | 12°                                 | 4                    | 45                       | 3.22                                                                | 3.37 | 3.52  | 3.70 | 4.10 |
| 07-00100-05040   |             | 4                            | 1                       | 0.46                 | 12°                                 | 4                    | 45                       | 4.26                                                                | 4.46 | 4.66  | 4.89 | 5.43 |
| 07-00100-05060   | 0.6         | 6                            | 1                       | 0.46                 | 12°                                 | 4                    | 45                       | 6.35                                                                | 6.63 | 6.95  | 7.29 | 8.08 |
| 07-00100-06020   |             | 2                            | 1.2                     | 0.56                 | 12°                                 | 4                    | 45                       | 2.18                                                                | 2.28 | 2.38  | 2.50 | 2.77 |
| 07-00100-06030   |             | 3                            | 1.2                     | 0.56                 | 12°                                 | 4                    | 45                       | 3.22                                                                | 3.37 | 3.52  | 3.70 | 4.10 |
| 07-00100-06040   |             | 4                            | 1.2                     | 0.56                 | 12°                                 | 4                    | 45                       | 4.26                                                                | 4.46 | 4.66  | 4.89 | 5.43 |
| 07-00100-06060   |             | 6                            | 1.2                     | 0.56                 | 12°                                 | 4                    | 45                       | 6.35                                                                | 6.63 | 6.95  | 7.29 | 8.08 |

How to Order

When you order, indicate DHR237 (D)×(l1).

※( $\gamma$ ) is reference value.

Machining case

W-022

| Code No.         | Dia.<br>(D) | Under Neck<br>Length<br>(l1) | Length<br>of Cut<br>(l) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|------------------|-------------|------------------------------|-------------------------|----------------------|-------------------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                  |             |                              |                         |                      |                                     |                      |                          | 30°                                                                 | 1°    | 1°30' | 2°    | 3°    |
| 07-00100-08030   | 0.8         | 3                            | 1.6                     | 0.76                 | 12°                                 | 4                    | 45                       | 3.22                                                                | 3.37  | 3.52  | 3.70  | 4.10  |
| 07-00100-08040   |             | 4                            | 1.6                     | 0.76                 | 12°                                 | 4                    | 45                       | 4.26                                                                | 4.46  | 4.66  | 4.89  | 5.43  |
| 07-00100-08060   |             | 6                            | 1.6                     | 0.76                 | 12°                                 | 4                    | 45                       | 6.35                                                                | 6.63  | 6.95  | 7.29  | 8.08  |
| 07-00100-08080   |             | 8                            | 1.6                     | 0.76                 | 12°                                 | 4                    | 50                       | 8.44                                                                | 8.81  | 9.23  | 9.68  | 10.74 |
| 07-00100-10030   | 1           | 3                            | 2                       | 0.95                 | 12°                                 | 4                    | 45                       | 3.25                                                                | 3.39  | 3.55  | 3.73  | 4.13  |
| 07-00100-10040   |             | 4                            | 2                       | 0.95                 | 12°                                 | 4                    | 45                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 07-00100-10050   |             | 5                            | 2                       | 0.95                 | 12°                                 | 4                    | 45                       | 5.33                                                                | 5.57  | 5.83  | 6.12  | 6.79  |
| 07-00100-10060   |             | 6                            | 2                       | 0.95                 | 12°                                 | 4                    | 45                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 07-00100-10080   | 1           | 8                            | 2                       | 0.95                 | 12°                                 | 4                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| 07-00100-10100   |             | 10                           | 2                       | 0.95                 | 12°                                 | 4                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 07-00100-10120   |             | 12                           | 2                       | 0.95                 | 12°                                 | 4                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| ◆ 07-00100-15040 | 1.5         | 4                            | 3                       | 1.45                 | 12°                                 | 4                    | 45                       | 4.29                                                                | 4.48  | 4.69  | 4.92  | 5.46  |
| 07-00100-15060   |             | 6                            | 3                       | 1.45                 | 12°                                 | 4                    | 50                       | 6.37                                                                | 6.66  | 6.97  | 7.32  | 8.11  |
| 07-00100-15080   |             | 8                            | 3                       | 1.45                 | 12°                                 | 4                    | 50                       | 8.46                                                                | 8.84  | 9.25  | 9.71  | 10.77 |
| ◆ 07-00100-15100 |             | 10                           | 3                       | 1.45                 | 12°                                 | 4                    | 50                       | 10.55                                                               | 11.02 | 11.53 | 12.10 | 13.42 |
| 07-00100-15120   | 1.5         | 12                           | 3                       | 1.45                 | 12°                                 | 4                    | 50                       | 12.63                                                               | 13.20 | 13.82 | 14.49 | 16.08 |
| 07-00100-15160   |             | 16                           | 3                       | 1.45                 | 12°                                 | 4                    | 60                       | 16.80                                                               | 17.55 | 18.38 | 19.28 | 21.39 |
| 07-00100-20060   | 2           | 6                            | 4                       | 1.94                 | 12°                                 | 4                    | 50                       | 6.40                                                                | 6.69  | 7.00  | 7.34  | 8.15  |
| 07-00100-20080   |             | 8                            | 4                       | 1.94                 | 12°                                 | 4                    | 50                       | 8.48                                                                | 8.86  | 9.28  | 9.74  | 10.80 |
| 07-00100-20100   |             | 10                           | 4                       | 1.94                 | 12°                                 | 4                    | 50                       | 10.57                                                               | 11.04 | 11.56 | 12.13 | 13.45 |
| 07-00100-20120   |             | 12                           | 4                       | 1.94                 | 12°                                 | 4                    | 50                       | 12.66                                                               | 13.22 | 13.84 | 14.52 | 16.11 |
| 07-00100-20140   | 2           | 14                           | 4                       | 1.94                 | 12°                                 | 4                    | 50                       | 14.74                                                               | 15.40 | 16.12 | 16.92 | 18.76 |
| 07-00100-20160   |             | 16                           | 4                       | 1.94                 | 12°                                 | 4                    | 60                       | 16.83                                                               | 17.58 | 18.40 | 19.31 | Free  |
| 07-00100-20200   |             | 20                           | 4                       | 1.94                 | 12°                                 | 4                    | 60                       | 21.00                                                               | 21.94 | 22.97 | 24.10 | Free  |
| ◆ 07-00100-25060 | 2.5         | 6                            | 5                       | 2.4                  | 12°                                 | 4                    | 45                       | 6.50                                                                | 6.79  | 7.11  | 7.46  | 8.27  |
| ◆ 07-00100-25080 |             | 8                            | 5                       | 2.4                  | 12°                                 | 4                    | 50                       | 8.58                                                                | 8.97  | 9.39  | 9.85  | 10.93 |
| ◆ 07-00100-25100 |             | 10                           | 5                       | 2.4                  | 12°                                 | 4                    | 50                       | 10.67                                                               | 11.15 | 11.67 | 12.24 | 13.58 |
| ◆ 07-00100-25120 |             | 12                           | 5                       | 2.4                  | 12°                                 | 4                    | 50                       | 12.75                                                               | 13.32 | 13.95 | 14.64 | Free  |
| ◆ 07-00100-25140 | 2.5         | 14                           | 5                       | 2.4                  | 12°                                 | 4                    | 50                       | 14.84                                                               | 15.50 | 16.23 | 17.03 | Free  |
| ◆ 07-00100-25160 |             | 16                           | 5                       | 2.4                  | 12°                                 | 4                    | 50                       | 16.93                                                               | 17.68 | 18.51 | 19.42 | Free  |
| ◆ 07-00100-25200 |             | 20                           | 5                       | 2.4                  | 12°                                 | 4                    | 60                       | 21.10                                                               | 22.04 | 23.07 | Free  | Free  |
| ◆ 07-00100-30080 | 3           | 8                            | 6                       | 2.85                 | 12°                                 | 6                    | 50                       | 8.71                                                                | 9.10  | 9.52  | 9.99  | 11.08 |
| 07-00100-30100   |             | 10                           | 6                       | 2.85                 | 12°                                 | 6                    | 50                       | 10.79                                                               | 11.27 | 11.80 | 12.38 | 13.74 |
| 07-00100-30150   |             | 15                           | 6                       | 2.85                 | 12°                                 | 6                    | 60                       | 16.01                                                               | 16.72 | 17.50 | 18.37 | 20.37 |
| 07-00100-30200   |             | 20                           | 6                       | 2.85                 | 12°                                 | 6                    | 60                       | 21.22                                                               | 22.17 | 23.21 | 24.35 | 27.01 |
| 07-00100-30250   | 3           | 25                           | 6                       | 2.85                 | 12°                                 | 6                    | 70                       | 26.43                                                               | 27.62 | 28.91 | 30.33 | Free  |
| ◆ 07-00100-40100 |             | 10                           | 8                       | 3.8                  | 12°                                 | 6                    | 50                       | 10.91                                                               | 11.40 | 11.94 | 12.52 | 13.89 |
| 07-00100-40150   |             | 15                           | 8                       | 3.8                  | 12°                                 | 6                    | 60                       | 16.13                                                               | 16.85 | 17.64 | 18.51 | 20.53 |
| 07-00100-40200   |             | 20                           | 8                       | 3.8                  | 12°                                 | 6                    | 60                       | 21.34                                                               | 22.30 | 23.34 | 24.49 | Free  |
| 07-00100-40250   | 4           | 25                           | 8                       | 3.8                  | 12°                                 | 6                    | 70                       | 26.56                                                               | 27.74 | 29.04 | Free  | Free  |
| 07-00100-40300   |             | 30                           | 8                       | 3.8                  | 12°                                 | 6                    | 70                       | 31.77                                                               | 33.19 | 34.75 | Free  | Free  |
| ◆ 07-00100-50150 |             | 15                           | 10                      | 4.8                  | 12°                                 | 6                    | 50                       | 16.13                                                               | 16.85 | 17.64 | Free  | Free  |
| ◆ 07-00100-50200 |             | 20                           | 10                      | 4.8                  | 12°                                 | 6                    | 60                       | 21.34                                                               | 22.30 | Free  | Free  | Free  |
| ◆ 07-00100-50250 | 5           | 25                           | 10                      | 4.8                  | 12°                                 | 6                    | 60                       | 26.56                                                               | 27.74 | Free  | Free  | Free  |
| ◆ 07-00100-50300 |             | 30                           | 10                      | 4.8                  | 12°                                 | 6                    | 70                       | 31.77                                                               | Free  | Free  | Free  | Free  |
| ◆ 07-00100-60150 |             | 15                           | 12                      | 5.8                  | —                                   | 6                    | 50                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00100-60200   |             | 20                           | 12                      | 5.8                  | —                                   | 6                    | 60                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00100-60300   | 6           | 30                           | 12                      | 5.8                  | —                                   | 6                    | 70                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00100-60500   |             | 50                           | 12                      | 5.8                  | —                                   | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free  |



| Work Material |                   |      | Copper            |        |              |       |                   |        |              | Copper Tungsten (W70%-Cu30%) |        |              |       |                   |        |              |
|---------------|-------------------|------|-------------------|--------|--------------|-------|-------------------|--------|--------------|------------------------------|--------|--------------|-------|-------------------|--------|--------------|
| Dia.          | Under Neck Length | L/D  | Side Milling      |        |              |       | Slotting          |        |              | Side Milling                 |        |              |       | Slotting          |        |              |
|               |                   |      | Spindle Speed     | Feed   | Depth of Cut |       | Spindle Speed     | Feed   | Depth of Cut | Spindle Speed                | Feed   | Depth of Cut |       | Spindle Speed     | Feed   | Depth of Cut |
|               |                   |      |                   |        | ap mm        | ae mm |                   |        |              |                              |        | ap mm        | ae mm |                   |        |              |
|               |                   |      | min <sup>-1</sup> | mm/min | ap mm        | ae mm | min <sup>-1</sup> | mm/min | ap mm        | min <sup>-1</sup>            | mm/min | ap mm        | ae mm | min <sup>-1</sup> | mm/min | ap mm        |
| 0.1           | 0.3               | 3    | 40,000            | 180    | 0.1          | 0.006 | 40,000            | 170    | 0.01         | 30,000                       | 120    | 0.05         | 0.004 | 30,000            | 110    | 0.006        |
|               | 0.5               | 5    | 40,000            | 140    | 0.1          | 0.004 | 40,000            | 130    | 0.007        | 30,000                       | 80     | 0.05         | 0.003 | 30,000            | 70     | 0.004        |
|               | 0.75              | 7.5  | 40,000            | 100    | 0.1          | 0.003 | 40,000            | 90     | 0.005        | 30,000                       | 50     | 0.05         | 0.003 | 30,000            | 45     | 0.003        |
|               | 1                 | 10   | 40,000            | 80     | 0.1          | 0.003 | 40,000            | 70     | 0.003        | 30,000                       | 40     | 0.05         | 0.003 | 30,000            | 35     | 0.002        |
| 0.2           | 0.5               | 2.5  | 40,000            | 400    | 0.2          | 0.008 | 40,000            | 380    | 0.02         | 30,000                       | 260    | 0.1          | 0.006 | 30,000            | 250    | 0.01         |
|               | 1                 | 5    | 40,000            | 350    | 0.2          | 0.006 | 40,000            | 320    | 0.015        | 30,000                       | 220    | 0.1          | 0.004 | 30,000            | 200    | 0.008        |
|               | 1.5               | 7.5  | 40,000            | 300    | 0.2          | 0.004 | 40,000            | 250    | 0.01         | 30,000                       | 200    | 0.1          | 0.003 | 30,000            | 130    | 0.005        |
|               | 2                 | 10   | 40,000            | 250    | 0.2          | 0.003 | 40,000            | 180    | 0.005        | 30,000                       | 150    | 0.1          | 0.003 | 30,000            | 90     | 0.003        |
| 0.3           | 1                 | 3.3  | 40,000            | 500    | 0.3          | 0.01  | 40,000            | 450    | 0.035        | 30,000                       | 350    | 0.15         | 0.008 | 30,000            | 280    | 0.014        |
|               | 1.5               | 5    | 40,000            | 450    | 0.3          | 0.008 | 40,000            | 400    | 0.025        | 30,000                       | 300    | 0.15         | 0.006 | 30,000            | 250    | 0.012        |
|               | 2                 | 6.7  | 40,000            | 380    | 0.3          | 0.006 | 40,000            | 350    | 0.017        | 30,000                       | 250    | 0.15         | 0.004 | 30,000            | 220    | 0.008        |
|               | 3                 | 10   | 35,000            | 300    | 0.3          | 0.004 | 35,000            | 250    | 0.01         | 30,000                       | 200    | 0.15         | 0.003 | 30,000            | 150    | 0.005        |
| 0.4           | 1                 | 2.5  | 40,000            | 700    | 0.4          | 0.02  | 40,000            | 650    | 0.045        | 30,000                       | 500    | 0.2          | 0.014 | 30,000            | 450    | 0.025        |
|               | 2                 | 5    | 40,000            | 600    | 0.4          | 0.015 | 40,000            | 550    | 0.03         | 30,000                       | 450    | 0.2          | 0.01  | 30,000            | 400    | 0.02         |
|               | 3                 | 7.5  | 35,000            | 500    | 0.4          | 0.01  | 35,000            | 450    | 0.02         | 26,000                       | 350    | 0.2          | 0.007 | 26,000            | 300    | 0.015        |
|               | 4                 | 10   | 28,000            | 350    | 0.4          | 0.006 | 28,000            | 300    | 0.015        | 24,000                       | 220    | 0.2          | 0.004 | 22,000            | 200    | 0.01         |
| 0.5           | 1.5               | 3    | 40,000            | 900    | 0.5          | 0.025 | 40,000            | 800    | 0.07         | 30,000                       | 650    | 0.3          | 0.02  | 30,000            | 550    | 0.05         |
|               | 2                 | 4    | 38,000            | 800    | 0.5          | 0.02  | 35,000            | 700    | 0.055        | 28,000                       | 550    | 0.3          | 0.016 | 26,000            | 450    | 0.04         |
|               | 3                 | 6    | 35,000            | 700    | 0.5          | 0.015 | 32,000            | 600    | 0.04         | 26,000                       | 500    | 0.3          | 0.012 | 25,000            | 400    | 0.03         |
|               | 4                 | 8    | 28,000            | 550    | 0.5          | 0.008 | 26,000            | 500    | 0.03         | 24,000                       | 400    | 0.3          | 0.005 | 22,000            | 300    | 0.02         |
|               | 6                 | 12   | 18,000            | 350    | 0.5          | 0.005 | 18,000            | 300    | 0.015        | 15,000                       | 220    | 0.3          | 0.003 | 15,000            | 180    | 0.01         |
| 0.6           | 2                 | 3.3  | 38,000            | 1,000  | 0.6          | 0.025 | 35,000            | 850    | 0.1          | 28,000                       | 700    | 0.4          | 0.018 | 26,000            | 650    | 0.08         |
|               | 3                 | 5    | 32,000            | 800    | 0.6          | 0.02  | 30,000            | 700    | 0.08         | 24,000                       | 550    | 0.4          | 0.014 | 22,000            | 500    | 0.06         |
|               | 4                 | 6.7  | 28,000            | 700    | 0.6          | 0.015 | 26,000            | 600    | 0.06         | 22,000                       | 500    | 0.4          | 0.012 | 20,000            | 400    | 0.04         |
|               | 6                 | 10   | 20,000            | 450    | 0.6          | 0.01  | 20,000            | 400    | 0.03         | 18,000                       | 350    | 0.4          | 0.008 | 16,000            | 300    | 0.02         |
| 0.8           | 3                 | 3.8  | 30,000            | 1,300  | 0.8          | 0.04  | 28,000            | 1,200  | 0.15         | 24,000                       | 1,000  | 0.6          | 0.03  | 22,000            | 900    | 0.1          |
|               | 4                 | 5    | 26,000            | 1,100  | 0.8          | 0.03  | 24,000            | 1,000  | 0.12         | 22,000                       | 850    | 0.6          | 0.02  | 18,000            | 650    | 0.08         |
|               | 6                 | 7.5  | 22,000            | 900    | 0.8          | 0.02  | 18,000            | 650    | 0.08         | 16,000                       | 600    | 0.6          | 0.014 | 14,000            | 500    | 0.06         |
|               | 8                 | 10   | 16,000            | 600    | 0.8          | 0.01  | 16,000            | 500    | 0.05         | 14,000                       | 450    | 0.6          | 0.01  | 13,000            | 350    | 0.03         |
| 1             | 3                 | 3    | 24,000            | 2,200  | 1            | 0.06  | 24,000            | 2,000  | 0.22         | 20,000                       | 1,600  | 0.8          | 0.04  | 20,000            | 1,400  | 0.16         |
|               | 4                 | 4    | 24,000            | 2,000  | 1            | 0.05  | 22,000            | 1,800  | 0.2          | 20,000                       | 1,400  | 0.8          | 0.035 | 18,000            | 1,100  | 0.14         |
|               | 5                 | 5    | 22,000            | 1,700  | 1            | 0.04  | 20,000            | 1,500  | 0.16         | 18,000                       | 1,200  | 0.8          | 0.028 | 16,000            | 950    | 0.12         |
|               | 6                 | 6    | 20,000            | 1,500  | 1            | 0.03  | 18,000            | 1,200  | 0.14         | 16,000                       | 1,000  | 0.8          | 0.02  | 14,000            | 800    | 0.1          |
|               | 8                 | 8    | 16,000            | 1,200  | 1            | 0.025 | 15,000            | 1,000  | 0.1          | 14,000                       | 800    | 0.8          | 0.018 | 12,000            | 650    | 0.08         |
|               | 10                | 10   | 14,000            | 1,000  | 1            | 0.02  | 12,000            | 800    | 0.07         | 12,000                       | 650    | 0.8          | 0.014 | 11,000            | 550    | 0.05         |
|               | 12                | 12   | 10,000            | 700    | 1            | 0.01  | 10,000            | 650    | 0.05         | 9,000                        | 450    | 0.8          | 0.007 | 8,000             | 400    | 0.035        |
| 1.5           | 4                 | 2.7  | 20,000            | 2,500  | 1.5          | 0.08  | 18,000            | 2,000  | 0.35         | 17,000                       | 1,850  | 1            | 0.06  | 15,000            | 1,300  | 0.22         |
|               | 6                 | 4    | 18,000            | 2,200  | 1.5          | 0.08  | 16,000            | 1,800  | 0.3          | 15,000                       | 1,600  | 1            | 0.05  | 14,000            | 1,200  | 0.2          |
|               | 8                 | 5.3  | 16,000            | 1,700  | 1.5          | 0.06  | 14,000            | 1,400  | 0.25         | 13,000                       | 1,200  | 1            | 0.04  | 12,000            | 950    | 0.18         |
|               | 10                | 6.7  | 14,000            | 1,450  | 1.5          | 0.05  | 12,000            | 1,150  | 0.2          | 11,000                       | 950    | 1            | 0.035 | 10,000            | 750    | 0.15         |
|               | 12                | 8    | 12,000            | 1,200  | 1.5          | 0.04  | 11,000            | 1,000  | 0.15         | 10,000                       | 800    | 1            | 0.03  | 9,000             | 650    | 0.1          |
|               | 16                | 10.7 | 10,000            | 900    | 1.5          | 0.02  | 10,000            | 800    | 0.08         | 8,000                        | 600    | 1            | 0.015 | 7,000             | 500    | 0.06         |

| Work Material |                   |     | Copper                                                                                                                                                                                                                                                                                                                                                                              |        |              |       |                   |        |              | Copper Tungsten (W70%-Cu30%) |        |              |       |                   |        |              |
|---------------|-------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|-------------------|--------|--------------|------------------------------|--------|--------------|-------|-------------------|--------|--------------|
| Dia.          | Under Neck Length | L/D | Side Milling                                                                                                                                                                                                                                                                                                                                                                        |        |              |       | Slotting          |        |              | Side Milling                 |        |              |       | Slotting          |        |              |
|               |                   |     | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                       | Feed   | Depth of Cut |       | Spindle Speed     | Feed   | Depth of Cut | Spindle Speed                | Feed   | Depth of Cut |       | Spindle Speed     | Feed   | Depth of Cut |
|               |                   |     |                                                                                                                                                                                                                                                                                                                                                                                     |        | ap mm        | ae mm |                   |        |              |                              |        | ap mm        | ae mm |                   |        |              |
|               |                   |     | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                   | mm/min | ap mm        | ae mm | min <sup>-1</sup> | mm/min | ap mm        | min <sup>-1</sup>            | mm/min | ap mm        | ae mm | min <sup>-1</sup> | mm/min | ap mm        |
| 2             | 6                 | 3   | 18,000                                                                                                                                                                                                                                                                                                                                                                              | 2,500  | 2            | 0.1   | 16,000            | 2,200  | 0.45         | 14,000                       | 1,800  | 1.5          | 0.08  | 12,000            | 1,500  | 0.3          |
|               | 8                 | 4   | 16,000                                                                                                                                                                                                                                                                                                                                                                              | 2,200  | 2            | 0.09  | 14,000            | 1,900  | 0.4          | 12,000                       | 1,500  | 1.5          | 0.07  | 12,000            | 1,400  | 0.28         |
|               | 10                | 5   | 14,000                                                                                                                                                                                                                                                                                                                                                                              | 1,900  | 2            | 0.08  | 12,000            | 1,600  | 0.35         | 10,000                       | 1,200  | 1.5          | 0.06  | 10,000            | 1,000  | 0.24         |
|               | 12                | 6   | 12,000                                                                                                                                                                                                                                                                                                                                                                              | 1,600  | 2            | 0.07  | 11,000            | 1,400  | 0.28         | 10,000                       | 1,100  | 1.5          | 0.05  | 9,000             | 900    | 0.2          |
|               | 14                | 7   | 11,000                                                                                                                                                                                                                                                                                                                                                                              | 1,400  | 2            | 0.06  | 10,000            | 1,200  | 0.24         | 9,000                        | 950    | 1.5          | 0.04  | 8,000             | 800    | 0.16         |
|               | 16                | 8   | 10,000                                                                                                                                                                                                                                                                                                                                                                              | 1,200  | 2            | 0.045 | 9,000             | 1,000  | 0.18         | 8,000                        | 800    | 1.5          | 0.03  | 7,000             | 650    | 0.12         |
|               | 20                | 10  | 9,000                                                                                                                                                                                                                                                                                                                                                                               | 1,000  | 2            | 0.03  | 8,000             | 850    | 0.12         | 7,000                        | 700    | 1.5          | 0.02  | 6,000             | 550    | 0.08         |
| 2.5           | 6                 | 2.4 | 17,000                                                                                                                                                                                                                                                                                                                                                                              | 2,450  | 2.5          | 0.13  | 15,000            | 2,100  | 0.55         | 13,000                       | 1,800  | 2            | 0.1   | 12,000            | 1,600  | 0.4          |
|               | 8                 | 3.2 | 16,000                                                                                                                                                                                                                                                                                                                                                                              | 2,300  | 2.5          | 0.12  | 14,000            | 1,950  | 0.5          | 12,000                       | 1,650  | 2            | 0.09  | 11,000            | 1,450  | 0.35         |
|               | 10                | 4   | 15,000                                                                                                                                                                                                                                                                                                                                                                              | 2,100  | 2.5          | 0.1   | 13,000            | 1,700  | 0.4          | 11,000                       | 1,500  | 2            | 0.07  | 10,000            | 1,300  | 0.3          |
|               | 12                | 4.8 | 14,000                                                                                                                                                                                                                                                                                                                                                                              | 1,900  | 2.5          | 0.08  | 12,000            | 1,550  | 0.35         | 10,000                       | 1,300  | 2            | 0.065 | 9,000             | 1,100  | 0.25         |
|               | 14                | 5.6 | 13,000                                                                                                                                                                                                                                                                                                                                                                              | 1,700  | 2.5          | 0.07  | 11,000            | 1,350  | 0.3          | 10,000                       | 1250   | 2            | 0.06  | 9,000             | 1050   | 0.2          |
|               | 16                | 6.4 | 11,000                                                                                                                                                                                                                                                                                                                                                                              | 1,400  | 2.5          | 0.06  | 10,000            | 1,200  | 0.25         | 9,000                        | 1100   | 2            | 0.05  | 8,000             | 850    | 0.15         |
|               | 20                | 8   | 10,000                                                                                                                                                                                                                                                                                                                                                                              | 1,250  | 2.5          | 0.05  | 9,000             | 1000   | 0.2          | 8,000                        | 950    | 2            | 0.04  | 7,000             | 700    | 0.12         |
| 3             | 8                 | 2.7 | 16,000                                                                                                                                                                                                                                                                                                                                                                              | 2,400  | 3            | 0.15  | 14,000            | 2,000  | 0.75         | 12,000                       | 1,800  | 2.4          | 0.11  | 11,000            | 1500   | 0.55         |
|               | 10                | 3.3 | 16,000                                                                                                                                                                                                                                                                                                                                                                              | 2,400  | 3            | 0.12  | 14,000            | 2,000  | 0.7          | 12,000                       | 1,800  | 2.4          | 0.08  | 11,000            | 1,500  | 0.5          |
|               | 15                | 5   | 14,000                                                                                                                                                                                                                                                                                                                                                                              | 2,100  | 3            | 0.1   | 12,000            | 1,600  | 0.6          | 11,000                       | 1,600  | 2.4          | 0.07  | 9,000             | 1,100  | 0.4          |
|               | 20                | 6.7 | 11,000                                                                                                                                                                                                                                                                                                                                                                              | 1,500  | 3            | 0.07  | 10,000            | 1,200  | 0.4          | 9,000                        | 1,100  | 2.4          | 0.05  | 8,000             | 900    | 0.3          |
|               | 25                | 8.3 | 10,000                                                                                                                                                                                                                                                                                                                                                                              | 1,300  | 3            | 0.05  | 9,000             | 1,000  | 0.2          | 8,000                        | 900    | 2.4          | 0.03  | 7,000             | 700    | 0.15         |
| 4             | 10                | 2.5 | 12,000                                                                                                                                                                                                                                                                                                                                                                              | 2,400  | 4            | 0.2   | 10,000            | 2,000  | 1            | 9,000                        | 1,600  | 3            | 0.15  | 8,000             | 1,400  | 0.8          |
|               | 15                | 3.8 | 12,000                                                                                                                                                                                                                                                                                                                                                                              | 2,400  | 4            | 0.2   | 10,000            | 2,000  | 0.9          | 9,000                        | 1,600  | 3            | 0.15  | 8,000             | 1,400  | 0.7          |
|               | 20                | 5   | 10,000                                                                                                                                                                                                                                                                                                                                                                              | 2,000  | 4            | 0.15  | 8,000             | 1,600  | 0.7          | 8,000                        | 1,400  | 3            | 0.1   | 6,000             | 1,000  | 0.5          |
|               | 25                | 6.3 | 9,000                                                                                                                                                                                                                                                                                                                                                                               | 1,700  | 4            | 0.1   | 8,000             | 1,500  | 0.5          | 7,000                        | 1,200  | 3            | 0.07  | 6,000             | 1,000  | 0.3          |
|               | 30                | 7.5 | 8,000                                                                                                                                                                                                                                                                                                                                                                               | 1,500  | 4            | 0.07  | 7,000             | 1,300  | 0.3          | 6,000                        | 1,000  | 3            | 0.05  | 5,000             | 800    | 0.2          |
| 5             | 15                | 3   | 9,500                                                                                                                                                                                                                                                                                                                                                                               | 2,600  | 5            | 0.25  | 8,500             | 2,200  | 1.1          | 7,000                        | 1,800  | 3.5          | 0.18  | 6,000             | 1,400  | 0.8          |
|               | 20                | 4   | 8,000                                                                                                                                                                                                                                                                                                                                                                               | 2,150  | 5            | 0.2   | 7,000             | 1,750  | 1            | 6,500                        | 1,650  | 3.5          | 0.15  | 5,500             | 1,150  | 0.6          |
|               | 25                | 5   | 7,000                                                                                                                                                                                                                                                                                                                                                                               | 1,800  | 5            | 0.15  | 6,000             | 1,400  | 0.9          | 5,800                        | 1,300  | 3.5          | 0.12  | 4,800             | 1,000  | 0.5          |
|               | 30                | 6   | 6,000                                                                                                                                                                                                                                                                                                                                                                               | 1,500  | 5            | 0.1   | 5,000             | 1,100  | 0.7          | 5,000                        | 1,000  | 3.5          | 0.1   | 4,000             | 830    | 0.4          |
| 6             | 15                | 2.5 | 8,000                                                                                                                                                                                                                                                                                                                                                                               | 2,750  | 6            | 0.3   | 7,000             | 2,350  | 1.2          | 6,000                        | 1,950  | 4            | 0.2   | 5,000             | 1400   | 0.9          |
|               | 20                | 3.3 | 7,000                                                                                                                                                                                                                                                                                                                                                                               | 2,400  | 6            | 0.3   | 6,000             | 2,000  | 1.2          | 5,000                        | 1,600  | 4            | 0.2   | 4,500             | 1,200  | 0.8          |
|               | 30                | 5   | 5,000                                                                                                                                                                                                                                                                                                                                                                               | 1,600  | 6            | 0.2   | 4,000             | 1,200  | 1            | 4,000                        | 1,100  | 4            | 0.15  | 3,500             | 900    | 0.6          |
|               | 50                | 8.3 | 3,500                                                                                                                                                                                                                                                                                                                                                                               | 800    | 6            | 0.1   | 3,000             | 650    | 0.4          | 3,000                        | 600    | 4            | 0.07  | 3,000             | 500    | 0.25         |
| Notes         |                   |     | ※1 Recommend to use the milling condition as just reference. Adjust milling conditions according to machining shape and machine status.<br>※2 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※3 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※4 Water-insoluble fluid is recommended. |        |              |       |                   |        |              |                              |        |              |       |                   |        |              |

## Long Neck Ball End Mill for Copper Electrode

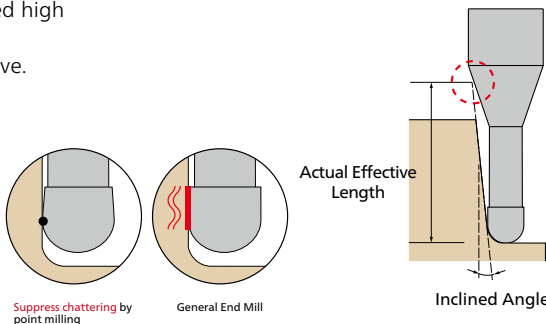
- Long neck ball end mill specialized for machining copper electrode.
- Sharp edge shearing ability and DLC coating realized high quality and stable a long life machining.
- Machining copper tungsten electrodes is also effective.



|                    |               |
|--------------------|---------------|
| $R \leq 0.2$       | $R \pm 0.002$ |
| $0.2 < R \leq 0.5$ | $R \pm 0.003$ |
| $R > 0.5$          | $R \pm 0.004$ |



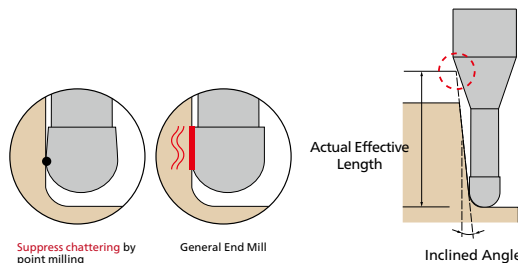
※ R accuracy of DRB230 is based on a half value.



| ◆ New Size       |            |                        |                   |          |                |                      |                |                    | Unit : mm                                                        |      |       |      |      |
|------------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|------------------------------------------------------------------|------|-------|------|------|
| Code No.         | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |      |       |      |      |
|                  |            |                        |                   |          |                |                      |                |                    | 30°                                                              | 1°   | 1°30' | 2°   | 3°   |
| 07-00530-00503   | R0.05      | 0.3                    | 0.07              | 0.1      | 0.085          | 12°                  | 4              | 45                 | 0.34                                                             | 0.36 | 0.37  | 0.39 | 0.42 |
| 07-00530-00505   |            | 0.5                    | 0.07              | 0.1      | 0.085          | 12°                  | 4              | 45                 | 0.55                                                             | 0.57 | 0.60  | 0.63 | 0.69 |
| ◆ 07-00530-00703 | R0.075     | 0.3                    | 0.1               | 0.15     | 0.13           | 12°                  | 4              | 45                 | 0.35                                                             | 0.37 | 0.38  | 0.40 | 0.43 |
| ◆ 07-00530-00705 |            | 0.5                    | 0.1               | 0.15     | 0.13           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.61  | 0.64 | 0.70 |
| ◆ 07-00530-00710 |            | 1                      | 0.1               | 0.15     | 0.13           | 12°                  | 4              | 45                 | 1.08                                                             | 1.13 | 1.18  | 1.23 | 1.36 |
| 07-00530-01005   | R0.1       | 0.5                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.61  | 0.63 | 0.69 |
| ◆ 07-00530-01007 |            | 0.75                   | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 0.82                                                             | 0.85 | 0.89  | 0.93 | 1.02 |
| 07-00530-01010   |            | 1                      | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 1.08                                                             | 1.13 | 1.18  | 1.23 | 1.35 |
| 07-00530-01015   |            | 1.5                    | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 1.60                                                             | 1.67 | 1.75  | 1.83 | 2.02 |
| ◆ 07-00530-01020 |            | 2                      | 0.15              | 0.2      | 0.18           | 12°                  | 4              | 45                 | 2.13                                                             | 2.22 | 2.32  | 2.43 | 2.68 |
| ◆ 07-00530-01505 | R0.15      | 0.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 0.56                                                             | 0.58 | 0.60  | 0.62 | 0.67 |
| 07-00530-01510   |            | 1                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.08                                                             | 1.12 | 1.17  | 1.22 | 1.34 |
| 07-00530-01515   |            | 1.5                    | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 1.60                                                             | 1.67 | 1.74  | 1.82 | 2.00 |
| 07-00530-01520   |            | 2                      | 0.2               | 0.3      | 0.28           | 12°                  | 4              | 45                 | 2.12                                                             | 2.21 | 2.31  | 2.42 | 2.66 |
| ◆ 07-00530-02005 | R0.2       | 0.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 0.58                                                             | 0.60 | 0.62  | 0.64 | 0.69 |
| 07-00530-02010   |            | 1                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 1.10                                                             | 1.14 | 1.19  | 1.24 | 1.35 |
| ◆ 07-00530-02015 |            | 1.5                    | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 1.62                                                             | 1.69 | 1.76  | 1.84 | 2.02 |
| 07-00530-02020   |            | 2                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 2.15                                                             | 2.23 | 2.33  | 2.43 | 2.68 |
| 07-00530-02030   |            | 3                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 3.19                                                             | 3.32 | 3.47  | 3.63 | 4.01 |
| 07-00530-02040   |            | 4                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 4.23                                                             | 4.41 | 4.61  | 4.83 | 5.33 |
| ◆ 07-00530-02050 |            | 5                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 5.27                                                             | 5.50 | 5.75  | 6.02 | 6.66 |
| ◆ 07-00530-02060 |            | 6                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 | 6.32                                                             | 6.59 | 6.89  | 7.22 | 7.99 |

**How to Order** When you order, indicate DRB230 (R)×(ℓ<sub>1</sub>). ※(γ) is reference value.

Machining case W-021



Unit : mm

| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|----------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                |            |                                     |                   |          |                             |                      |                |                    | 30°                                                              | 1°    | 1°30' | 2°    | 3°    |
| 07-00530-02510 | R0.25      | 1                                   | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 1.13                                                             | 1.16  | 1.21  | 1.26  | 1.37  |
| 07-00530-02515 |            | 1.5                                 | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 1.65                                                             | 1.71  | 1.78  | 1.85  | 2.03  |
| 07-00530-02520 |            | 2                                   | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 2.17                                                             | 2.25  | 2.35  | 2.45  | 2.69  |
| 07-00530-02530 |            | 3                                   | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 3.21                                                             | 3.34  | 3.49  | 3.65  | 4.02  |
| 07-00530-02540 |            | 4                                   | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 4.25                                                             | 4.43  | 4.63  | 4.85  | 5.35  |
| 07-00530-02550 |            | 5                                   | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 5.30                                                             | 5.52  | 5.77  | 6.04  | 6.68  |
| 07-00530-02560 |            | 6                                   | 0.35              | 0.5      | 0.46                        | 12°                  | 4              | 45                 | 6.34                                                             | 6.61  | 6.91  | 7.24  | 8.00  |
| 07-00530-03010 | R0.3       | 1                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 1.12                                                             | 1.16  | 1.20  | 1.25  | 1.35  |
| 07-00530-03015 |            | 1.5                                 | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 1.64                                                             | 1.71  | 1.77  | 1.84  | 2.02  |
| 07-00530-03020 |            | 2                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 2.17                                                             | 2.25  | 2.34  | 2.44  | 2.68  |
| 07-00530-03030 |            | 3                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 3.21                                                             | 3.34  | 3.48  | 3.64  | 4.01  |
| 07-00530-03040 |            | 4                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 4.25                                                             | 4.43  | 4.62  | 4.84  | 5.33  |
| 07-00530-03050 |            | 5                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 5.29                                                             | 5.52  | 5.76  | 6.03  | 6.66  |
| 07-00530-03060 |            | 6                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 6.34                                                             | 6.61  | 6.90  | 7.23  | 7.99  |
| 07-00530-03080 |            | 8                                   | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 45                 | 8.42                                                             | 8.79  | 9.18  | 9.62  | 10.64 |
| 07-00530-03100 |            | 10                                  | 0.45              | 0.6      | 0.56                        | 12°                  | 4              | 50                 | 10.51                                                            | 10.97 | 11.47 | 12.02 | 13.30 |
| 07-00530-04015 |            | R0.4                                | 1.5               | 0.6      | 0.8                         | 0.76                 | 12°            | 4                  | 45                                                               | 1.64  | 1.70  | 1.76  | 1.83  |
| 07-00530-04020 | 2          |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 | 2.16                                                             | 2.24  | 2.33  | 2.42  | 2.65  |
| 07-00530-04030 | 3          |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 | 3.20                                                             | 3.33  | 3.47  | 3.62  | 3.97  |
| 07-00530-04040 | 4          |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 | 4.25                                                             | 4.42  | 4.61  | 4.82  | 5.30  |
| 07-00530-04050 | 5          |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 | 5.29                                                             | 5.51  | 5.75  | 6.01  | 6.63  |
| 07-00530-04060 | 6          |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 | 6.33                                                             | 6.60  | 6.89  | 7.21  | 7.96  |
| 07-00530-04080 | 8          |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 | 8.42                                                             | 8.78  | 9.17  | 9.60  | 10.61 |
| 07-00530-04100 | 10         |                                     | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 50                 | 10.50                                                            | 10.96 | 11.45 | 12.00 | 13.26 |
| 07-00530-05020 | R0.5       | 2                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 2.18                                                             | 2.26  | 2.34  | 2.43  | 2.65  |
| 07-00530-05030 |            | 3                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 3.22                                                             | 3.35  | 3.48  | 3.63  | 3.97  |
| 07-00530-05040 |            | 4                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 4.27                                                             | 4.44  | 4.62  | 4.83  | 5.30  |
| 07-00530-05050 |            | 5                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 5.31                                                             | 5.53  | 5.76  | 6.02  | 6.63  |
| 07-00530-05060 |            | 6                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 6.35                                                             | 6.62  | 6.90  | 7.22  | 7.96  |
| 07-00530-05080 |            | 8                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 8.44                                                             | 8.79  | 9.18  | 9.61  | 10.61 |
| 07-00530-05100 |            | 10                                  | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 10.52                                                            | 10.97 | 11.46 | 12.01 | 13.26 |
| 07-00530-05120 |            | 12                                  | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 | 12.61                                                            | 13.15 | 13.75 | 14.40 | 15.92 |
| 07-00530-05140 |            | 14                                  | 0.75              | 1        | 0.95                        | 12°                  | 4              | 50                 | 14.70                                                            | 15.33 | 16.03 | 16.79 | 18.57 |
| 07-00530-05160 |            | 16                                  | 0.75              | 1        | 0.95                        | 12°                  | 4              | 50                 | 16.78                                                            | 17.51 | 18.31 | 19.18 | 21.23 |
| 07-00530-07504 | R0.75      | 4                                   | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 4.26                                                             | 4.41  | 4.59  | 4.78  | 5.22  |
| 07-00530-07506 |            | 6                                   | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 6.34                                                             | 6.59  | 6.87  | 7.17  | 7.88  |
| 07-00530-07508 |            | 8                                   | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 8.43                                                             | 8.77  | 9.15  | 9.56  | 10.53 |
| 07-00530-07510 |            | 10                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 10.51                                                            | 10.95 | 11.43 | 11.96 | 13.18 |
| 07-00530-07512 |            | 12                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 12.60                                                            | 13.13 | 13.71 | 14.35 | 15.84 |
| 07-00530-07514 |            | 14                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 14.69                                                            | 15.31 | 15.99 | 16.74 | 18.49 |
| 07-00530-07516 |            | 16                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 16.77                                                            | 17.49 | 18.27 | 19.14 | 21.15 |
| 07-00530-07518 |            | 18                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 | 18.86                                                            | 19.67 | 20.55 | 21.53 | 23.80 |

**N** Aluminium Alloy ☐

**N** Copper ☒

Copper Tungsten ☒

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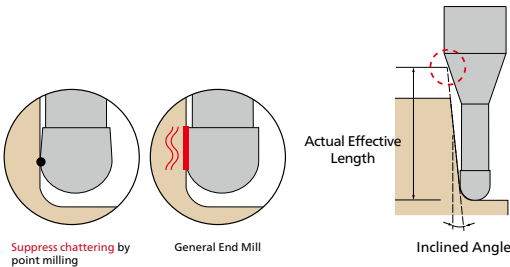
**N** Resin ☐

M-009



DRB230

Long Neck Ball End Mill for Copper Electrode



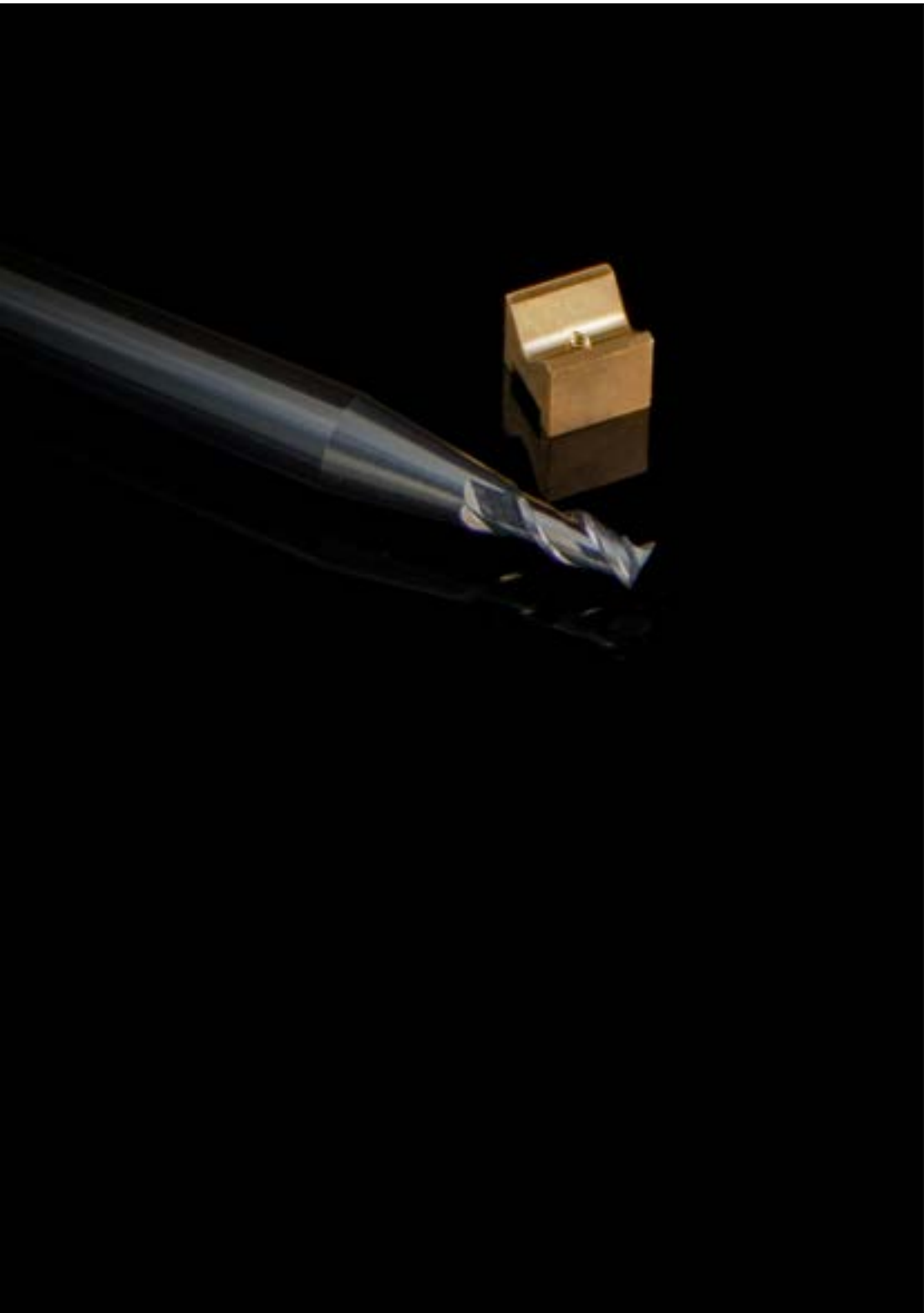
◆ New Size

Unit : mm

| Code No.         | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece |       |       |       |       |
|------------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------|------------------------------------------------------------------|-------|-------|-------|-------|
|                  |            |                                     |                   |          |                             |                      |                |                    | 30°                                                              | 1°    | 1°30′ | 2°    | 3°    |
| ◆ 07-00530-10030 | R1         | 3                                   | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 3.23                                                             | 3.33  | 3.44  | 3.56  | 3.85  |
| 07-00530-10040   |            | 4                                   | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 4.27                                                             | 4.42  | 4.58  | 4.76  | 5.17  |
| 07-00530-10060   |            | 6                                   | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 6.36                                                             | 6.60  | 6.86  | 7.15  | 7.83  |
| 07-00530-10080   |            | 8                                   | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 8.44                                                             | 8.78  | 9.14  | 9.54  | 10.48 |
| 07-00530-10100   |            | 10                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 10.53                                                            | 10.95 | 11.42 | 11.94 | 13.14 |
| 07-00530-10120   |            | 12                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 12.61                                                            | 13.13 | 13.70 | 14.33 | 15.79 |
| ◆ 07-00530-10140 |            | 14                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 14.70                                                            | 15.31 | 15.98 | 16.72 | 18.45 |
| 07-00530-10160   |            | 16                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 | 16.78                                                            | 17.49 | 18.27 | 19.12 | Free  |
| 07-00530-10200   |            | 20                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 60                 | 20.96                                                            | 21.85 | 22.83 | 23.90 | Free  |
| 07-00530-10250   |            | 25                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 60                 | 26.17                                                            | 27.30 | 28.53 | 29.89 | Free  |
| ◆ 07-00530-15060 | R1.5       | 6                                   | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 6.56                                                             | 6.78  | 7.03  | 7.31  | 7.95  |
| ◆ 07-00530-15080 |            | 8                                   | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 8.64                                                             | 8.96  | 9.31  | 9.70  | 10.60 |
| 07-00530-15100   |            | 10                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 10.73                                                            | 11.14 | 11.59 | 12.09 | 13.26 |
| ◆ 07-00530-15120 |            | 12                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 | 12.81                                                            | 13.32 | 13.88 | 14.49 | 15.91 |
| 07-00530-15150   |            | 15                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 70                 | 15.94                                                            | 16.59 | 17.30 | 18.08 | 19.89 |
| 07-00530-15200   |            | 20                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 70                 | 21.16                                                            | 22.04 | 23.00 | 24.06 | 26.53 |
| 07-00530-15250   |            | 25                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 70                 | 26.37                                                            | 27.48 | 28.70 | 30.04 | Free  |
| 07-00530-15300   |            | 30                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 70                 | 31.58                                                            | 32.93 | 34.40 | 36.03 | Free  |
| 07-00530-20100   |            | 10                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 60                 | 10.83                                                            | 11.22 | 11.66 | 12.14 | 13.25 |
| ◆ 07-00530-20120 |            | 12                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 60                 | 12.91                                                            | 13.40 | 13.94 | 14.53 | 15.91 |
| 07-00530-20150   | R2         | 15                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 60                 | 16.04                                                            | 16.67 | 17.36 | 18.12 | 19.89 |
| 07-00530-20200   |            | 20                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 60                 | 21.26                                                            | 22.12 | 23.06 | 24.10 | Free  |
| 07-00530-20250   |            | 25                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 70                 | 26.47                                                            | 27.57 | 28.77 | 30.09 | Free  |
| 07-00530-20300   |            | 30                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 70                 | 31.68                                                            | 33.01 | 34.47 | Free  | Free  |
| 07-00530-20400   |            | 40                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 80                 | 42.11                                                            | 43.91 | Free  | Free  | Free  |
| 07-00530-30200   |            | 20                                  | 6                 | 6        | 5.7                         | —                    | 6              | 70                 | Free                                                             | Free  | Free  | Free  | Free  |
| ◆ 07-00530-30250 | R3         | 25                                  | 6                 | 6        | 5.7                         | —                    | 6              | 70                 | Free                                                             | Free  | Free  | Free  | Free  |
| 07-00530-30300   |            | 30                                  | 6                 | 6        | 5.7                         | —                    | 6              | 80                 | Free                                                             | Free  | Free  | Free  | Free  |
| ◆ 07-00530-30400 |            | 40                                  | 6                 | 6        | 5.7                         | —                    | 6              | 80                 | Free                                                             | Free  | Free  | Free  | Free  |
| 07-00530-30500   |            | 50                                  | 6                 | 6        | 5.7                         | —                    | 6              | 100                | Free                                                             | Free  | Free  | Free  | Free  |

How to Order

When you order, indicate DRB230 (R)×(ℓ<sub>1</sub>). ※ ( γ ) is reference value.

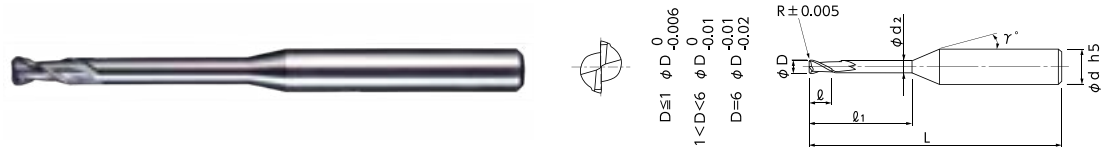




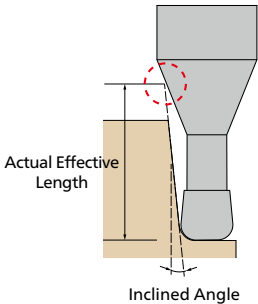
| Work Material |                   |      | Copper       |       |        |                   | Copper Tungsten (W70% - Cu30%) |       |        |                   |
|---------------|-------------------|------|--------------|-------|--------|-------------------|--------------------------------|-------|--------|-------------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut |       | Feed   | Spindle Speed     | Depth of Cut                   |       | Feed   | Spindle Speed     |
|               |                   |      | ap mm        | ae mm | mm/min | min <sup>-1</sup> | ap mm                          | ae mm | mm/min | min <sup>-1</sup> |
| 0.05          | 0.3               | 3    | 0.01         | 0.01  | 200    | 40,000            | 0.008                          | 0.008 | 150    | 30,000            |
|               | 0.5               | 5    | 0.007        | 0.007 | 150    | 40,000            | 0.005                          | 0.005 | 100    | 30,000            |
|               | 0.3               | 2    | 0.015        | 0.02  | 250    | 40,000            | 0.01                           | 0.015 | 180    | 30,000            |
| 0.075         | 0.5               | 3.3  | 0.015        | 0.02  | 200    | 40,000            | 0.008                          | 0.015 | 150    | 30,000            |
|               | 1                 | 6.7  | 0.007        | 0.01  | 150    | 40,000            | 0.005                          | 0.008 | 100    | 30,000            |
|               | 0.5               | 2.5  | 0.025        | 0.05  | 500    | 40,000            | 0.02                           | 0.04  | 350    | 30,000            |
| 0.1           | 0.75              | 3.75 | 0.025        | 0.05  | 450    | 40,000            | 0.02                           | 0.04  | 300    | 30,000            |
|               | 1                 | 5    | 0.02         | 0.04  | 400    | 40,000            | 0.015                          | 0.03  | 250    | 30,000            |
|               | 1.5               | 7.5  | 0.015        | 0.03  | 300    | 40,000            | 0.008                          | 0.02  | 150    | 30,000            |
|               | 2                 | 10   | 0.008        | 0.015 | 200    | 40,000            | 0.005                          | 0.01  | 100    | 30,000            |
| 0.15          | 0.5               | 1.7  | 0.03         | 0.07  | 700    | 40,000            | 0.03                           | 0.07  | 500    | 30,000            |
|               | 1                 | 3.3  | 0.03         | 0.07  | 700    | 40,000            | 0.03                           | 0.07  | 500    | 30,000            |
|               | 1.5               | 5    | 0.025        | 0.05  | 500    | 40,000            | 0.02                           | 0.05  | 300    | 30,000            |
|               | 2                 | 6.7  | 0.015        | 0.03  | 400    | 40,000            | 0.01                           | 0.02  | 200    | 30,000            |
| 0.2           | 0.5               | 1.3  | 0.05         | 0.1   | 1,000  | 40,000            | 0.04                           | 0.08  | 700    | 30,000            |
|               | 1                 | 2.5  | 0.05         | 0.1   | 1,000  | 40,000            | 0.04                           | 0.08  | 700    | 30,000            |
|               | 1.5               | 3.8  | 0.04         | 0.08  | 1,000  | 40,000            | 0.03                           | 0.06  | 700    | 30,000            |
|               | 2                 | 5    | 0.035        | 0.06  | 600    | 40,000            | 0.02                           | 0.05  | 350    | 30,000            |
|               | 3                 | 7.5  | 0.02         | 0.04  | 400    | 30,000            | 0.01                           | 0.03  | 200    | 25,000            |
|               | 4                 | 10   | 0.008        | 0.015 | 250    | 25,000            | 0.005                          | 0.01  | 100    | 18,000            |
|               | 5                 | 12.5 | 0.005        | 0.015 | 200    | 25,000            | 0.005                          | 0.01  | 80     | 16,000            |
|               | 6                 | 15   | 0.005        | 0.015 | 150    | 22,000            | 0.005                          | 0.01  | 70     | 14,000            |
| 0.25          | 1                 | 2    | 0.08         | 0.15  | 800    | 40,000            | 0.08                           | 0.15  | 500    | 30,000            |
|               | 1.5               | 3    | 0.08         | 0.15  | 800    | 40,000            | 0.08                           | 0.15  | 500    | 30,000            |
|               | 2                 | 4    | 0.08         | 0.15  | 800    | 40,000            | 0.08                           | 0.15  | 500    | 30,000            |
|               | 3                 | 6    | 0.06         | 0.1   | 600    | 35,000            | 0.06                           | 0.08  | 400    | 27,000            |
|               | 4                 | 8    | 0.04         | 0.08  | 400    | 30,000            | 0.025                          | 0.05  | 200    | 22,000            |
|               | 5                 | 10   | 0.02         | 0.04  | 300    | 25,000            | 0.01                           | 0.02  | 150    | 18,000            |
| 0.3           | 6                 | 12   | 0.015        | 0.03  | 250    | 22,000            | 0.005                          | 0.01  | 120    | 16,000            |
|               | 1                 | 1.7  | 0.12         | 0.2   | 1,600  | 40,000            | 0.12                           | 0.2   | 1,200  | 30,000            |
|               | 1.5               | 2.5  | 0.12         | 0.2   | 1,600  | 40,000            | 0.12                           | 0.2   | 1,200  | 30,000            |
|               | 2                 | 3.3  | 0.12         | 0.2   | 1,600  | 40,000            | 0.12                           | 0.2   | 1,200  | 30,000            |
|               | 3                 | 5    | 0.1          | 0.14  | 1,000  | 40,000            | 0.08                           | 0.1   | 700    | 30,000            |
|               | 4                 | 6.7  | 0.07         | 0.1   | 700    | 30,000            | 0.04                           | 0.06  | 400    | 25,000            |
|               | 5                 | 8.3  | 0.05         | 0.08  | 600    | 27,000            | 0.02                           | 0.04  | 300    | 22,000            |
|               | 6                 | 10   | 0.04         | 0.06  | 500    | 25,000            | 0.01                           | 0.03  | 200    | 20,000            |
|               | 8                 | 13.3 | 0.015        | 0.05  | 400    | 22,000            | 0.005                          | 0.02  | 150    | 18,000            |
|               | 10                | 16.7 | 0.015        | 0.03  | 350    | 20,000            | 0.005                          | 0.01  | 120    | 16,000            |
| 0.4           | 1.5               | 1.9  | 0.15         | 0.3   | 2,000  | 40,000            | 0.15                           | 0.3   | 1,400  | 30,000            |
|               | 2                 | 2.5  | 0.15         | 0.3   | 2,000  | 40,000            | 0.15                           | 0.3   | 1,400  | 30,000            |
|               | 3                 | 3.8  | 0.15         | 0.3   | 2,000  | 40,000            | 0.15                           | 0.3   | 1,400  | 30,000            |
|               | 4                 | 5    | 0.12         | 0.2   | 1,600  | 35,000            | 0.1                            | 0.16  | 1,000  | 27,000            |
|               | 5                 | 6.3  | 0.1          | 0.18  | 1,200  | 32,000            | 0.08                           | 0.12  | 750    | 24,000            |
|               | 6                 | 7.5  | 0.08         | 0.15  | 1,000  | 30,000            | 0.05                           | 0.1   | 500    | 20,000            |
|               | 8                 | 10   | 0.05         | 0.06  | 700    | 22,000            | 0.02                           | 0.025 | 300    | 16,000            |
|               | 10                | 12.5 | 0.02         | 0.05  | 600    | 20,000            | 0.01                           | 0.02  | 200    | 14,000            |
|               | 2                 | 2    | 0.25         | 0.4   | 2,800  | 40,000            | 0.25                           | 0.4   | 2,000  | 30,000            |
| 0.5           | 3                 | 3    | 0.25         | 0.4   | 2,800  | 40,000            | 0.25                           | 0.4   | 2,000  | 30,000            |
|               | 4                 | 4    | 0.2          | 0.4   | 2,400  | 40,000            | 0.2                            | 0.4   | 1,600  | 30,000            |
|               | 5                 | 5    | 0.16         | 0.3   | 2,000  | 35,000            | 0.12                           | 0.25  | 1,400  | 27,000            |
|               | 6                 | 6    | 0.14         | 0.3   | 1,600  | 30,000            | 0.1                            | 0.25  | 1,000  | 25,000            |

| Work Material |                   |      | Copper                                                                                                                                                                                                                                                                                                                                                                          |       |        |                   | Copper Tungsten (W70% - Cu30%) |       |        |                   |
|---------------|-------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-------------------|--------------------------------|-------|--------|-------------------|
| Radius        | Under Neck Length | L/D  | Depth of Cut                                                                                                                                                                                                                                                                                                                                                                    |       | Feed   | Spindle Speed     | Depth of Cut                   |       | Feed   | Spindle Speed     |
|               |                   |      | ap mm                                                                                                                                                                                                                                                                                                                                                                           | ae mm | mm/min | min <sup>-1</sup> | ap mm                          | ae mm | mm/min | min <sup>-1</sup> |
| 0.5           | 8                 | 8    | 0.12                                                                                                                                                                                                                                                                                                                                                                            | 0.2   | 1,000  | 25,000            | 0.06                           | 0.1   | 500    | 18,000            |
|               | 10                | 10   | 0.08                                                                                                                                                                                                                                                                                                                                                                            | 0.15  | 800    | 20,000            | 0.03                           | 0.05  | 300    | 16,000            |
|               | 12                | 12   | 0.06                                                                                                                                                                                                                                                                                                                                                                            | 0.1   | 600    | 16,000            | 0.015                          | 0.04  | 200    | 12,000            |
|               | 14                | 14   | 0.04                                                                                                                                                                                                                                                                                                                                                                            | 0.08  | 500    | 14,000            | 0.01                           | 0.04  | 160    | 10,000            |
|               | 16                | 16   | 0.02                                                                                                                                                                                                                                                                                                                                                                            | 0.06  | 400    | 12,000            | 0.005                          | 0.03  | 120    | 8,000             |
| 0.75          | 4                 | 2.7  | 0.3                                                                                                                                                                                                                                                                                                                                                                             | 0.6   | 2,800  | 35,000            | 0.3                            | 0.6   | 2,200  | 30,000            |
|               | 6                 | 4    | 0.3                                                                                                                                                                                                                                                                                                                                                                             | 0.6   | 2,400  | 30,000            | 0.3                            | 0.6   | 1,800  | 25,000            |
|               | 8                 | 5.3  | 0.25                                                                                                                                                                                                                                                                                                                                                                            | 0.5   | 1,800  | 25,000            | 0.2                            | 0.4   | 1,200  | 20,000            |
|               | 10                | 6.7  | 0.2                                                                                                                                                                                                                                                                                                                                                                             | 0.4   | 1,400  | 20,000            | 0.15                           | 0.3   | 800    | 16,000            |
|               | 12                | 8    | 0.15                                                                                                                                                                                                                                                                                                                                                                            | 0.3   | 1,000  | 16,000            | 0.1                            | 0.2   | 500    | 12,000            |
|               | 14                | 9.3  | 0.12                                                                                                                                                                                                                                                                                                                                                                            | 0.2   | 800    | 14,000            | 0.08                           | 0.1   | 350    | 10,000            |
|               | 16                | 10.7 | 0.1                                                                                                                                                                                                                                                                                                                                                                             | 0.15  | 650    | 12,000            | 0.05                           | 0.08  | 280    | 9,000             |
|               | 18                | 12   | 0.08                                                                                                                                                                                                                                                                                                                                                                            | 0.12  | 500    | 10,000            | 0.02                           | 0.06  | 200    | 8,000             |
| 1             | 3                 | 1.5  | 0.45                                                                                                                                                                                                                                                                                                                                                                            | 0.8   | 4,000  | 30,000            | 0.45                           | 0.8   | 2,400  | 25,000            |
|               | 4                 | 2    | 0.45                                                                                                                                                                                                                                                                                                                                                                            | 0.8   | 4,000  | 30,000            | 0.45                           | 0.8   | 2,400  | 22,000            |
|               | 6                 | 3    | 0.45                                                                                                                                                                                                                                                                                                                                                                            | 0.8   | 3,000  | 27,000            | 0.45                           | 0.8   | 1,800  | 20,000            |
|               | 8                 | 4    | 0.4                                                                                                                                                                                                                                                                                                                                                                             | 0.8   | 2,400  | 25,000            | 0.4                            | 0.8   | 1,600  | 18,000            |
|               | 10                | 5    | 0.3                                                                                                                                                                                                                                                                                                                                                                             | 0.6   | 2,000  | 22,000            | 0.25                           | 0.5   | 1,400  | 16,000            |
|               | 12                | 6    | 0.3                                                                                                                                                                                                                                                                                                                                                                             | 0.6   | 1,400  | 16,000            | 0.25                           | 0.5   | 900    | 12,000            |
|               | 14                | 7    | 0.25                                                                                                                                                                                                                                                                                                                                                                            | 0.6   | 1,200  | 14,000            | 0.2                            | 0.5   | 700    | 10,000            |
|               | 16                | 8    | 0.25                                                                                                                                                                                                                                                                                                                                                                            | 0.5   | 1,000  | 12,000            | 0.12                           | 0.25  | 500    | 9,000             |
|               | 20                | 10   | 0.15                                                                                                                                                                                                                                                                                                                                                                            | 0.3   | 800    | 10,000            | 0.06                           | 0.1   | 350    | 8,000             |
|               | 25                | 12.5 | 0.08                                                                                                                                                                                                                                                                                                                                                                            | 0.15  | 600    | 8,000             | 0.03                           | 0.05  | 200    | 6,000             |
| 1.5           | 6                 | 2    | 0.7                                                                                                                                                                                                                                                                                                                                                                             | 1.5   | 3,400  | 20,000            | 0.6                            | 1.2   | 2,400  | 16,000            |
|               | 8                 | 2.7  | 0.7                                                                                                                                                                                                                                                                                                                                                                             | 1.5   | 3,400  | 20,000            | 0.6                            | 1.2   | 2,400  | 16,000            |
|               | 10                | 3.3  | 0.7                                                                                                                                                                                                                                                                                                                                                                             | 1.5   | 3,400  | 20,000            | 0.6                            | 1.2   | 2,400  | 16,000            |
|               | 12                | 4    | 0.6                                                                                                                                                                                                                                                                                                                                                                             | 1.2   | 3,400  | 20,000            | 0.6                            | 1     | 2,400  | 16,000            |
|               | 15                | 5    | 0.6                                                                                                                                                                                                                                                                                                                                                                             | 1     | 3,000  | 18,000            | 0.5                            | 0.8   | 2,000  | 14,000            |
|               | 20                | 6.7  | 0.5                                                                                                                                                                                                                                                                                                                                                                             | 0.8   | 2,400  | 16,000            | 0.4                            | 0.6   | 1,400  | 12,000            |
|               | 25                | 8.3  | 0.4                                                                                                                                                                                                                                                                                                                                                                             | 0.6   | 1,800  | 12,000            | 0.2                            | 0.3   | 900    | 10,000            |
|               | 30                | 10   | 0.2                                                                                                                                                                                                                                                                                                                                                                             | 0.4   | 1,200  | 8,000             | 0.08                           | 0.15  | 500    | 6,000             |
|               | 10                | 2.5  | 1                                                                                                                                                                                                                                                                                                                                                                               | 1.6   | 4,000  | 16,000            | 0.8                            | 1.6   | 2,800  | 12,000            |
|               | 12                | 3    | 1                                                                                                                                                                                                                                                                                                                                                                               | 1.6   | 3,600  | 16,000            | 0.8                            | 1.6   | 2,800  | 12,000            |
| 2             | 15                | 3.8  | 0.8                                                                                                                                                                                                                                                                                                                                                                             | 1.6   | 3,400  | 16,000            | 0.8                            | 1.6   | 2,400  | 12,000            |
|               | 20                | 5    | 0.8                                                                                                                                                                                                                                                                                                                                                                             | 1.6   | 3,000  | 14,000            | 0.8                            | 1.6   | 2,000  | 10,000            |
|               | 25                | 6.3  | 0.6                                                                                                                                                                                                                                                                                                                                                                             | 1.2   | 3,000  | 14,000            | 0.5                            | 1     | 2,000  | 10,000            |
|               | 30                | 7.5  | 0.5                                                                                                                                                                                                                                                                                                                                                                             | 1     | 2,400  | 12,000            | 0.3                            | 0.5   | 1,200  | 7,000             |
|               | 40                | 10   | 0.4                                                                                                                                                                                                                                                                                                                                                                             | 0.8   | 1,200  | 8,000             | 0.15                           | 0.3   | 500    | 5,000             |
|               | 20                | 3.3  | 1                                                                                                                                                                                                                                                                                                                                                                               | 2     | 3,600  | 12,000            | 1                              | 2     | 2,400  | 9,000             |
|               | 25                | 4.2  | 1                                                                                                                                                                                                                                                                                                                                                                               | 1.8   | 3,300  | 11,000            | 0.8                            | 1.2   | 2,100  | 8,000             |
| 3             | 30                | 5    | 0.8                                                                                                                                                                                                                                                                                                                                                                             | 1.6   | 3,000  | 10,000            | 0.4                            | 0.8   | 1,800  | 7,000             |
|               | 40                | 6.7  | 0.6                                                                                                                                                                                                                                                                                                                                                                             | 1.2   | 2,400  | 8,000             | 0.3                            | 0.6   | 1,250  | 5,500             |
|               | 50                | 8.3  | 0.5                                                                                                                                                                                                                                                                                                                                                                             | 1     | 1,800  | 6,000             | 0.25                           | 0.5   | 800    | 4,000             |
| Notes         |                   |      | ※1 These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.<br>※2 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※3 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※4 Water-insoluble fluid is recommended. |       |        |                   |                                |       |        |                   |

Long neck corner radius end mill specialized for machining copper alloy  
Sharpe cutting edge makes less burr and high quality surface



- Long neck radius end mill specialized for machining copper electrode.
- 37.5°helix angle provides both sharpness shearing ability and finishing surface quality, combining the most suitable cutting edge design realizes the higher quality of finishing surface.
- High quality and stable milling performance with long tool life by optimized design and DLC COATING.
- Machining copper tungsten electrodes is also effective.



◆ New Size

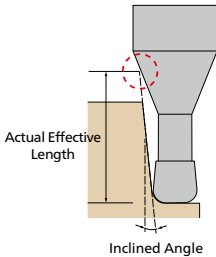
| Code No.         | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(l1) | Length<br>of Cut<br>(l) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |      |       |      |      |
|------------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|------|-------|------|------|
|                  |             |                         |                              |                         |                      |                            |                      |                          | 30°                                                                 | 1°   | 1°30′ | 2°   | 3°   |
| ◆ 07-00110-02021 | 0.2         | R0.02                   | 0.5                          | 0.4                     | 0.18                 | 12°                        | 4                    | 45                       | 0.56                                                                | 0.59 | 0.62  | 0.65 | 0.71 |
| ◆ 07-00110-02023 |             |                         | 1                            | 0.4                     | 0.18                 | 12°                        | 4                    | 45                       | 1.09                                                                | 1.13 | 1.19  | 1.24 | 1.38 |
| ◆ 07-00110-02025 |             |                         | 1.5                          | 0.4                     | 0.18                 | 12°                        | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| 07-00110-02051   |             | R0.05                   | 0.5                          | 0.4                     | 0.18                 | 12°                        | 4                    | 45                       | 0.57                                                                | 0.59 | 0.62  | 0.64 | 0.71 |
| 07-00110-02053   |             |                         | 1                            | 0.4                     | 0.18                 | 12°                        | 4                    | 45                       | 1.09                                                                | 1.14 | 1.19  | 1.24 | 1.37 |
| 07-00110-02055   | 0.3         | R0.02                   | 1                            | 0.6                     | 0.28                 | 12°                        | 4                    | 45                       | 1.09                                                                | 1.13 | 1.19  | 1.24 | 1.38 |
| ◆ 07-00110-03021 |             |                         | 1.5                          | 0.6                     | 0.28                 | 12°                        | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| ◆ 07-00110-03022 |             |                         | 2                            | 0.6                     | 0.28                 | 12°                        | 4                    | 45                       | 2.13                                                                | 2.22 | 2.33  | 2.44 | 2.71 |
| ◆ 07-00110-03023 |             | R0.05                   | 1                            | 0.6                     | 0.28                 | 12°                        | 4                    | 45                       | 1.09                                                                | 1.14 | 1.19  | 1.24 | 1.37 |
| 07-00110-03051   |             |                         | 1.5                          | 0.6                     | 0.28                 | 12°                        | 4                    | 45                       | 1.61                                                                | 1.68 | 1.76  | 1.84 | 2.04 |
| 07-00110-03052   | 0.4         | R0.02                   | 2                            | 0.6                     | 0.28                 | 12°                        | 4                    | 45                       | 2.13                                                                | 2.23 | 2.33  | 2.44 | 2.70 |
| 07-00110-03053   |             |                         | 1                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.27 | 1.41 |
| ◆ 07-00110-04021 |             |                         | 2                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 2.15                                                                | 2.25 | 2.35  | 2.47 | 2.74 |
| ◆ 07-00110-04023 |             | R0.05                   | 3                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 3.20                                                                | 3.34 | 3.49  | 3.67 | 4.06 |
| ◆ 07-00110-04025 |             |                         | 4                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 4.24                                                                | 4.43 | 4.63  | 4.86 | 5.39 |
| ◆ 07-00110-04027 |             |                         | 1                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.27 | 1.40 |
| 07-00110-04051   |             | R0.1                    | 2                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 2.16                                                                | 2.25 | 2.35  | 2.47 | 2.73 |
| 07-00110-04053   |             |                         | 3                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 3.20                                                                | 3.34 | 3.50  | 3.66 | 4.06 |
| 07-00110-04055   |             |                         | 4                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 4.24                                                                | 4.43 | 4.64  | 4.86 | 5.39 |
| 07-00110-04057   |             | R0.1                    | 1                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 1.11                                                                | 1.16 | 1.21  | 1.26 | 1.39 |
| 07-00110-04101   |             |                         | 2                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 2.15                                                                | 2.25 | 2.35  | 2.46 | 2.72 |
| 07-00110-04103   |             |                         | 3                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 3.20                                                                | 3.34 | 3.49  | 3.65 | 4.04 |
| 07-00110-04105   |             | R0.1                    | 4                            | 0.8                     | 0.37                 | 12°                        | 4                    | 45                       | 4.24                                                                | 4.43 | 4.63  | 4.85 | 5.37 |
| 07-00110-04107   |             |                         |                              |                         |                      |                            |                      |                          |                                                                     |      |       |      |      |
|                  |             |                         |                              |                         |                      |                            |                      |                          |                                                                     |      |       |      |      |

How to Order

When you order, indicate DHR237R (D)×(R)×(l1). ※(γ) is reference value.

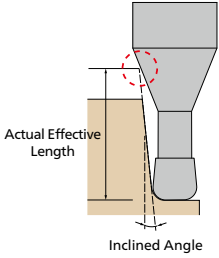
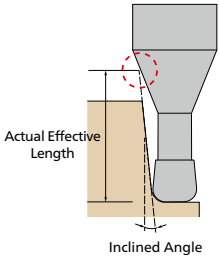
Machining case

W-024



Unit : mm

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |       |
| 07-00110-05022 | 0.5         | R0.02                   | 2                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.50  | 2.77  |       |
| 07-00110-05023 |             |                         | 3                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 3.22                                                                | 3.36  | 3.52  | 3.69  | 4.10  |       |
| 07-00110-05024 |             |                         | 4                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.89  | 5.42  |       |
| 07-00110-05025 |             |                         | 5                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 5.31                                                                | 5.54  | 5.80  | 6.09  | 6.75  |       |
| 07-00110-05052 |             | R0.05                   | 2                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.28  | 2.38  | 2.50  | 2.76  |       |
| 07-00110-05053 |             |                         | 3                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 3.22                                                                | 3.37  | 3.52  | 3.69  | 4.09  |       |
| 07-00110-05054 |             |                         | 4                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.46  | 4.66  | 4.89  | 5.42  |       |
| 07-00110-05055 |             |                         | 5                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 5.31                                                                | 5.55  | 5.80  | 6.09  | 6.75  |       |
| 07-00110-05102 |             | R0.1                    | 2                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.37  | 2.49  | 2.75  |       |
| 07-00110-05103 |             |                         | 3                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 3.22                                                                | 3.36  | 3.51  | 3.68  | 4.07  |       |
| 07-00110-05104 |             |                         | 4                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.45  | 4.66  | 4.88  | 5.40  |       |
| 07-00110-05105 |             |                         | 5                                         | 1                       | 0.46                              | 12°                        | 4                    | 45                       | 5.31                                                                | 5.54  | 5.80  | 6.08  | 6.73  |       |
| 07-00110-06022 | 0.6         | R0.02                   | 2                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.38  | 2.50  | 2.77  |       |
| 07-00110-06024 |             |                         | 4                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 4.26                                                                | 4.45  | 4.66  | 4.89  | 5.42  |       |
| 07-00110-06026 |             |                         | 6                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.08  |       |
| 07-00110-06052 |             | R0.05                   | 2                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.28  | 2.38  | 2.50  | 2.76  |       |
| 07-00110-06054 |             |                         | 4                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.46  | 4.66  | 4.89  | 5.42  |       |
| 07-00110-06056 |             |                         | 6                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.07  |       |
| 07-00110-06102 |             | R0.1                    | 2                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 2.18                                                                | 2.27  | 2.37  | 2.49  | 2.75  |       |
| 07-00110-06104 |             |                         | 4                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.45  | 4.66  | 4.88  | 5.40  |       |
| 07-00110-06106 |             |                         | 6                                         | 1.2                     | 0.56                              | 12°                        | 4                    | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.27  | 8.06  |       |
| 07-00110-08024 |             | 0.8                     | R0.02                                     | 4                       | 1.6                               | 0.76                       | 12°                  | 4                        | 45                                                                  | 4.26  | 4.45  | 4.66  | 4.89  | 5.42  |
| 07-00110-08026 |             |                         |                                           | 6                       | 1.6                               | 0.76                       | 12°                  | 4                        | 45                                                                  | 6.35  | 6.63  | 6.94  | 7.28  | 8.08  |
| 07-00110-08028 |             |                         |                                           | 8                       | 1.6                               | 0.76                       | 12°                  | 4                        | 50                                                                  | 8.43  | 8.81  | 9.22  | 9.68  | 10.73 |
| 07-00110-08054 | R0.05       |                         | 4                                         | 1.6                     | 0.76                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.46  | 4.66  | 4.89  | 5.42  |       |
| 07-00110-08056 |             |                         | 6                                         | 1.6                     | 0.76                              | 12°                        | 4                    | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.28  | 8.07  |       |
| 07-00110-08058 |             |                         | 8                                         | 1.6                     | 0.76                              | 12°                        | 4                    | 50                       | 8.44                                                                | 8.81  | 9.22  | 9.68  | 10.73 |       |
| 07-00110-08104 | R0.1        |                         | 4                                         | 1.6                     | 0.76                              | 12°                        | 4                    | 45                       | 4.27                                                                | 4.45  | 4.66  | 4.88  | 5.40  |       |
| 07-00110-08106 |             |                         | 6                                         | 1.6                     | 0.76                              | 12°                        | 4                    | 45                       | 6.35                                                                | 6.63  | 6.94  | 7.27  | 8.06  |       |
| 07-00110-08108 |             |                         | 8                                         | 1.6                     | 0.76                              | 12°                        | 4                    | 50                       | 8.44                                                                | 8.81  | 9.22  | 9.67  | 10.71 |       |
| 07-00110-10053 | 1           | R0.05                   | 3                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 3.24                                                                | 3.39  | 3.54  | 3.72  | 4.12  |       |
| 07-00110-10054 |             |                         | 4                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 4.29                                                                | 4.48  | 4.68  | 4.91  | 5.44  |       |
| 07-00110-10055 |             |                         | 5                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 5.33                                                                | 5.57  | 5.82  | 6.11  | 6.77  |       |
| 07-00110-10056 |             |                         | 6                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 6.37                                                                | 6.66  | 6.97  | 7.31  | 8.10  |       |
| 07-00110-10058 |             |                         | 8                                         | 2                       | 0.95                              | 12°                        | 4                    | 50                       | 8.46                                                                | 8.83  | 9.25  | 9.70  | 10.75 |       |
| 07-00110-10060 |             | R0.1                    | 10                                        | 2                       | 0.95                              | 12°                        | 4                    | 50                       | 10.54                                                               | 11.01 | 11.53 | 12.09 | 13.41 |       |
| 07-00110-10103 |             |                         | 3                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 3.25                                                                | 3.39  | 3.54  | 3.71  | 4.11  |       |
| 07-00110-10104 |             |                         | 4                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 4.29                                                                | 4.48  | 4.68  | 4.91  | 5.43  |       |
| 07-00110-10105 |             |                         | 5                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 5.33                                                                | 5.57  | 5.82  | 6.10  | 6.76  |       |
| 07-00110-10106 |             |                         | 6                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 6.38                                                                | 6.66  | 6.96  | 7.30  | 8.09  |       |
| 07-00110-10108 |             | R0.2                    | 8                                         | 2                       | 0.95                              | 12°                        | 4                    | 50                       | 8.46                                                                | 8.84  | 9.24  | 9.69  | 10.74 |       |
| 07-00110-10110 |             |                         | 10                                        | 2                       | 0.95                              | 12°                        | 4                    | 50                       | 10.55                                                               | 11.01 | 11.53 | 12.09 | 13.40 |       |
| 07-00110-10203 |             |                         | 3                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 3.24                                                                | 3.38  | 3.53  | 3.69  | 4.07  |       |
| 07-00110-10204 |             |                         | 4                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 4.29                                                                | 4.47  | 4.67  | 4.89  | 5.40  |       |
| 07-00110-10205 |             |                         | 5                                         | 2                       | 0.95                              | 12°                        | 4                    | 45                       | 5.33                                                                | 5.56  | 5.81  | 6.09  | 6.73  |       |
| 07-00110-10206 |             | 6                       | 2                                         | 0.95                    | 12°                               | 4                          | 45                   | 6.37                     | 6.65                                                                | 6.95  | 7.28  | 8.06  |       |       |
| 07-00110-10208 |             | 8                       | 2                                         | 0.95                    | 12°                               | 4                          | 50                   | 8.46                     | 8.83                                                                | 9.23  | 9.67  | 10.71 |       |       |
| 07-00110-10210 |             | 10                      | 2                                         | 0.95                    | 12°                               | 4                          | 50                   | 10.54                    | 11.01                                                               | 11.51 | 12.07 | 13.36 |       |       |



- ☐ Aluminium Alloy
- ☒ Copper
- ☒ Copper Tungsten
- ☐ Resin

◆ New Size

| Code No.         | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ1) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d2) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|------------------|-------------|-------------------------|------------------------------|-------------------------|----------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                  |             |                         |                              |                         |                      |                            |                      |                          | 30´                                                                 | 1°    | 1°30´ | 2°    | 3°    |
|                  |             |                         |                              |                         |                      |                            |                      |                          | Unit : mm                                                           |       |       |       |       |
| ◆ 07-00110-15105 | 1.5         | R0.1                    | 5                            | 3                       | 1.45                 | 12°                        | 4                    | 45                       | 5.33                                                                | 5.56  | 5.82  | 6.10  | 6.76  |
| ◆ 07-00110-15110 |             |                         | 10                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 10.54                                                               | 11.01 | 11.52 | 12.08 | 13.39 |
| ◆ 07-00110-15115 |             |                         | 15                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 15.76                                                               | 16.46 | 17.22 | 18.07 | 20.03 |
| ◆ 07-00110-15205 |             | R0.2                    | 5                            | 3                       | 1.45                 | 12°                        | 4                    | 45                       | 5.32                                                                | 5.55  | 5.80  | 6.08  | 6.72  |
| ◆ 07-00110-15210 |             |                         | 10                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 10.54                                                               | 11.00 | 11.51 | 12.06 | 13.36 |
| ◆ 07-00110-15215 |             |                         | 15                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 15.75                                                               | 16.45 | 17.21 | 18.05 | 20.00 |
| ◆ 07-00110-15305 |             | R0.3                    | 5                            | 3                       | 1.45                 | 12°                        | 4                    | 45                       | 5.32                                                                | 5.54  | 5.79  | 6.06  | 6.69  |
| ◆ 07-00110-15310 |             |                         | 10                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 10.53                                                               | 10.99 | 11.49 | 12.04 | 13.33 |
| ◆ 07-00110-15315 |             |                         | 15                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 15.75                                                               | 16.44 | 17.20 | 18.03 | 19.96 |
| ◆ 07-00110-15505 |             | R0.5                    | 5                            | 3                       | 1.45                 | 12°                        | 4                    | 45                       | 5.31                                                                | 5.53  | 5.76  | 6.02  | 6.63  |
| 07-00110-15510   |             |                         | 10                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 10.53                                                               | 10.98 | 11.47 | 12.01 | 13.27 |
| ◆ 07-00110-15515 |             |                         | 15                           | 3                       | 1.45                 | 12°                        | 4                    | 50                       | 15.74                                                               | 16.42 | 17.17 | 17.99 | 19.90 |
| 07-00110-15520   |             |                         | 20                           | 3                       | 1.45                 | 12°                        | 4                    | 60                       | 20.96                                                               | 21.87 | 22.87 | 23.98 | Free  |
| 07-00110-20105   | 2           | R0.1                    | 5                            | 4                       | 1.94                 | 12°                        | 4                    | 45                       | 5.36                                                                | 5.59  | 5.85  | 6.13  | 6.79  |
| 07-00110-20108   |             |                         | 8                            | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 8.49                                                                | 8.86  | 9.27  | 9.72  | 10.77 |
| 07-00110-20110   |             |                         | 10                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 10.57                                                               | 11.04 | 11.55 | 12.12 | 13.43 |
| 07-00110-20115   |             |                         | 15                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 15.79                                                               | 16.49 | 17.25 | 18.10 | Free  |
| 07-00110-20120   |             | R0.2                    | 20                           | 4                       | 1.94                 | 12°                        | 4                    | 60                       | 21.00                                                               | 21.93 | 22.96 | 24.08 | Free  |
| ◆ 07-00110-20205 |             |                         | 5                            | 4                       | 1.94                 | 12°                        | 4                    | 45                       | 5.35                                                                | 5.58  | 5.83  | 6.11  | 6.75  |
| ◆ 07-00110-20208 |             |                         | 8                            | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 8.48                                                                | 8.85  | 9.25  | 9.70  | 10.74 |
| ◆ 07-00110-20210 |             |                         | 10                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 10.56                                                               | 11.03 | 11.53 | 12.09 | 13.39 |
| ◆ 07-00110-20215 |             |                         | 15                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 15.78                                                               | 16.47 | 17.24 | 18.07 | Free  |
| ◆ 07-00110-20220 |             |                         | 20                           | 4                       | 1.94                 | 12°                        | 4                    | 60                       | 20.99                                                               | 21.92 | 22.94 | 24.06 | Free  |
| 07-00110-20305   |             | R0.3                    | 5                            | 4                       | 1.94                 | 12°                        | 4                    | 45                       | 5.35                                                                | 5.57  | 5.82  | 6.09  | 6.73  |
| 07-00110-20308   |             |                         | 8                            | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 8.48                                                                | 8.84  | 9.24  | 9.68  | 10.71 |
| 07-00110-20310   |             |                         | 10                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 10.56                                                               | 11.02 | 11.52 | 12.08 | 13.36 |
| 07-00110-20315   |             |                         | 15                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 15.78                                                               | 16.47 | 17.23 | 18.06 | Free  |
| 07-00110-20320   |             | R0.5                    | 20                           | 4                       | 1.94                 | 12°                        | 4                    | 60                       | 20.99                                                               | 21.92 | 22.93 | 24.04 | Free  |
| ◆ 07-00110-20505 |             |                         | 5                            | 4                       | 1.94                 | 12°                        | 4                    | 45                       | 5.33                                                                | 5.55  | 5.79  | 6.05  | 6.66  |
| ◆ 07-00110-20508 |             |                         | 8                            | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 8.46                                                                | 8.82  | 9.21  | 9.64  | 10.64 |
| ◆ 07-00110-20510 |             |                         | 10                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 10.55                                                               | 11.00 | 11.49 | 12.03 | 13.30 |
| ◆ 07-00110-20515 |             |                         | 15                           | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 15.76                                                               | 16.45 | 17.19 | 18.02 | Free  |
| ◆ 07-00110-20520 |             |                         | 20                           | 4                       | 1.94                 | 12°                        | 4                    | 60                       | 20.98                                                               | 21.89 | 22.90 | 24.00 | Free  |
| ◆ 07-00110-25208 | 2.5         | R0.2                    | 8                            | 5                       | 2.4                  | 12°                        | 4                    | 50                       | 8.57                                                                | 8.95  | 9.36  | 9.81  | 10.86 |
| ◆ 07-00110-25214 |             |                         | 14                           | 5                       | 2.4                  | 12°                        | 4                    | 50                       | 14.83                                                               | 15.49 | 16.20 | 16.99 | Free  |
| ◆ 07-00110-25220 |             |                         | 20                           | 5                       | 2.4                  | 12°                        | 4                    | 60                       | 21.09                                                               | 22.02 | 23.05 | Free  | Free  |
| ◆ 07-00110-25508 |             | R0.5                    | 8                            | 5                       | 2.4                  | 12°                        | 4                    | 50                       | 8.56                                                                | 8.92  | 9.32  | 9.75  | 10.77 |
| ◆ 07-00110-25514 |             |                         | 14                           | 5                       | 2.4                  | 12°                        | 4                    | 50                       | 14.82                                                               | 15.46 | 16.16 | 16.93 | Free  |
| ◆ 07-00110-25520 |             |                         | 20                           | 5                       | 2.4                  | 12°                        | 4                    | 60                       | 21.08                                                               | 22.00 | 23.00 | Free  | Free  |
| 07-00110-25520   |             | R0.1                    | 5                            | 4                       | 1.94                 | 12°                        | 4                    | 45                       | 5.36                                                                | 5.59  | 5.85  | 6.13  | 6.79  |
| 07-00110-25520   |             |                         | 8                            | 4                       | 1.94                 | 12°                        | 4                    | 50                       | 8.49                                                                | 8.86  | 9.27  | 9.72  | 10.77 |

How to Order

When you order, indicate DHR237R (D)×(R)×(ℓ1). ※(γ) is reference value.

◆ New Size

| Code No.       | Dia.<br>(D) | Corner<br>Radius<br>(R) | Under Neck<br>Length<br>(ℓ <sub>1</sub> ) | Length<br>of Cut<br>(ℓ) | Neck<br>Dia.<br>(d <sub>2</sub> ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Actual effective length depending on<br>inclined angle of workpiece |       |       |       |       |
|----------------|-------------|-------------------------|-------------------------------------------|-------------------------|-----------------------------------|----------------------------|----------------------|--------------------------|---------------------------------------------------------------------|-------|-------|-------|-------|
|                |             |                         |                                           |                         |                                   |                            |                      |                          | 30°                                                                 | 1°    | 1°30′ | 2°    | 3°    |
| 07-00110-30112 | 3           | R0.1                    | 12                                        | 6                       | 2.85                              | 12°                        | 6                    | 50                       | 12.87                                                               | 13.44 | 14.07 | 14.76 | 16.36 |
| 07-00110-30118 |             |                         | 18                                        | 6                       | 2.85                              | 12°                        | 6                    | 60                       | 19.13                                                               | 19.98 | 20.91 | 21.94 | 24.32 |
| 07-00110-30124 |             |                         | 24                                        | 6                       | 2.85                              | 12°                        | 6                    | 70                       | 25.39                                                               | 26.52 | 27.76 | 29.12 | Free  |
| 07-00110-30212 |             | R0.2                    | 12                                        | 6                       | 2.85                              | 12°                        | 6                    | 50                       | 12.87                                                               | 13.44 | 14.06 | 14.74 | 16.33 |
| 07-00110-30218 |             |                         | 18                                        | 6                       | 2.85                              | 12°                        | 6                    | 60                       | 19.13                                                               | 19.98 | 20.90 | 21.92 | 24.29 |
| 07-00110-30224 |             |                         | 24                                        | 6                       | 2.85                              | 12°                        | 6                    | 70                       | 25.39                                                               | 26.51 | 27.75 | 29.10 | Free  |
| 07-00110-30312 |             | R0.3                    | 12                                        | 6                       | 2.85                              | 12°                        | 6                    | 50                       | 12.86                                                               | 13.43 | 14.04 | 14.72 | 16.29 |
| 07-00110-30318 |             |                         | 18                                        | 6                       | 2.85                              | 12°                        | 6                    | 60                       | 19.12                                                               | 19.96 | 20.88 | 21.90 | 24.26 |
| 07-00110-30324 |             |                         | 24                                        | 6                       | 2.85                              | 12°                        | 6                    | 70                       | 25.38                                                               | 26.50 | 27.73 | 29.08 | Free  |
| 07-00110-30512 |             | R0.5                    | 12                                        | 6                       | 2.85                              | 12°                        | 6                    | 50                       | 12.86                                                               | 13.41 | 14.02 | 14.68 | 16.24 |
| 07-00110-30515 |             |                         | 15                                        | 6                       | 2.85                              | 12°                        | 6                    | 60                       | 15.99                                                               | 16.68 | 17.44 | 18.27 | 20.22 |
| 07-00110-30518 |             |                         | 18                                        | 6                       | 2.85                              | 12°                        | 6                    | 60                       | 19.12                                                               | 19.95 | 20.86 | 21.86 | 24.20 |
| 07-00110-30524 |             |                         | 24                                        | 6                       | 2.85                              | 12°                        | 6                    | 70                       | 25.37                                                               | 26.49 | 27.71 | 29.04 | Free  |
| 07-00110-30530 |             |                         | 30                                        | 6                       | 2.85                              | 12°                        | 6                    | 70                       | 31.63                                                               | 33.02 | 34.55 | 36.22 | Free  |
| 07-00110-40116 | 4           | R0.1                    | 16                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 17.17                                                               | 17.93 | 18.77 | 19.68 | Free  |
| 07-00110-40124 |             |                         | 24                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 25.51                                                               | 26.65 | 27.89 | Free  | Free  |
| 07-00110-40132 |             |                         | 32                                        | 8                       | 3.8                               | 12°                        | 6                    | 70                       | 33.85                                                               | 35.36 | 37.01 | Free  | Free  |
| 07-00110-40216 |             | R0.2                    | 16                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 17.17                                                               | 17.93 | 18.76 | 19.67 | Free  |
| 07-00110-40224 |             |                         | 24                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 25.51                                                               | 26.64 | 27.88 | Free  | Free  |
| 07-00110-40232 |             |                         | 32                                        | 8                       | 3.8                               | 12°                        | 6                    | 70                       | 33.85                                                               | 35.36 | 37.00 | Free  | Free  |
| 07-00110-40316 |             | R0.3                    | 16                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 17.16                                                               | 17.91 | 18.74 | 19.65 | Free  |
| 07-00110-40324 |             |                         | 24                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 25.50                                                               | 26.63 | 27.86 | Free  | Free  |
| 07-00110-40332 |             |                         | 32                                        | 8                       | 3.8                               | 12°                        | 6                    | 70                       | 33.84                                                               | 35.34 | 36.99 | Free  | Free  |
| 07-00110-40516 |             | R0.5                    | 16                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 17.15                                                               | 17.90 | 18.72 | 19.61 | Free  |
| 07-00110-40524 |             |                         | 24                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 25.50                                                               | 26.62 | 27.84 | Free  | Free  |
| 07-00110-40532 |             |                         | 32                                        | 8                       | 3.8                               | 12°                        | 6                    | 70                       | 33.84                                                               | 35.33 | 36.96 | Free  | Free  |
| 07-00110-41016 |             | R1                      | 16                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 17.13                                                               | 17.86 | 18.65 | 19.52 | Free  |
| 07-00110-41024 |             |                         | 24                                        | 8                       | 3.8                               | 12°                        | 6                    | 60                       | 25.48                                                               | 26.57 | 27.77 | 29.09 | Free  |
| 07-00110-41032 | 32          |                         | 8                                         | 3.8                     | 12°                               | 6                          | 70                   | 33.82                    | 35.29                                                               | 36.89 | Free  | Free  |       |
| 07-00110-50120 | 5           | R0.1                    | 20                                        | 10                      | 4.8                               | 12°                        | 6                    | 60                       | 21.34                                                               | 22.29 | Free  | Free  | Free  |
| 07-00110-50140 |             |                         | 40                                        | 10                      | 4.8                               | 12°                        | 6                    | 80                       | 42.19                                                               | Free  | Free  | Free  | Free  |
| 07-00110-60124 | 6           | R0.1                    | 24                                        | 12                      | 5.8                               | —                          | 6                    | 60                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60148 |             |                         | 48                                        | 12                      | 5.8                               | —                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60224 |             | R0.2                    | 24                                        | 12                      | 5.8                               | —                          | 6                    | 60                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60248 |             |                         | 48                                        | 12                      | 5.8                               | —                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60324 |             | R0.3                    | 24                                        | 12                      | 5.8                               | —                          | 6                    | 60                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60348 |             |                         | 48                                        | 12                      | 5.8                               | —                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60524 |             | R0.5                    | 24                                        | 12                      | 5.8                               | —                          | 6                    | 60                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60530 |             |                         | 30                                        | 12                      | 5.8                               | —                          | 6                    | 70                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-60548 |             |                         | 48                                        | 12                      | 5.8                               | —                          | 6                    | 90                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-61024 |             | R1                      | 24                                        | 12                      | 5.8                               | —                          | 6                    | 60                       | Free                                                                | Free  | Free  | Free  | Free  |
| 07-00110-61048 | 48          |                         | 12                                        | 5.8                     | —                                 | 6                          | 90                   | Free                     | Free                                                                | Free  | Free  | Free  |       |

Aluminium Alloy

Copper

Copper Tungsten

Resin

N

N

N

N

Aluminium Alloy

Copper

Copper Tungsten

Resin

N

N

N

N



| Work Material |               |                   |     | Copper            |        |                   |                   | Copper Tungsten (W70%-Cu30%) |        |                   |                   |
|---------------|---------------|-------------------|-----|-------------------|--------|-------------------|-------------------|------------------------------|--------|-------------------|-------------------|
| Dia.          | Corner Radius | Under Neck Length | L/D | Spindle Speed     | Feed   | Depth of Cut      |                   | Spindle Speed                | Feed   | Depth of Cut      |                   |
|               |               |                   |     | min <sup>-1</sup> | mm/min | a <sub>p</sub> mm | a <sub>e</sub> mm | min <sup>-1</sup>            | mm/min | a <sub>p</sub> mm | a <sub>e</sub> mm |
| 0.2           | 0.02          | 0.5               | 2.5 | 40,000            | 400    | 0.01              | 0.1               | 36,000                       | 360    | 0.009             | 0.09              |
|               |               | 1                 | 5   | 40,000            | 320    | 0.008             | 0.1               | 36,000                       | 280    | 0.007             | 0.09              |
|               |               | 1.5               | 7.5 | 30,000            | 180    | 0.005             | 0.1               | 27,000                       | 160    | 0.005             | 0.09              |
|               | 0.05          | 0.5               | 2.5 | 40,000            | 400    | 0.03              | 0.1               | 36,000                       | 360    | 0.027             | 0.09              |
|               |               | 1                 | 5   | 40,000            | 320    | 0.02              | 0.1               | 36,000                       | 280    | 0.018             | 0.09              |
|               |               | 1.5               | 7.5 | 30,000            | 180    | 0.01              | 0.1               | 27,000                       | 160    | 0.009             | 0.09              |
| 0.3           | 0.02          | 1                 | 3.3 | 40,000            | 480    | 0.01              | 0.15              | 36,000                       | 420    | 0.009             | 0.14              |
|               |               | 1.5               | 5   | 40,000            | 360    | 0.008             | 0.15              | 36,000                       | 320    | 0.007             | 0.14              |
|               |               | 2                 | 6.7 | 30,000            | 240    | 0.005             | 0.15              | 27,000                       | 210    | 0.005             | 0.14              |
|               | 0.05          | 1                 | 3.3 | 40,000            | 480    | 0.03              | 0.15              | 36,000                       | 420    | 0.027             | 0.14              |
|               |               | 1.5               | 5   | 40,000            | 360    | 0.024             | 0.15              | 36,000                       | 320    | 0.022             | 0.14              |
|               |               | 2                 | 6.7 | 30,000            | 240    | 0.018             | 0.15              | 27,000                       | 210    | 0.016             | 0.14              |
| 0.4           | 0.02          | 1                 | 2.5 | 40,000            | 640    | 0.01              | 0.2               | 36,000                       | 580    | 0.009             | 0.18              |
|               |               | 2                 | 5   | 40,000            | 560    | 0.01              | 0.2               | 36,000                       | 500    | 0.009             | 0.18              |
|               |               | 3                 | 7.5 | 30,000            | 420    | 0.008             | 0.2               | 27,000                       | 380    | 0.007             | 0.18              |
|               |               | 4                 | 10  | 30,000            | 360    | 0.005             | 0.2               | 27,000                       | 320    | 0.005             | 0.18              |
|               |               | 1                 | 2.5 | 40,000            | 640    | 0.03              | 0.2               | 36,000                       | 580    | 0.027             | 0.18              |
|               | 0.05          | 2                 | 5   | 40,000            | 560    | 0.024             | 0.2               | 36,000                       | 500    | 0.022             | 0.18              |
|               |               | 3                 | 7.5 | 30,000            | 420    | 0.018             | 0.2               | 27,000                       | 380    | 0.016             | 0.18              |
|               |               | 4                 | 10  | 30,000            | 360    | 0.012             | 0.2               | 27,000                       | 320    | 0.01              | 0.18              |
|               |               | 1                 | 2.5 | 40,000            | 640    | 0.06              | 0.2               | 36,000                       | 580    | 0.054             | 0.18              |
|               | 0.1           | 2                 | 5   | 40,000            | 560    | 0.05              | 0.2               | 36,000                       | 500    | 0.045             | 0.18              |
|               |               | 3                 | 7.5 | 30,000            | 420    | 0.036             | 0.2               | 27,000                       | 380    | 0.032             | 0.18              |
|               |               | 4                 | 10  | 30,000            | 360    | 0.024             | 0.2               | 27,000                       | 320    | 0.022             | 0.18              |
| 0.5           | 0.02          | 2                 | 4   | 40,000            | 800    | 0.01              | 0.25              | 36,000                       | 720    | 0.009             | 0.23              |
|               |               | 3                 | 6   | 35,000            | 640    | 0.01              | 0.25              | 32,000                       | 580    | 0.009             | 0.23              |
|               |               | 4                 | 8   | 30,000            | 480    | 0.008             | 0.25              | 27,000                       | 420    | 0.007             | 0.23              |
|               |               | 5                 | 10  | 25,000            | 400    | 0.005             | 0.25              | 23,000                       | 360    | 0.005             | 0.23              |
|               |               | 2                 | 4   | 40,000            | 800    | 0.03              | 0.25              | 36,000                       | 720    | 0.027             | 0.23              |
|               | 0.05          | 3                 | 6   | 35,000            | 640    | 0.024             | 0.25              | 32,000                       | 580    | 0.022             | 0.23              |
|               |               | 4                 | 8   | 30,000            | 480    | 0.018             | 0.25              | 27,000                       | 420    | 0.016             | 0.23              |
|               |               | 5                 | 10  | 25,000            | 400    | 0.012             | 0.25              | 23,000                       | 360    | 0.01              | 0.23              |
|               |               | 2                 | 4   | 40,000            | 800    | 0.06              | 0.25              | 36,000                       | 720    | 0.054             | 0.23              |
|               | 0.1           | 3                 | 6   | 35,000            | 640    | 0.05              | 0.25              | 32,000                       | 580    | 0.045             | 0.23              |
|               |               | 4                 | 8   | 30,000            | 480    | 0.036             | 0.25              | 27,000                       | 420    | 0.032             | 0.23              |
|               |               | 5                 | 10  | 25,000            | 400    | 0.024             | 0.25              | 23,000                       | 360    | 0.022             | 0.23              |
| 0.6           | 0.02          | 2                 | 3.3 | 30,000            | 1,000  | 0.01              | 0.3               | 27,000                       | 900    | 0.009             | 0.27              |
|               |               | 4                 | 6.7 | 25,000            | 800    | 0.01              | 0.3               | 23,000                       | 720    | 0.009             | 0.27              |
|               |               | 6                 | 10  | 20,000            | 600    | 0.008             | 0.3               | 18,000                       | 540    | 0.007             | 0.27              |
|               | 0.05          | 2                 | 3.3 | 30,000            | 1,000  | 0.03              | 0.3               | 27,000                       | 900    | 0.027             | 0.27              |
|               |               | 4                 | 6.7 | 25,000            | 800    | 0.02              | 0.3               | 23,000                       | 720    | 0.018             | 0.27              |
|               |               | 6                 | 10  | 20,000            | 600    | 0.012             | 0.3               | 18,000                       | 540    | 0.01              | 0.27              |
|               |               | 2                 | 3.3 | 30,000            | 1,000  | 0.06              | 0.3               | 27,000                       | 900    | 0.054             | 0.27              |
|               | 0.1           | 4                 | 6.7 | 25,000            | 800    | 0.05              | 0.3               | 23,000                       | 720    | 0.045             | 0.27              |
|               |               | 6                 | 10  | 20,000            | 600    | 0.036             | 0.3               | 18,000                       | 540    | 0.032             | 0.27              |
|               |               | 2                 | 3.3 | 30,000            | 1,000  | 0.06              | 0.3               | 27,000                       | 900    | 0.054             | 0.27              |

| Work Material |               |                   |      | Copper            |        |                   |                   | Copper Tungsten (W70%-Cu30%) |        |                   |                   |
|---------------|---------------|-------------------|------|-------------------|--------|-------------------|-------------------|------------------------------|--------|-------------------|-------------------|
| Dia.          | Corner Radius | Under Neck Length | L/D  | Spindle Speed     | Feed   | Depth of Cut      |                   | Spindle Speed                | Feed   | Depth of Cut      |                   |
|               |               |                   |      | min <sup>-1</sup> | mm/min | a <sub>p</sub> mm | a <sub>e</sub> mm | min <sup>-1</sup>            | mm/min | a <sub>p</sub> mm | a <sub>e</sub> mm |
| 0.8           | 0.02          | 4                 | 5    | 25,000            | 1,600  | 0.01              | 0.4               | 23,000                       | 1,400  | 0.009             | 0.36              |
|               |               | 6                 | 7.5  | 20,000            | 1,200  | 0.01              | 0.4               | 18,000                       | 1,100  | 0.009             | 0.36              |
|               |               | 8                 | 10   | 16,000            | 800    | 0.01              | 0.4               | 14,000                       | 720    | 0.009             | 0.36              |
|               | 0.05          | 4                 | 5    | 25,000            | 1,600  | 0.03              | 0.4               | 23,000                       | 1,400  | 0.027             | 0.36              |
|               |               | 6                 | 7.5  | 20,000            | 1,200  | 0.024             | 0.4               | 18,000                       | 1,100  | 0.022             | 0.36              |
|               |               | 8                 | 10   | 16,000            | 800    | 0.02              | 0.4               | 14,000                       | 720    | 0.018             | 0.36              |
| 1             | 0.1           | 4                 | 5    | 25,000            | 1,600  | 0.06              | 0.4               | 23,000                       | 1,400  | 0.054             | 0.36              |
|               |               | 6                 | 7.5  | 20,000            | 1,200  | 0.05              | 0.4               | 18,000                       | 1,100  | 0.045             | 0.36              |
|               |               | 8                 | 10   | 16,000            | 800    | 0.04              | 0.4               | 14,000                       | 720    | 0.036             | 0.36              |
|               | 0.05          | 3                 | 3    | 25,000            | 2,400  | 0.03              | 0.6               | 23,000                       | 2,200  | 0.027             | 0.55              |
|               |               | 4                 | 4    | 25,000            | 2,200  | 0.03              | 0.6               | 23,000                       | 2,000  | 0.027             | 0.55              |
|               |               | 5                 | 5    | 22,000            | 2,000  | 0.024             | 0.6               | 20,000                       | 1,800  | 0.022             | 0.55              |
| 1.5           | 0.1           | 6                 | 6    | 20,000            | 1,800  | 0.024             | 0.6               | 18,000                       | 1,600  | 0.022             | 0.55              |
|               |               | 8                 | 8    | 16,000            | 1,400  | 0.02              | 0.6               | 14,000                       | 1,200  | 0.018             | 0.55              |
|               |               | 10                | 10   | 12,000            | 1,000  | 0.02              | 0.6               | 11,000                       | 900    | 0.018             | 0.55              |
|               |               | 3                 | 3    | 25,000            | 2,400  | 0.06              | 0.6               | 23,000                       | 2,200  | 0.054             | 0.55              |
|               |               | 4                 | 4    | 25,000            | 2,200  | 0.055             | 0.6               | 23,000                       | 2,000  | 0.05              | 0.55              |
|               | 0.2           | 5                 | 5    | 22,000            | 2,000  | 0.05              | 0.6               | 20,000                       | 1,800  | 0.045             | 0.55              |
|               |               | 6                 | 6    | 20,000            | 1,800  | 0.045             | 0.6               | 18,000                       | 1,600  | 0.04              | 0.55              |
|               |               | 8                 | 8    | 16,000            | 1,400  | 0.04              | 0.6               | 14,000                       | 1,200  | 0.036             | 0.55              |
|               |               | 10                | 10   | 12,000            | 1,000  | 0.03              | 0.6               | 11,000                       | 900    | 0.027             | 0.55              |
|               | 0.3           | 3                 | 3    | 25,000            | 2,400  | 0.12              | 0.6               | 23,000                       | 2,200  | 0.11              | 0.55              |
|               |               | 4                 | 4    | 25,000            | 2,200  | 0.11              | 0.6               | 23,000                       | 2,000  | 0.1               | 0.55              |
|               |               | 5                 | 5    | 22,000            | 2,000  | 0.1               | 0.6               | 20,000                       | 1,800  | 0.09              | 0.55              |
| 1.5           | 0.2           | 6                 | 6    | 20,000            | 1,800  | 0.09              | 0.6               | 18,000                       | 1,600  | 0.08              | 0.55              |
|               |               | 8                 | 8    | 16,000            | 1,400  | 0.08              | 0.6               | 14,000                       | 1,200  | 0.07              | 0.55              |
|               |               | 10                | 10   | 12,000            | 1,000  | 0.06              | 0.6               | 11,000                       | 900    | 0.054             | 0.55              |
|               |               | 5                 | 3.3  | 20,000            | 2,400  | 0.06              | 0.9               | 18,000                       | 2,200  | 0.054             | 0.8               |
|               | 0.1           | 10                | 6.6  | 16,000            | 1,600  | 0.05              | 0.9               | 14,000                       | 1,400  | 0.045             | 0.8               |
|               |               | 15                | 10   | 12,000            | 1,000  | 0.04              | 0.9               | 11,000                       | 900    | 0.036             | 0.8               |
|               |               | 5                 | 3.3  | 20,000            | 2,400  | 0.12              | 0.9               | 18,000                       | 2,200  | 0.11              | 0.8               |
|               | 0.2           | 10                | 6.6  | 16,000            | 1,600  | 0.1               | 0.9               | 14,000                       | 1,400  | 0.09              | 0.8               |
|               |               | 15                | 10   | 12,000            | 1,000  | 0.08              | 0.9               | 11,000                       | 900    | 0.07              | 0.8               |
|               |               | 5                 | 3.3  | 20,000            | 2,400  | 0.18              | 0.9               | 18,000                       | 2,200  | 0.16              | 0.8               |
| 1.5           | 0.3           | 10                | 6.6  | 16,000            | 1,600  | 0.15              | 0.9               | 14,000                       | 1,400  | 0.14              | 0.8               |
|               |               | 15                | 10   | 12,000            | 1,000  | 0.12              | 0.9               | 11,000                       | 900    | 0.11              | 0.8               |
|               |               | 5                 | 3.3  | 20,000            | 2,400  | 0.25              | 0.5               | 18,000                       | 2,200  | 0.23              | 0.8               |
|               | 0.5           | 10                | 6.6  | 16,000            | 1,600  | 0.2               | 0.5               | 14,000                       | 1,400  | 0.18              | 0.8               |
|               |               | 15                | 10   | 12,000            | 1,000  | 0.12              | 0.5               | 11,000                       | 900    | 0.11              | 0.8               |
|               |               | 20                | 13.3 | 8,000             | 600    | 0.06              | 0.5               | 7,000                        | 540    | 0.054             | 0.8               |
|               |               | 5                 | 3.3  | 20,000            | 2,400  | 0.06              | 0.9               | 18,000                       | 2,200  | 0.054             | 0.8               |
|               |               | 10                | 6.6  | 16,000            | 1,600  | 0.05              | 0.9               | 14,000                       | 1,400  | 0.045             | 0.8               |
|               |               | 15                | 10   | 12,000            | 1,000  | 0.04              | 0.9               | 11,000                       | 900    | 0.036             | 0.8               |





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Aluminium Alloy

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Copper

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Copper Tungsten

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Resin

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Aluminium Alloy

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Copper

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Copper Tungsten

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Resin

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| Work Material |               |                   |     | Copper            |        |              |       | Copper Tungsten (W70%-Cu30%) |        |              |       |
|---------------|---------------|-------------------|-----|-------------------|--------|--------------|-------|------------------------------|--------|--------------|-------|
| Dia.          | Corner Radius | Under Neck Length | L/D | Spindle Speed     | Feed   | Depth of Cut |       | Spindle Speed                | Feed   | Depth of Cut |       |
|               |               |                   |     | min <sup>-1</sup> | mm/min | ap mm        | ae mm | min <sup>-1</sup>            | mm/min | ap mm        | ae mm |
| 2             | 0.1           | 5                 | 2.5 | 16,000            | 3,000  | 0.06         | 1.2   | 14,000                       | 2,700  | 0.054        | 1.1   |
|               |               | 8                 | 4   | 14,000            | 2,600  | 0.06         | 1.2   | 13,000                       | 2,400  | 0.054        | 1.1   |
|               |               | 10                | 5   | 12,000            | 2,000  | 0.06         | 1.2   | 11,000                       | 1,800  | 0.054        | 1.1   |
|               |               | 15                | 7.5 | 10,000            | 1,600  | 0.05         | 1.2   | 9,000                        | 1,400  | 0.045        | 1.1   |
|               |               | 20                | 10  | 8,000             | 1,200  | 0.04         | 1.2   | 7,000                        | 1,100  | 0.036        | 1.1   |
|               | 0.2           | 5                 | 2.5 | 16,000            | 3,000  | 0.12         | 1.2   | 14,000                       | 2,700  | 0.11         | 1.1   |
|               |               | 8                 | 4   | 14,000            | 2,600  | 0.12         | 1.2   | 13,000                       | 2,400  | 0.11         | 1.1   |
|               |               | 10                | 5   | 12,000            | 2,000  | 0.12         | 1.2   | 11,000                       | 1,800  | 0.11         | 1.1   |
|               |               | 15                | 7.5 | 10,000            | 1,600  | 0.1          | 1.2   | 9,000                        | 1,400  | 0.09         | 1.1   |
|               |               | 20                | 10  | 8,000             | 1,200  | 0.08         | 1.2   | 7,000                        | 1,100  | 0.07         | 1.1   |
|               | 0.3           | 5                 | 2.5 | 16,000            | 3,000  | 0.18         | 1.2   | 14,000                       | 2,700  | 0.16         | 1.1   |
|               |               | 8                 | 4   | 14,000            | 2,600  | 0.18         | 1.2   | 13,000                       | 2,400  | 0.16         | 1.1   |
|               |               | 10                | 5   | 12,000            | 2,000  | 0.18         | 1.2   | 11,000                       | 1,800  | 0.16         | 1.1   |
|               |               | 15                | 7.5 | 10,000            | 1,600  | 0.14         | 1.2   | 9,000                        | 1,400  | 0.13         | 1.1   |
|               |               | 20                | 10  | 8,000             | 1,200  | 0.1          | 1.2   | 7,000                        | 1,100  | 0.09         | 1.1   |
|               | 0.5           | 5                 | 2.5 | 16,000            | 3,000  | 0.3          | 1.2   | 14,000                       | 2,700  | 0.27         | 1.1   |
|               |               | 8                 | 4   | 14,000            | 2,600  | 0.3          | 1.2   | 13,000                       | 2,400  | 0.27         | 1.1   |
|               |               | 10                | 5   | 12,000            | 2,000  | 0.3          | 1.2   | 11,000                       | 1,800  | 0.27         | 1.1   |
|               |               | 15                | 7.5 | 10,000            | 1,600  | 0.2          | 1.2   | 9,000                        | 1,400  | 0.18         | 1.1   |
|               |               | 20                | 10  | 8,000             | 1,200  | 0.15         | 1.2   | 7,000                        | 1,100  | 0.14         | 1.1   |
| 2.5           | 0.2           | 8                 | 3.2 | 15,000            | 3,000  | 0.12         | 1.5   | 13,500                       | 2,700  | 0.11         | 1.4   |
|               |               | 14                | 5.6 | 12,000            | 2,200  | 0.1          | 1.5   | 11,000                       | 2,000  | 0.09         | 1.4   |
|               |               | 20                | 8   | 10,000            | 1,600  | 0.08         | 1.5   | 9,000                        | 1,400  | 0.04         | 1.4   |
|               | 0.5           | 8                 | 3.2 | 15,000            | 3,000  | 0.3          | 1.5   | 13,500                       | 2,700  | 0.027        | 1.4   |
|               |               | 14                | 5.6 | 12,000            | 2,200  | 0.25         | 1.5   | 11,000                       | 2,000  | 0.23         | 1.4   |
|               |               | 20                | 8   | 10,000            | 1,600  | 0.2          | 1.5   | 9,000                        | 1,400  | 0.18         | 1.4   |
| 3             | 0.1           | 12                | 4   | 14,000            | 3,000  | 0.06         | 1.8   | 13,000                       | 2,700  | 0.054        | 1.6   |
|               |               | 18                | 6   | 12,000            | 2,400  | 0.05         | 1.8   | 11,000                       | 2,200  | 0.045        | 1.6   |
|               |               | 24                | 8   | 10,000            | 1,800  | 0.04         | 1.8   | 9,000                        | 1,600  | 0.036        | 1.6   |
|               | 0.2           | 12                | 4   | 14,000            | 3,000  | 0.12         | 1.8   | 13,000                       | 2,700  | 0.11         | 1.6   |
|               |               | 18                | 6   | 12,000            | 2,400  | 0.1          | 1.8   | 11,000                       | 2,200  | 0.09         | 1.6   |
|               |               | 24                | 8   | 10,000            | 1,800  | 0.08         | 1.8   | 9,000                        | 1,600  | 0.07         | 1.6   |
|               | 0.3           | 12                | 4   | 14,000            | 3,000  | 0.18         | 1.8   | 13,000                       | 2,700  | 0.16         | 1.6   |
|               |               | 18                | 6   | 12,000            | 2,400  | 0.15         | 1.8   | 11,000                       | 2,200  | 0.14         | 1.6   |
|               |               | 24                | 8   | 10,000            | 1,800  | 0.12         | 1.8   | 9,000                        | 1,600  | 0.11         | 1.6   |
|               | 0.5           | 12                | 4   | 14,000            | 3,000  | 0.3          | 1.8   | 13,000                       | 2,700  | 0.27         | 1.6   |
|               |               | 15                | 5   | 13,000            | 2,600  | 0.3          | 1.8   | 12,000                       | 2,400  | 0.27         | 1.6   |
|               |               | 18                | 6   | 12,000            | 2,400  | 0.25         | 1.8   | 11,000                       | 2,200  | 0.23         | 1.6   |
|               |               | 24                | 8   | 10,000            | 1,800  | 0.2          | 1.8   | 9,000                        | 1,600  | 0.18         | 1.6   |
|               |               | 30                | 10  | 8,000             | 1,400  | 0.16         | 1.8   | 7,000                        | 1,200  | 0.14         | 1.6   |

| Work Material |               |                   |       | Copper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |              |       | Copper Tungsten (W70%-Cu30%) |        |              |       |
|---------------|---------------|-------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|------------------------------|--------|--------------|-------|
| Dia.          | Corner Radius | Under Neck Length | L/D   | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Feed   | Depth of Cut |       | Spindle Speed                | Feed   | Depth of Cut |       |
|               |               |                   |       | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | mm/min | ap mm        | ae mm | min <sup>-1</sup>            | mm/min | ap mm        | ae mm |
| 4             | 0.1           | 16                | 4     | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,800  | 0.06         | 2.8   | 9,000                        | 2,500  | 0.054        | 2.5   |
|               |               | 24                | 6     | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,200  | 0.05         | 2.8   | 7,000                        | 1,900  | 0.045        | 2.5   |
|               |               | 32                | 8     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.04         | 2.8   | 5,500                        | 1,400  | 0.036        | 2.5   |
|               | 0.2           | 16                | 4     | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,800  | 0.14         | 2.8   | 9,000                        | 2,500  | 0.13         | 2.5   |
|               |               | 24                | 6     | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,200  | 0.12         | 2.8   | 7,000                        | 1,900  | 0.11         | 2.5   |
|               |               | 32                | 8     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.1          | 2.8   | 5,500                        | 1,400  | 0.09         | 2.5   |
|               | 0.3           | 16                | 4     | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,800  | 0.18         | 2.8   | 9,000                        | 2,500  | 0.16         | 2.5   |
|               |               | 24                | 6     | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,200  | 0.15         | 2.8   | 7,000                        | 1,900  | 0.14         | 2.5   |
|               |               | 32                | 8     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.12         | 2.8   | 5,500                        | 1,400  | 0.11         | 2.5   |
|               | 0.5           | 16                | 4     | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,800  | 0.3          | 2.4   | 9,000                        | 2,500  | 0.27         | 2.2   |
|               |               | 24                | 6     | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,200  | 0.24         | 2.4   | 7,000                        | 1,900  | 0.22         | 2.2   |
|               |               | 32                | 8     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.18         | 2.4   | 5,500                        | 1,400  | 0.16         | 2.2   |
|               | 1             | 16                | 4     | 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2,800  | 0.6          | 2     | 9,000                        | 2,500  | 0.54         | 1.8   |
|               |               | 24                | 6     | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,200  | 0.48         | 2     | 7,000                        | 1,900  | 0.43         | 1.8   |
|               |               | 32                | 8     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.36         | 2     | 5,500                        | 1,400  | 0.32         | 1.8   |
| 5             | 0.1           | 20                | 4     | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,700  | 0.06         | 3.5   | 7,000                        | 2,400  | 0.054        | 3.2   |
|               |               | 40                | 8     | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.04         | 3.5   | 4,500                        | 1,400  | 0.036        | 3.2   |
| 6             | 0.1           | 24                | 4     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,600  | 0.06         | 4.2   | 5,500                        | 2,300  | 0.054        | 3.8   |
|               |               | 48                | 8     | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.03         | 4.2   | 3,500                        | 1,400  | 0.027        | 3.8   |
|               | 0.2           | 24                | 4     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,600  | 0.12         | 4.2   | 5,500                        | 2,300  | 0.11         | 3.8   |
|               |               | 48                | 8     | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.06         | 4.2   | 3,500                        | 1,400  | 0.054        | 3.8   |
|               | 0.3           | 24                | 4     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,600  | 0.18         | 4.2   | 5,500                        | 2,300  | 0.16         | 3.8   |
|               |               | 48                | 8     | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.09         | 4.2   | 3,500                        | 1,400  | 0.08         | 3.8   |
|               | 0.5           | 24                | 4     | 6,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,600  | 0.3          | 3.6   | 5,500                        | 2,300  | 0.27         | 3.2   |
|               |               | 30                | 5     | 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2,200  | 0.24         | 3.6   | 4,500                        | 1,900  | 0.22         | 3.2   |
|               |               | 48                | 8     | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1,600  | 0.16         | 3.6   | 3,500                        | 1,400  | 0.14         | 3.2   |
| 1             | 24            | 4                 | 6,000 | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.6    | 3            | 5,500 | 2,300                        | 0.54   | 2.7          |       |
|               | 48            | 8                 | 4,000 | 1,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0.3    | 3            | 3,500 | 1,400                        | 0.27   | 2.7          |       |
| Notes         |               |                   |       | ※1 Recommend to use the milling condition as just reference. Adjust milling conditions according to machining shape and machine status.<br>※2 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.<br>※3 Recommend to apply helical or ramping for approaching into axial direction.<br>※4 For slotting, recommend reciprocating milling by adjusting feed & ap in below 60% of recommended milling condition.<br>※5 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※6 Water-insoluble fluid is recommended. |        |              |       |                              |        |              |       |



Resin Milling

High machinability sharp cutting edge suppresses burrs and enables good finished surface

| Model                                                                                          | Size      | Length of Cut | Number of Flute                                                                   | Helix Angle                                                                       | Side Milling                                                                      | Slot Milling                                                                      | Face Milling                                                                      | 3D Milling                                                                         | Work Material |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          |                |        |        |   | Number of Sizes | Page  |
|------------------------------------------------------------------------------------------------|-----------|---------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------|-------------|-------------------|-----------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------|--------------------------|----------------|--------|--------|---|-----------------|-------|
|                                                                                                |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    | P             | P           | P                 | M               | N                                                                                  | N                                                                                   | N                                                                                   | N                                                                                   | N                     | S                        | H              |        |        |   |                 |       |
|                                                                                                |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy                                                                    | Copper                                                                              | Resin                                                                               | Graphite                                                                            | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |        |        |   |                 |       |
|                                                                                                |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |               |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          | 55 HRC         | 65 HRC | 70 HRC |   |                 |       |
| Square • Long Neck Square                                                                      |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |               |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          |                |        |        |   |                 |       |
|  RSES230      | φ0.1 ~ φ6 | 1.5D          |  |  |  |  |  | -                                                                                  | -             | -           | -                 | -               |  |  |  | -                                                                                   | -                     | -                        | -              | -      | -      | - | 155             | N-004 |
| Square end mill for resin. High rigidity with short length of cut                              |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |               |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          |                |        |        |   |                 |       |
|  RSE230       | φ0.1 ~ φ6 | 3D~10D        |  |  |  |  |  | -                                                                                  | -             | -           | -                 | -               |  |  |  |  | -                     | -                        | -              | -      | -      | - | 135             | N-012 |
| Square end mill for resin. Maximum L/D=10 for standard type, maximum L/D=35 for long neck type |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |               |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          |                |        |        |   |                 |       |
| Ball • Long Neck Ball                                                                          |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |               |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          |                |        |        |   |                 |       |
|  RSB230      | R0.1 ~ R3 | 3D~10D        |  |  | -                                                                                 | -                                                                                 | -                                                                                 |  | -             | -           | -                 | -               |  |  |  |  | -                     | -                        | -              | -      | -      | - | 63              | N-020 |
| Ball end mill for resin. Maximum L/D=10 for standard type, maximum L/D=35 for long neck type   |           |               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |               |             |                   |                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                       |                          |                |        |        |   |                 |       |



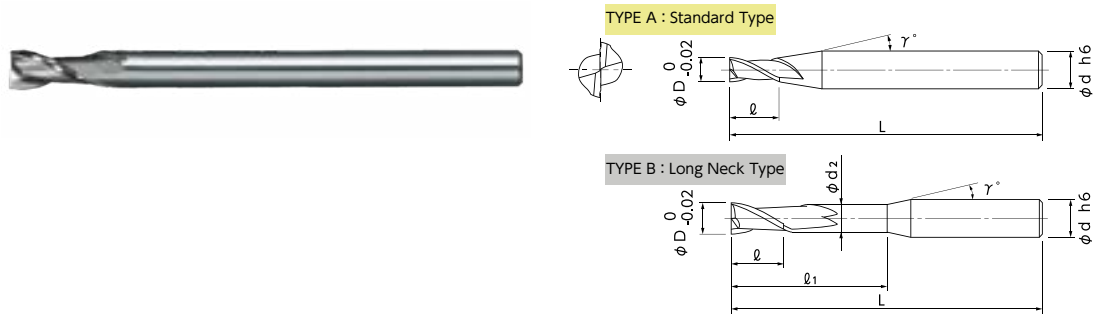
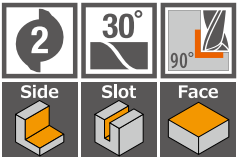
RSES230

Size  $\phi$  0.1 ~  $\phi$  6



Short Flute End Mill for Resin

Square end mill for resin. High rigidity with short length of cut



- Applicable to nonferrous material such as Aluminium and Copper.
- Eliminate the conventional problem of the long flute length.

| Unit : mm      |          |                   |                                     |      |                             |                      |                |                    |
|----------------|----------|-------------------|-------------------------------------|------|-----------------------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Length of Cut (ℓ) | Under neck Length (ℓ <sub>1</sub> ) | Type | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00640-01000 | 0.1      | 0.15              | —                                   | A    | —                           | 9°                   | 4              | 50                 |
| 01-00640-01003 |          |                   | 0.3                                 | B    | 0.085                       | 12°                  | 4              | 50                 |
| 01-00640-01005 |          |                   | 0.5                                 |      | 0.085                       | 12°                  | 4              | 50                 |
| 01-00640-01008 |          |                   | 0.8                                 |      | 0.085                       | 12°                  | 4              | 50                 |
| 01-00640-01010 |          |                   | 1                                   |      | 0.085                       | 12°                  | 4              | 50                 |
| 01-00640-01500 | 0.15     | 0.23              | —                                   | A    | —                           | 9°                   | 4              | 50                 |
| 01-00640-01505 |          |                   | 0.5                                 | B    | 0.13                        | 12°                  | 4              | 50                 |
| 01-00640-01508 |          |                   | 0.8                                 |      | 0.13                        | 12°                  | 4              | 50                 |
| 01-00640-01510 |          |                   | 1                                   |      | 0.13                        | 12°                  | 4              | 50                 |
| 01-00640-01515 |          |                   | 1.5                                 |      | 0.13                        | 12°                  | 4              | 50                 |
| 01-00640-02000 | 0.2      | 0.3               | —                                   | A    | —                           | 9°                   | 4              | 50                 |
| 01-00640-02006 |          |                   | 0.6                                 | B    | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02010 |          |                   | 1                                   |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02015 |          |                   | 1.5                                 |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02020 |          |                   | 2                                   |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02025 |          |                   | 2.5                                 |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02030 |          |                   | 3                                   |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02035 |          |                   | 3.5                                 |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-02040 |          |                   | 4                                   |      | 0.18                        | 12°                  | 4              | 50                 |
| 01-00640-03000 | 0.3      | 0.45              | —                                   | A    | —                           | 9°                   | 4              | 50                 |
| 01-00640-03010 |          |                   | 1                                   | B    | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03015 |          |                   | 1.5                                 |      | 0.28                        | 12°                  | 4              | 50                 |

**How to Order** When you order, indicate RSES230 (D)×(ℓ) [×(ℓ<sub>1</sub>)]. Choose Shank Dia. (d) for TypeA of Dia. 4. ※(γ) is reference value.

■ : Semi-standard item, please inquire for price and delivery.

**Machining case** W-025

RSES230

| Unit : mm      |          |                   |                                     |      |                             |                      |                |                    |
|----------------|----------|-------------------|-------------------------------------|------|-----------------------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Length of Cut (ℓ) | Under neck Length (ℓ <sub>1</sub> ) | Type | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00640-03020 | 0.3      | 0.45              | 2                                   | B    | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03025 |          |                   | 2.5                                 |      | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03030 |          |                   | 3                                   |      | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03040 |          |                   | 4                                   |      | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03050 |          |                   | 5                                   |      | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03060 |          |                   | 6                                   |      | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-03090 |          |                   | 9                                   |      | 0.28                        | 12°                  | 4              | 50                 |
| 01-00640-04000 | 0.4      | 0.6               | —                                   | A    | —                           | 9°                   | 4              | 60                 |
| 01-00640-04015 |          |                   | 1.5                                 | B    | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04020 |          |                   | 2                                   |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04025 |          |                   | 2.5                                 |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04030 |          |                   | 3                                   |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04035 |          |                   | 3.5                                 |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04040 |          |                   | 4                                   |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04060 |          |                   | 6                                   |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04080 |          |                   | 8                                   |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04100 |          |                   | 10                                  |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-04120 |          |                   | 12                                  |      | 0.37                        | 12°                  | 4              | 60                 |
| 01-00640-05000 | 0.5      | 0.75              | —                                   | A    | —                           | 9°                   | 4              | 60                 |
| 01-00640-05020 |          |                   | 2                                   | B    | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05030 |          |                   | 3                                   |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05040 |          |                   | 4                                   |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05060 |          |                   | 6                                   |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05080 |          |                   | 8                                   |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05100 |          |                   | 10                                  |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05120 |          |                   | 12                                  |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05150 |          |                   | 15                                  |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05180 |          |                   | 18                                  |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-05200 |          |                   | 20                                  |      | 0.46                        | 12°                  | 4              | 60                 |
| 01-00640-06000 | 0.6      | 0.9               | —                                   | A    | —                           | 9°                   | 4              | 60                 |
| 01-00640-06030 |          |                   | 3                                   | B    | 0.56                        | 12°                  | 4              | 60                 |
| 01-00640-06040 |          |                   | 4                                   |      | 0.56                        | 12°                  | 4              | 60                 |
| 01-00640-06060 |          |                   | 6                                   |      | 0.56                        | 12°                  | 4              | 60                 |
| 01-00640-06080 |          |                   | 8                                   |      | 0.56                        | 12°                  | 4              | 60                 |

Aluminium Alloy

Copper

Resin

N

N

N

Square

Long Neck Square

RSES230

Short Flute End Mill for Resin

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Under neck Length<br>(ℓ <sub>1</sub> ) | Type | Neck Dia.<br>(d <sub>2</sub> ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------------|------|--------------------------------|-------------------------|-------------------|-----------------------|
| 01-00640-06100 | 0.6         | 0.9                  | 10                                     | B    | 0.56                           | 12°                     | 4                 | 60                    |
| 01-00640-06120 |             |                      | 12                                     |      | 0.56                           | 12°                     | 4                 | 60                    |
| 01-00640-06150 |             |                      | 15                                     |      | 0.56                           | 12°                     | 4                 | 60                    |
| 01-00640-06180 |             |                      | 18                                     |      | 0.56                           | 12°                     | 4                 | 60                    |
| 01-00640-07000 | 0.7         | 1.05                 | —                                      | A    | —                              | 9°                      | 4                 | 60                    |
| 01-00640-07040 |             |                      | 4                                      | B    | 0.66                           | 12°                     | 4                 | 60                    |
| 01-00640-07060 |             |                      | 6                                      |      | 0.66                           | 12°                     | 4                 | 60                    |
| 01-00640-07080 |             |                      | 8                                      |      | 0.66                           | 12°                     | 4                 | 60                    |
| 01-00640-07100 |             |                      | 10                                     |      | 0.66                           | 12°                     | 4                 | 60                    |
| 01-00640-07120 |             |                      | 12                                     |      | 0.66                           | 12°                     | 4                 | 60                    |
| 01-00640-07140 |             |                      | 14                                     |      | 0.66                           | 12°                     | 4                 | 60                    |
| 01-00640-08000 | 0.8         | 1.2                  | —                                      | A    | —                              | 9°                      | 4                 | 60                    |
| 01-00640-08040 |             |                      | 4                                      | B    | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08060 |             |                      | 6                                      |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08080 |             |                      | 8                                      |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08100 |             |                      | 10                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08120 |             |                      | 12                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08140 |             |                      | 14                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08160 |             |                      | 16                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08180 |             |                      | 18                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08200 |             |                      | 20                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-08240 |             |                      | 24                                     |      | 0.76                           | 12°                     | 4                 | 60                    |
| 01-00640-09000 | 0.9         | 1.35                 | —                                      | A    | —                              | 9°                      | 4                 | 60                    |
| 01-00640-09060 |             |                      | 6                                      | B    | 0.86                           | 12°                     | 4                 | 60                    |
| 01-00640-09080 |             |                      | 8                                      |      | 0.86                           | 12°                     | 4                 | 60                    |
| 01-00640-09100 |             |                      | 10                                     |      | 0.86                           | 12°                     | 4                 | 60                    |
| 01-00640-09120 |             |                      | 12                                     |      | 0.86                           | 12°                     | 4                 | 60                    |
| 01-00640-09160 |             |                      | 16                                     |      | 0.86                           | 12°                     | 4                 | 60                    |
| 01-00640-09180 |             |                      | 18                                     |      | 0.86                           | 12°                     | 4                 | 60                    |
| 01-00640-10000 | 1           | 1.5                  | —                                      | A    | —                              | 9°                      | 4                 | 70                    |
| 01-00640-10040 |             |                      | 4                                      | B    | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10060 |             |                      | 6                                      |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10080 |             |                      | 8                                      |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10100 |             |                      | 10                                     |      | 0.95                           | 12°                     | 4                 | 70                    |

How to Order

When you order, indicate RSES230 (D)×(ℓ) [×(ℓ<sub>1</sub>)] . Choose Shank Dia. (d) for TypeA of Dia. 4.      ※(γ) is reference value.

01-00640-09100 : Semi-standard item, please inquire for price and delivery.

Aluminium Alloy

Copper

Resin

N

N

N

Square

Long Neck Square

RSES230

Short Flute End Mill for Resin

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Under neck Length<br>(ℓ <sub>1</sub> ) | Type | Neck Dia.<br>(d <sub>2</sub> ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------------|------|--------------------------------|-------------------------|-------------------|-----------------------|
| 01-00640-10120 | 1           | 1.5                  | 12                                     | B    | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10140 |             |                      | 14                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10150 |             |                      | 15                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10180 |             |                      | 18                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10200 |             |                      | 20                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10250 |             |                      | 25                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10300 |             |                      | 30                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-10350 |             |                      | 35                                     |      | 0.95                           | 12°                     | 4                 | 70                    |
| 01-00640-15000 | 1.5         | 2.25                 | —                                      | A    | —                              | 9°                      | 4                 | 70                    |
| 01-00640-15060 |             |                      | 6                                      | B    | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15080 |             |                      | 8                                      |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15100 |             |                      | 10                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15120 |             |                      | 12                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15150 |             |                      | 15                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15180 |             |                      | 18                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15200 |             |                      | 20                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15230 |             |                      | 23                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15250 |             |                      | 25                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15300 |             |                      | 30                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15350 |             |                      | 35                                     |      | 1.45                           | 12°                     | 4                 | 70                    |
| 01-00640-15400 |             |                      | 40                                     |      | 1.45                           | 12°                     | 4                 | 100                   |
| 01-00640-15450 |             |                      | 45                                     |      | 1.45                           | 12°                     | 4                 | 100                   |
| 01-00640-15530 |             |                      | 53                                     |      | 1.45                           | 12°                     | 4                 | 100                   |
| 01-00640-20000 | 2           | 3                    | —                                      | A    | —                              | 9°                      | 4                 | 60                    |
| 01-00640-20060 |             |                      | 6                                      | B    | 1.94                           | 12°                     | 4                 | 60                    |
| 01-00640-20080 |             |                      | 8                                      |      | 1.94                           | 12°                     | 4                 | 60                    |
| 01-00640-20100 |             |                      | 10                                     |      | 1.94                           | 12°                     | 4                 | 60                    |
| 01-00640-20120 |             |                      | 12                                     |      | 1.94                           | 12°                     | 4                 | 60                    |
| 01-00640-20150 |             |                      | 15                                     |      | 1.94                           | 12°                     | 4                 | 60                    |
| 01-00640-20200 |             |                      | 20                                     |      | 1.94                           | 12°                     | 4                 | 80                    |
| 01-00640-20240 |             |                      | 24                                     |      | 1.94                           | 12°                     | 4                 | 80                    |
| 01-00640-20300 |             |                      | 30                                     |      | 1.94                           | 12°                     | 4                 | 80                    |
| 01-00640-20400 |             |                      | 40                                     |      | 1.94                           | 12°                     | 4                 | 100                   |
| 01-00640-20500 |             |                      | 50                                     |      | 1.94                           | 12°                     | 4                 | 100                   |

Aluminium Alloy

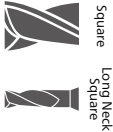
Copper

Resin

N

N

N



RSES230

Short Flute End Mill for Resin

Unit : mm

| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Under neck Length<br>(ℓ <sub>1</sub> ) | Type | Neck Dia.<br>(d <sub>2</sub> ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------|----------------------------------------|------|--------------------------------|-------------------------|-------------------|-----------------------|
| 01-00640-20600 | 2           | 3                    | 60                                     | B    | 1.94                           | 12°                     | 4                 | 120                   |
| 01-00640-20700 |             |                      | 70                                     |      | 1.94                           | 12°                     | 4                 | 150                   |
| 01-00640-30000 | 3           | 4.5                  | —                                      | A    | —                              | —                       | 3                 | 80                    |
| 01-00640-30100 |             |                      | 10                                     | B    | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30120 |             |                      | 12                                     |      | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30150 |             |                      | 15                                     |      | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30200 |             |                      | 20                                     |      | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30240 |             |                      | 24                                     |      | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30300 |             |                      | 30                                     |      | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30360 |             |                      | 36                                     |      | 2.85                           | 12°                     | 6                 | 80                    |
| 01-00640-30450 |             |                      | 45                                     |      | 2.85                           | 12°                     | 6                 | 100                   |
| 01-00640-30600 |             |                      | 60                                     |      | 2.85                           | 12°                     | 6                 | 120                   |
| 01-00640-30750 |             |                      | 75                                     |      | 2.85                           | 12°                     | 6                 | 150                   |
| 01-00640-40000 | 4           | 6                    | —                                      | A    | —                              | —                       | 4                 | 80                    |
| 01-00640-40001 |             |                      | —                                      | B    | —                              | 9°                      | 6                 | 80                    |
| 01-00640-40100 |             |                      | 10                                     |      | 3.8                            | 12°                     | 6                 | 80                    |
| 01-00640-40150 |             |                      | 15                                     |      | 3.8                            | 12°                     | 6                 | 80                    |
| 01-00640-40200 |             |                      | 20                                     |      | 3.8                            | 12°                     | 6                 | 80                    |
| 01-00640-40300 |             |                      | 30                                     |      | 3.8                            | 12°                     | 6                 | 80                    |
| 01-00640-40400 |             |                      | 40                                     |      | 3.8                            | 12°                     | 6                 | 100                   |
| 01-00640-40550 |             |                      | 55                                     |      | 3.8                            | 12°                     | 6                 | 120                   |
| 01-00640-40700 |             |                      | 70                                     |      | 3.8                            | 12°                     | 6                 | 150                   |
| 01-00640-50000 | 5           | 7.5                  | —                                      | A    | —                              | 9°                      | 6                 | 80                    |
| 01-00640-50300 |             |                      | 30                                     | B    | 4.8                            | 12°                     | 6                 | 80                    |
| 01-00640-50400 |             |                      | 40                                     |      | 4.8                            | 12°                     | 6                 | 100                   |
| 01-00640-50550 |             |                      | 55                                     |      | 4.8                            | 12°                     | 6                 | 120                   |
| 01-00640-50700 |             |                      | 70                                     |      | 4.8                            | 12°                     | 6                 | 150                   |
| 01-00640-60000 | 6           | 9                    | —                                      | A    | —                              | —                       | 6                 | 90                    |
| 01-00640-60400 |             |                      | 40                                     | B    | 5.8                            | —                       | 6                 | 90                    |
| 01-00640-60600 |             |                      | 60                                     |      | 5.8                            | —                       | 6                 | 120                   |
| 01-00640-60800 |             |                      | 80                                     |      | 5.8                            | —                       | 6                 | 150                   |

**How to Order** When you order, indicate RSES230 (D)×(ℓ) [×(ℓ<sub>1</sub>)]. Choose Shank Dia. (d) for TypeA of Dia. 4. ※(γ) is reference value.

┃ :Semi-standard item, please inquire for price and delivery.

RSES230

Recommended Milling Conditions

| Work Material |               |                   |      | ABS・MC nylon ・PTFE |              |          |              |          | Polycarbonate・POM・PEEK |               |          |              |              | Acrylic・Bakelite  |          |               |              |          |              |       |       |
|---------------|---------------|-------------------|------|--------------------|--------------|----------|--------------|----------|------------------------|---------------|----------|--------------|--------------|-------------------|----------|---------------|--------------|----------|--------------|-------|-------|
| Dia.          | Length of Cut | Under neck Length | L/D  | Spindle Speed      | Feed         |          | Depth of Cut |          |                        | Spindle Speed | Feed     |              | Depth of Cut |                   |          | Spindle Speed | Feed         |          | Depth of Cut |       |       |
|               |               |                   |      |                    | Side Milling | Slotting | Side Milling | Slotting | Side Milling           |               | Slotting | Side Milling | Slotting     | Side Milling      | Slotting |               | Side Milling | Slotting |              |       |       |
|               |               |                   |      | min <sup>-1</sup>  | mm/min       | ap mm    | ae mm        | ap mm    | min <sup>-1</sup>      | mm/min        | ap mm    | ae mm        | ap mm        | min <sup>-1</sup> | mm/min   | ap mm         | ae mm        | ap mm    |              |       |       |
| 0.1           | 0.15          | —                 | 1.5  | 20,000             | 190          | 90       | 0.15         | 0.02     | 0.1                    | 20,000        | 160      | 80           | 0.15         | 0.02              | 0.1      | 20,000        | 120          | 60       | 0.15         | 0.02  | 0.1   |
|               |               | 0.3               | 3    | 20,000             | 190          | 90       | 0.15         | 0.02     | 0.1                    | 20,000        | 160      | 80           | 0.15         | 0.02              | 0.1      | 20,000        | 120          | 60       | 0.15         | 0.02  | 0.1   |
|               |               | 0.5               | 5    | 19,000             | 150          | 70       | 0.15         | 0.01     | 0.05                   | 19,000        | 120      | 60           | 0.15         | 0.01              | 0.05     | 19,000        | 100          | 50       | 0.15         | 0.01  | 0.05  |
|               |               | 0.8               | 8    | 17,000             | 120          | 60       | 0.15         | 0.005    | 0.025                  | 17,000        | 100      | 50           | 0.15         | 0.005             | 0.025    | 17,000        | 80           | 40       | 0.15         | 0.005 | 0.025 |
|               |               | 1                 | 10   | 15,600             | 80           | 40       | 0.15         | 0.003    | 0.012                  | 15,600        | 60       | 30           | 0.15         | 0.003             | 0.012    | 15,600        | 50           | 20       | 0.15         | 0.003 | 0.012 |
| 0.15          | 0.23          | —                 | 1.5  | 20,000             | 400          | 200      | 0.22         | 0.03     | 0.15                   | 20,000        | 340      | 170          | 0.22         | 0.03              | 0.15     | 20,000        | 270          | 130      | 0.22         | 0.03  | 0.15  |
|               |               | 0.5               | 3.3  | 19,800             | 390          | 190      | 0.22         | 0.028    | 0.13                   | 19,800        | 320      | 160          | 0.22         | 0.028             | 0.13     | 19,800        | 260          | 130      | 0.22         | 0.028 | 0.13  |
|               |               | 0.8               | 5.3  | 18,700             | 320          | 160      | 0.22         | 0.015    | 0.071                  | 18,700        | 260      | 130          | 0.22         | 0.015             | 0.071    | 18,700        | 210          | 100      | 0.22         | 0.015 | 0.071 |
|               |               | 1                 | 6.7  | 17,800             | 280          | 140      | 0.22         | 0.011    | 0.055                  | 17,800        | 240      | 120          | 0.22         | 0.011             | 0.055    | 17,800        | 190          | 90       | 0.22         | 0.011 | 0.055 |
|               |               | 1.5               | 10   | 15,600             | 170          | 80       | 0.22         | 0.004    | 0.018                  | 15,600        | 140      | 70           | 0.22         | 0.004             | 0.018    | 15,600        | 110          | 50       | 0.22         | 0.004 | 0.018 |
| 0.2           | 0.3           | —                 | 1.5  | 20,000             | 620          | 310      | 0.3          | 0.04     | 0.2                    | 20,000        | 520      | 260          | 0.3          | 0.04              | 0.2      | 20,000        | 410          | 200      | 0.3          | 0.04  | 0.2   |
|               |               | 0.6               | 3    | 20,000             | 620          | 310      | 0.3          | 0.04     | 0.2                    | 20,000        | 520      | 260          | 0.3          | 0.04              | 0.2      | 20,000        | 410          | 200      | 0.3          | 0.04  | 0.2   |
|               |               | 1                 | 5    | 19,000             | 500          | 250      | 0.3          | 0.02     | 0.1                    | 19,000        | 410      | 200          | 0.3          | 0.02              | 0.1      | 19,000        | 330          | 160      | 0.3          | 0.02  | 0.1   |
|               |               | 1.5               | 7.5  | 17,300             | 410          | 200      | 0.3          | 0.012    | 0.059                  | 17,300        | 340      | 170          | 0.3          | 0.012             | 0.059    | 17,300        | 270          | 130      | 0.3          | 0.012 | 0.059 |
|               |               | 2                 | 10   | 15,600             | 260          | 130      | 0.3          | 0.005    | 0.024                  | 15,600        | 220      | 110          | 0.3          | 0.005             | 0.024    | 15,600        | 170          | 80       | 0.3          | 0.005 | 0.024 |
|               |               | 2.5               | 12.5 | 15,000             | 230          | 110      | 0.3          | 0.004    | 0.02                   | 15,000        | 190      | 90           | 0.3          | 0.004             | 0.02     | 15,000        | 150          | 70       | 0.3          | 0.004 | 0.02  |
|               |               | 3                 | 15   | 14,500             | 200          | 100      | 0.3          | 0.004    | 0.016                  | 14,500        | 160      | 80           | 0.3          | 0.004             | 0.016    | 14,500        | 130          | 60       | 0.3          | 0.004 | 0.016 |
|               |               | 3.5               | 17.5 | 14,000             | 170          | 80       | 0.3          | 0.003    | 0.012                  | 14,000        | 140      | 70           | 0.3          | 0.003             | 0.012    | 14,000        | 110          | 50       | 0.3          | 0.003 | 0.012 |
|               |               | 4                 | 20   | 13,500             | 140          | 70       | 0.3          | 0.002    | 0.008                  | 13,500        | 120      | 60           | 0.3          | 0.002             | 0.008    | 13,500        | 90           | 40       | 0.3          | 0.002 | 0.008 |
|               |               | —                 | 1.5  | 20,000             | 1,050        | 520      | 0.45         | 0.06     | 0.3                    | 20,000        | 880      | 440          | 0.45         | 0.06              | 0.3      | 20,000        | 700          | 350      | 0.45         | 0.06  | 0.3   |
| 0.3           | 0.45          | 1                 | 3.3  | 19,800             | 1,020        | 510      | 0.45         | 0.055    | 0.27                   | 19,800        | 850      | 420          | 0.45         | 0.055             | 0.27     | 19,800        | 680          | 340      | 0.45         | 0.055 | 0.27  |
|               |               | 1.5               | 5    | 19,000             | 850          | 420      | 0.45         | 0.03     | 0.15                   | 19,000        | 710      | 350          | 0.45         | 0.03              | 0.15     | 19,000        | 560          | 280      | 0.45         | 0.03  | 0.15  |
|               |               | 2                 | 6.7  | 17,800             | 750          | 370      | 0.45         | 0.022    | 0.1                    | 17,800        | 620      | 310          | 0.45         | 0.022             | 0.1      | 17,800        | 500          | 250      | 0.45         | 0.022 | 0.1   |
|               |               | 2.5               | 8.3  | 16,700             | 630          | 310      | 0.45         | 0.014    | 0.069                  | 16,700        | 520      | 260          | 0.45         | 0.014             | 0.069    | 16,700        | 420          | 210      | 0.45         | 0.014 | 0.069 |
|               |               | 3                 | 10   | 15,600             | 450          | 220      | 0.45         | 0.008    | 0.036                  | 15,600        | 370      | 180          | 0.45         | 0.008             | 0.036    | 15,600        | 300          | 150      | 0.45         | 0.008 | 0.036 |
|               |               | 4                 | 13.3 | 14,800             | 370          | 180      | 0.45         | 0.006    | 0.028                  | 14,800        | 310      | 150          | 0.45         | 0.006             | 0.028    | 14,800        | 250          | 120      | 0.45         | 0.006 | 0.028 |
|               |               | 5                 | 16.7 | 14,100             | 310          | 150      | 0.45         | 0.004    | 0.02                   | 14,100        | 250      | 120          | 0.45         | 0.004             | 0.02     | 14,100        | 200          | 100      | 0.45         | 0.004 | 0.02  |
|               |               | 6                 | 20   | 13,500             | 240          | 120      | 0.45         | 0.003    | 0.012                  | 13,500        | 200      | 100          | 0.45         | 0.003             | 0.012    | 13,500        | 160          | 80       | 0.45         | 0.003 | 0.012 |
|               |               | —                 | 1.5  | 20,000             | 1,480        | 740      | 0.6          | 0.08     | 0.4                    | 20,000        | 1,240    | 620          | 0.6          | 0.08              | 0.4      | 20,000        | 990          | 490      | 0.6          | 0.08  | 0.4   |
|               |               | 1.5               | 3.8  | 19,600             | 1,370        | 680      | 0.6          | 0.065    | 0.32                   | 19,600        | 1,140    | 570          | 0.6          | 0.065             | 0.32     | 19,600        | 910          | 450      | 0.6          | 0.065 | 0.32  |
| 0.4           | 0.6           | 2                 | 5    | 19,000             | 1,200        | 600      | 0.6          | 0.04     | 0.2                    | 19,000        | 1,000    | 500          | 0.6          | 0.04              | 0.2      | 19,000        | 800          | 400      | 0.6          | 0.04  | 0.2   |
|               |               | 2.5               | 6.3  | 18,100             | 1,090        | 540      | 0.6          | 0.032    | 0.15                   | 18,100        | 910      | 450          | 0.6          | 0.032             | 0.15     | 18,100        | 720          | 360      | 0.6          | 0.032 | 0.15  |
|               |               | 3                 | 7.5  | 17,300             | 980          | 490      | 0.6          | 0.024    | 0.11                   | 17,300        | 820      | 410          | 0.6          | 0.024             | 0.11     | 17,300        | 650          | 320      | 0.6          | 0.024 | 0.11  |
|               |               | 3.5               | 8.8  | 16,400             | 820          | 410      | 0.6          | 0.017    | 0.081                  | 16,400        | 680      | 340          | 0.6          | 0.017             | 0.081    | 16,400        | 550          | 270      | 0.6          | 0.017 | 0.081 |
|               |               | 4                 | 10   | 15,600             | 630          | 310      | 0.6          | 0.01     | 0.048                  | 15,600        | 530      | 260          | 0.6          | 0.01              | 0.048    | 15,600        | 420          | 210      | 0.6          | 0.01  | 0.048 |
|               |               | 6                 | 15   | 14,500             | 480          | 240      | 0.6          | 0.007    | 0.032                  | 14,500        | 400      | 200          | 0.6          | 0.007             | 0.032    | 14,500        | 320          | 160      | 0.6          | 0.007 | 0.032 |
|               |               | 8                 | 20   | 13,500             | 350          | 170      | 0.6          | 0.004    | 0.016                  | 13,500        | 290      | 140          | 0.6          | 0.004             | 0.016    | 13,500        | 230          | 110      | 0.6          | 0.004 | 0.016 |
|               |               | —                 | 1.5  | 20,000             | 1,920        | 960      | 0.75         | 0.1      | 0.5                    | 20,000        | 1,600    | 800          | 0.75         | 0.1               | 0.5      | 20,000        | 1,280        | 640      | 0.75         | 0.1   | 0.5   |
| 0.5           | 0.75          | 2                 | 4    | 19,500             | 1,730        | 860      | 0.75         | 0.075    | 0.37                   | 19,500        | 1,440    | 720          | 0.75         | 0.075             | 0.37     | 19,500        | 1,150        | 570      | 0.75         | 0.075 | 0.37  |
|               |               | 3                 | 6    | 18,300             | 1,430        | 710      | 0.75         | 0.042    | 0.2                    | 18,300        | 1,190    | 590          | 0.75         | 0.042             | 0.2      | 18,300        | 950          | 470      | 0.75         | 0.042 | 0.2   |
|               |               | 4                 | 8    | 17,000             | 1,220        | 610      | 0.75         | 0.025    | 0.12                   | 17,000        | 1,020    | 510          | 0.75         | 0.025             | 0.12     | 17,000        | 810          | 400      | 0.75         | 0.025 | 0.12  |
|               |               | 6                 | 12   | 15,100             | 740          | 370      | 0.75         | 0.011    | 0.052                  | 15,100        | 610      | 300          | 0.75         | 0.011             | 0.052    | 15,100        | 490          | 240      | 0.75         | 0.011 | 0.052 |
|               |               | 8                 | 16   | 14,300             | 590          | 290      | 0.75         | 0.008    | 0.036                  | 14,300        | 490      | 240          | 0.75         | 0.008             | 0.036    | 14,300        | 390          | 190      | 0.75         | 0.008 | 0.036 |
|               |               | 10                | 20   | 13,500             | 450          | 220      | 0.75         | 0.004    | 0.02                   | 13,500        | 370      | 180          | 0.75         | 0.004             | 0.02     | 13,500        | 300          | 150      | 0.75         | 0.004 | 0.02  |
|               |               | —                 | 1.5  | 20,000             | 1,920        | 960      | 0.75         | 0.1      | 0.5                    | 20,000        | 1,600    | 800          | 0.75         | 0.1               | 0.5      | 20,000        | 1,280        | 640      | 0.75         | 0.1   | 0.5   |
| 0.6           | 0.9           | —                 | 1.5  | 20,000             | 2,160        | 1,080    | 0.9          | 0.12     | 0.6                    | 20,000        | 1,800    | 900          | 0.9          | 0.12              | 0.6      | 20,000        | 1,440        | 720      | 0.9          | 0.12  | 0.6   |
|               |               | 3                 | 5    | 19,000             | 1,740        | 870      | 0.9          | 0.06     | 0.3                    | 19,000        | 1,450    | 720          | 0.9          | 0.06              | 0.3      | 19,000        | 1,160        | 580      | 0.9          | 0.06  | 0.3   |
|               |               | 4                 | 6.7  | 17,800             | 1,530        | 760      | 0.9          | 0.044    | 0.21                   | 17,800        | 1,270    | 630          | 0.9          | 0.044             | 0.21     | 17,800        | 1,020        | 510      | 0.9          | 0.044 | 0.21  |
|               |               | 6                 | 10   | 15,000             | 890          | 440      | 0.9          | 0.015    | 0.072                  | 15,000        | 740      | 370          | 0.9          | 0.015             | 0.072    | 15,000        | 590          | 290      | 0.9          | 0.015 | 0.072 |
|               |               | 8                 | 13.3 | 14,400             | 750          | 370      | 0.9          | 0.012    | 0.056                  | 14,400        | 620      | 310          | 0.9          | 0.012             | 0.056    | 14,400        | 500          | 250      | 0.9          | 0.012 | 0.056 |
|               |               | 10                | 16.7 | 13,700             | 610          | 300      | 0.9          | 0.008    | 0.04                   | 13,700        | 510      | 250          | 0.9          | 0.008             | 0.04     | 13,700        | 410          | 200      | 0.9          | 0.008 | 0.04  |
|               |               | 12                | 20   | 13,000             | 490          | 240      | 0.9          | 0.005    | 0.024                  | 13,000        | 400      | 200          | 0.9          | 0.005             | 0.024    | 13,000        | 320          | 160      | 0.9          | 0.005 | 0.024 |

Aluminium Alloy

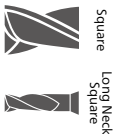
N

Copper

N

Resin

N



RSES230

Recommended Milling Conditions

| Work Material |               |                   |      | ABS・MC nylon ・PTFE |              |          |              |          | Polycarbonate・POM・PEEK |               |              |          |              | Acrylic・Bakelite  |          |               |       |       |              |       |       |
|---------------|---------------|-------------------|------|--------------------|--------------|----------|--------------|----------|------------------------|---------------|--------------|----------|--------------|-------------------|----------|---------------|-------|-------|--------------|-------|-------|
| Dia.          | Length of Cut | Under neck Length | L/D  | Spindle Speed      | Feed         |          | Depth of Cut |          |                        | Spindle Speed | Feed         |          | Depth of Cut |                   |          | Spindle Speed | Feed  |       | Depth of Cut |       |       |
|               |               |                   |      |                    | Side Milling | Slotting | Side Milling | Slotting |                        |               | Side Milling | Slotting |              | Side Milling      | Slotting |               |       |       |              |       |       |
|               |               |                   |      | min <sup>-1</sup>  | mm/min       | ap mm    | ae mm        | ap mm    | min <sup>-1</sup>      | mm/min        | ap mm        | ae mm    | ap mm        | min <sup>-1</sup> | mm/min   | ap mm         | ae mm | ap mm |              |       |       |
| 0.7           | 1.05          | -                 | 1.5  | 20,000             | 2,400        | 1,200    | 1.05         | 0.14     | 0.7                    | 20,000        | 2,000        | 1,000    | 1.05         | 0.14              | 0.7      | 20,000        | 1,600 | 800   | 1.05         | 0.14  | 0.7   |
|               |               | 4                 | 5.7  | 18,500             | 1,830        | 910      | 1.05         | 0.062    | 0.3                    | 18,500        | 1,530        | 760      | 1.05         | 0.062             | 0.3      | 18,500        | 1,220 | 610   | 1.05         | 0.062 | 0.3   |
|               |               | 6                 | 8.6  | 14,500             | 1,200        | 600      | 1.05         | 0.03     | 0.14                   | 14,500        | 1,000        | 500      | 1.05         | 0.03              | 0.14     | 14,500        | 800   | 400   | 1.05         | 0.03  | 0.14  |
|               |               | 8                 | 11.4 | 14,000             | 870          | 430      | 1.05         | 0.016    | 0.076                  | 14,000        | 730          | 360      | 1.05         | 0.016             | 0.076    | 14,000        | 580   | 290   | 1.05         | 0.016 | 0.076 |
|               |               | 10                | 14.3 | 13,500             | 750          | 370      | 1.05         | 0.012    | 0.06                   | 13,500        | 620          | 310      | 1.05         | 0.012             | 0.06     | 13,500        | 500   | 250   | 1.05         | 0.012 | 0.06  |
|               |               | 12                | 17.1 | 13,000             | 630          | 310      | 1.05         | 0.009    | 0.044                  | 13,000        | 520          | 260      | 1.05         | 0.009             | 0.044    | 13,000        | 420   | 210   | 1.05         | 0.009 | 0.044 |
|               |               | 14                | 20   | 12,500             | 520          | 260      | 1.05         | 0.006    | 0.028                  | 12,500        | 430          | 210      | 1.05         | 0.006             | 0.028    | 12,500        | 350   | 170   | 1.05         | 0.006 | 0.028 |
| 0.8           | 1.2           | -                 | 1.5  | 20,000             | 2,640        | 1,320    | 1.2          | 0.16     | 0.8                    | 20,000        | 2,200        | 1,100    | 1.2          | 0.16              | 0.8      | 20,000        | 1,760 | 880   | 1.2          | 0.16  | 0.8   |
|               |               | 4                 | 5    | 19,000             | 2,130        | 1,060    | 1.2          | 0.08     | 0.4                    | 19,000        | 1,770        | 880      | 1.2          | 0.08              | 0.4      | 19,000        | 1,420 | 710   | 1.2          | 0.08  | 0.4   |
|               |               | 6                 | 7.5  | 17,300             | 1,750        | 870      | 1.2          | 0.047    | 0.23                   | 17,300        | 1,460        | 730      | 1.2          | 0.047             | 0.23     | 17,300        | 1,160 | 580   | 1.2          | 0.047 | 0.23  |
|               |               | 8                 | 10   | 14,000             | 1,010        | 500      | 1.2          | 0.02     | 0.096                  | 14,000        | 840          | 420      | 1.2          | 0.02              | 0.096    | 14,000        | 670   | 330   | 1.2          | 0.02  | 0.096 |
|               |               | 10                | 12.5 | 13,400             | 880          | 440      | 1.2          | 0.016    | 0.08                   | 13,400        | 730          | 360      | 1.2          | 0.016             | 0.08     | 13,400        | 580   | 290   | 1.2          | 0.016 | 0.08  |
|               |               | 12                | 15   | 12,700             | 750          | 370      | 1.2          | 0.013    | 0.064                  | 12,700        | 620          | 310      | 1.2          | 0.013             | 0.064    | 12,700        | 500   | 250   | 1.2          | 0.013 | 0.064 |
|               |               | 14                | 17.5 | 12,300             | 640          | 320      | 1.2          | 0.01     | 0.048                  | 12,300        | 540          | 270      | 1.2          | 0.01              | 0.048    | 12,300        | 430   | 210   | 1.2          | 0.01  | 0.048 |
| 0.9           | 1.35          | -                 | 1.5  | 18,500             | 2,660        | 1,330    | 1.35         | 0.18     | 0.9                    | 18,500        | 2,220        | 1,110    | 1.35         | 0.18              | 0.9      | 18,500        | 1,770 | 880   | 1.35         | 0.18  | 0.9   |
|               |               | 6                 | 6.7  | 16,500             | 1,890        | 940      | 1.35         | 0.065    | 0.32                   | 16,500        | 1,570        | 780      | 1.35         | 0.065             | 0.32     | 16,500        | 1,260 | 630   | 1.35         | 0.065 | 0.32  |
|               |               | 8                 | 8.9  | 13,500             | 1,280        | 640      | 1.35         | 0.035    | 0.17                   | 13,500        | 1,070        | 530      | 1.35         | 0.035             | 0.17     | 13,500        | 850   | 420   | 1.35         | 0.035 | 0.17  |
|               |               | 10                | 11.1 | 13,000             | 980          | 490      | 1.35         | 0.02     | 0.1                    | 13,000        | 820          | 410      | 1.35         | 0.02              | 0.1      | 13,000        | 650   | 320   | 1.35         | 0.02  | 0.1   |
|               |               | 12                | 13.3 | 12,500             | 870          | 430      | 1.35         | 0.017    | 0.084                  | 12,500        | 720          | 360      | 1.35         | 0.017             | 0.084    | 12,500        | 580   | 290   | 1.35         | 0.017 | 0.084 |
|               |               | 16                | 17.8 | 12,000             | 680          | 340      | 1.35         | 0.011    | 0.052                  | 12,000        | 560          | 280      | 1.35         | 0.011             | 0.052    | 12,000        | 450   | 220   | 1.35         | 0.011 | 0.052 |
|               |               | 18                | 20   | 11,500             | 570          | 280      | 1.35         | 0.008    | 0.036                  | 11,500        | 480          | 240      | 1.35         | 0.008             | 0.036    | 11,500        | 380   | 190   | 1.35         | 0.008 | 0.036 |
| 1             | 1.5           | -                 | 1.5  | 17,000             | 2,650        | 1,320    | 1.5          | 0.2      | 1                      | 17,000        | 2,210        | 1,100    | 1.5          | 0.2               | 1        | 17,000        | 1,760 | 880   | 1.5          | 0.2   | 1     |
|               |               | 4                 | 4    | 16,500             | 2,390        | 1,190    | 1.5          | 0.15     | 0.75                   | 16,500        | 1,990        | 990      | 1.5          | 0.15              | 0.75     | 16,500        | 1,590 | 790   | 1.5          | 0.15  | 0.75  |
|               |               | 6                 | 6    | 15,500             | 1,980        | 990      | 1.5          | 0.084    | 0.41                   | 15,500        | 1,650        | 820      | 1.5          | 0.084             | 0.41     | 15,500        | 1,320 | 660   | 1.5          | 0.084 | 0.41  |
|               |               | 8                 | 8    | 14,400             | 1,690        | 840      | 1.5          | 0.05     | 0.25                   | 14,400        | 1,400        | 700      | 1.5          | 0.05              | 0.25     | 14,400        | 1,120 | 560   | 1.5          | 0.05  | 0.25  |
|               |               | 10                | 10   | 13,000             | 1,110        | 550      | 1.5          | 0.024    | 0.12                   | 13,000        | 920          | 460      | 1.5          | 0.024             | 0.12     | 13,000        | 740   | 370   | 1.5          | 0.024 | 0.12  |
|               |               | 12                | 12   | 12,400             | 980          | 490      | 1.5          | 0.021    | 0.1                    | 12,400        | 820          | 410      | 1.5          | 0.021             | 0.1      | 12,400        | 650   | 320   | 1.5          | 0.021 | 0.1   |
|               |               | 14                | 14   | 12,000             | 870          | 430      | 1.5          | 0.018    | 0.088                  | 12,000        | 730          | 360      | 1.5          | 0.018             | 0.088    | 12,000        | 580   | 290   | 1.5          | 0.018 | 0.088 |
|               |               | 15                | 15   | 11,700             | 820          | 410      | 1.5          | 0.016    | 0.08                   | 11,700        | 680          | 340      | 1.5          | 0.016             | 0.08     | 11,700        | 540   | 270   | 1.5          | 0.016 | 0.08  |
|               |               | 18                | 18   | 11,300             | 680          | 340      | 1.5          | 0.012    | 0.056                  | 11,300        | 570          | 280      | 1.5          | 0.012             | 0.056    | 11,300        | 450   | 220   | 1.5          | 0.012 | 0.056 |
| 1.5           | 2.25          | 20                | 20   | 11,000             | 600          | 300      | 1.5          | 0.008    | 0.04                   | 11,000        | 500          | 250      | 1.5          | 0.008             | 0.04     | 11,000        | 400   | 200   | 1.5          | 0.008 | 0.04  |
|               |               | -                 | 1.5  | 13,300             | 2,590        | 1,290    | 2.25         | 0.3      | 1.5                    | 13,300        | 2,150        | 1,070    | 2.25         | 0.3               | 1.5      | 13,300        | 1,720 | 860   | 2.25         | 0.3   | 1.5   |
|               |               | 6                 | 4    | 12,800             | 2,350        | 1,170    | 2.25         | 0.22     | 1.1                    | 12,800        | 1,950        | 970      | 2.25         | 0.22              | 1.1      | 12,800        | 1,560 | 780   | 2.25         | 0.22  | 1.1   |
|               |               | 8                 | 5.3  | 12,200             | 2,060        | 1,030    | 2.25         | 0.14     | 0.7                    | 12,200        | 1,720        | 860      | 2.25         | 0.14              | 0.7      | 12,200        | 1,370 | 680   | 2.25         | 0.14  | 0.7   |
|               |               | 10                | 6.7  | 11,400             | 1,850        | 920      | 2.25         | 0.1      | 0.54                   | 11,400        | 1,540        | 770      | 2.25         | 0.1               | 0.54     | 11,400        | 1,230 | 610   | 2.25         | 0.1   | 0.54  |
|               |               | 12                | 8    | 10,600             | 1,650        | 820      | 2.25         | 0.075    | 0.37                   | 10,600        | 1,380        | 690      | 2.25         | 0.075             | 0.37     | 10,600        | 1,100 | 550   | 2.25         | 0.075 | 0.37  |
|               |               | 15                | 10   | 9,400              | 1,150        | 570      | 2.25         | 0.036    | 0.18                   | 9,400         | 960          | 480      | 2.25         | 0.036             | 0.18     | 9,400         | 770   | 380   | 2.25         | 0.036 | 0.18  |
|               |               | 18                | 12   | 9,000              | 1,050        | 520      | 2.25         | 0.032    | 0.15                   | 9,000         | 870          | 430      | 2.25         | 0.032             | 0.15     | 9,000         | 700   | 350   | 2.25         | 0.032 | 0.15  |
|               |               | 20                | 13.3 | 8,700              | 980          | 490      | 2.25         | 0.028    | 0.14                   | 8,700         | 810          | 400      | 2.25         | 0.028             | 0.14     | 8,700         | 650   | 320   | 2.25         | 0.028 | 0.14  |
| 2             | 3             | 23                | 15.3 | 8,300              | 880          | 440      | 2.25         | 0.024    | 0.11                   | 8,300         | 730          | 360      | 2.25         | 0.024             | 0.11     | 8,300         | 580   | 290   | 2.25         | 0.024 | 0.11  |
|               |               | 25                | 16.7 | 8,100              | 820          | 410      | 2.25         | 0.02     | 0.1                    | 8,100         | 680          | 340      | 2.25         | 0.02              | 0.1      | 8,100         | 550   | 270   | 2.25         | 0.02  | 0.1   |
|               |               | 30                | 20   | 7,500              | 690          | 340      | 2.25         | 0.012    | 0.06                   | 7,500         | 570          | 280      | 2.25         | 0.012             | 0.06     | 7,500         | 460   | 230   | 2.25         | 0.012 | 0.06  |
|               |               | -                 | 1.5  | 9,900              | 2,320        | 1,160    | 3            | 0.4      | 2                      | 9,900         | 1,930        | 960      | 3            | 0.4               | 2        | 9,900         | 1,550 | 770   | 3            | 0.4   | 2     |
|               |               | 6                 | 3    | 9,900              | 2,320        | 1,160    | 3            | 0.4      | 2                      | 9,900         | 1,930        | 960      | 3            | 0.4               | 2        | 9,900         | 1,550 | 770   | 3            | 0.4   | 2     |
|               |               | 8                 | 4    | 9,500              | 2,140        | 1,070    | 3            | 0.3      | 1.5                    | 9,500         | 1,780        | 890      | 3            | 0.3               | 1.5      | 9,500         | 1,420 | 710   | 3            | 0.3   | 1.5   |
|               |               | 10                | 5    | 9,100              | 1,960        | 980      | 3            | 0.2      | 1                      | 9,100         | 1,640        | 820      | 3            | 0.2               | 1        | 9,100         | 1,310 | 650   | 3            | 0.2   | 1     |
|               |               | 12                | 6    | 8,600              | 1,800        | 900      | 3            | 0.16     | 0.83                   | 8,600         | 1,500        | 750      | 3            | 0.16              | 0.83     | 8,600         | 1,200 | 600   | 3            | 0.16  | 0.83  |
|               |               | 15                | 7.5  | 7,700              | 1,560        | 780      | 3            | 0.11     | 0.58                   | 7,700         | 1,300        | 650      | 3            | 0.11              | 0.58     | 7,700         | 1,040 | 520   | 3            | 0.11  | 0.58  |
| 2             | 3             | 20                | 10   | 6,200              | 1,050        | 520      | 3            | 0.048    | 0.24                   | 6,200         | 870          | 430      | 3            | 0.048             | 0.24     | 6,200         | 700   | 350   | 3            | 0.048 | 0.24  |
|               |               | 24                | 12   | 5,900              | 950          | 470      | 3            | 0.042    | 0.2                    | 5,900         | 790          | 390      | 3            | 0.042             | 0.2      | 5,900         | 630   | 310   | 3            | 0.042 | 0.2   |
|               |               | 30                | 15   | 5,300              | 810          | 400      | 3            | 0.032    | 0.16                   | 5,300         | 680          | 340      | 3            | 0.032             | 0.16     | 5,300         | 540   | 270   | 3            | 0.032 | 0.16  |
|               |               | 40                | 20   | 4,500              | 620          | 310      | 3            | 0.016    | 0.08                   | 4,500         | 510          | 250      | 3            | 0.016             | 0.08     | 4,500         | 410   | 200   | 3            | 0.016 | 0.08  |

| Work Material                                                                                                                      |               |                   |       | ABS・MC nylon ・PTFE                                                                                                                                                      |              |          |              |          | Polycarbonate・POM・PEEK |               |              |          |              | Acrylic・Bakelite  |          |               |              |          |              |       |      |
|------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|--------------|----------|------------------------|---------------|--------------|----------|--------------|-------------------|----------|---------------|--------------|----------|--------------|-------|------|
| Dia.                                                                                                                               | Length of Cut | Under neck Length | L/D   | Spindle Speed                                                                                                                                                           | Feed         |          | Depth of Cut |          |                        | Spindle Speed | Feed         |          | Depth of Cut |                   |          | Spindle Speed | Feed         |          | Depth of Cut |       |      |
|                                                                                                                                    |               |                   |       |                                                                                                                                                                         | Side Milling | Slotting | Side Milling | Slotting |                        |               | Side Milling | Slotting |              | Side Milling      | Slotting |               | Side Milling | Slotting |              |       |      |
|                                                                                                                                    |               |                   |       | min <sup>-1</sup>                                                                                                                                                       | mm/min       | ap mm    | ae mm        | ap mm    | min <sup>-1</sup>      | mm/min        | ap mm        | ae mm    | ap mm        | min <sup>-1</sup> | mm/min   | ap mm         | ae mm        | ap mm    |              |       |      |
| 3                                                                                                                                  | 4.5           | —                 | 1.5   | 6,600                                                                                                                                                                   | 2,060        | 1,030    | 4.5          | 0.6      | 3                      | 6,600         | 1,710        | 850      | 4.5          | 0.6               | 3        | 6,600         | 1,370        | 680      | 4.5          | 0.6   | 3    |
|                                                                                                                                    |               | 10                | 3.3   | 6,500                                                                                                                                                                   | 2,010        | 1,000    | 4.5          | 0.55     | 2.7                    | 6,500         | 1,670        | 830      | 4.5          | 0.55              | 2.7      | 6,500         | 1,340        | 670      | 4.5          | 0.55  | 2.7  |
|                                                                                                                                    |               | 12                | 4     | 6,300                                                                                                                                                                   | 1,910        | 950      | 4.5          | 0.45     | 2.2                    | 6,300         | 1,590        | 790      | 4.5          | 0.45              | 2.2      | 6,300         | 1,270        | 630      | 4.5          | 0.45  | 2.2  |
|                                                                                                                                    |               | 15                | 5     | 5,900                                                                                                                                                                   | 1,760        | 880      | 4.5          | 0.3      | 1.5                    | 5,900         | 1,460        | 730      | 4.5          | 0.3               | 1.5      | 5,900         | 1,170        | 580      | 4.5          | 0.3   | 1.5  |
|                                                                                                                                    |               | 20                | 6.7   | 5,200                                                                                                                                                                   | 1,500        | 750      | 4.5          | 0.21     | 1                      | 5,200         | 1,250        | 620      | 4.5          | 0.21              | 1        | 5,200         | 1,000        | 500      | 4.5          | 0.21  | 1    |
|                                                                                                                                    |               | 24                | 8     | 4,600                                                                                                                                                                   | 1,290        | 640      | 4.5          | 0.15     | 0.75                   | 4,600         | 1,080        | 540      | 4.5          | 0.15              | 0.75     | 4,600         | 860          | 430      | 4.5          | 0.15  | 0.75 |
|                                                                                                                                    |               | 30                | 10    | 3,700                                                                                                                                                                   | 920          | 460      | 4.5          | 0.072    | 0.36                   | 3,700         | 770          | 380      | 4.5          | 0.072             | 0.36     | 3,700         | 610          | 300      | 4.5          | 0.072 | 0.36 |
|                                                                                                                                    |               | 36                | 12    | 3,400                                                                                                                                                                   | 830          | 410      | 4.5          | 0.063    | 0.31                   | 3,400         | 690          | 340      | 4.5          | 0.063             | 0.31     | 3,400         | 550          | 270      | 4.5          | 0.063 | 0.31 |
|                                                                                                                                    |               | 45                | 15    | 2,900                                                                                                                                                                   | 690          | 340      | 4.5          | 0.048    | 0.24                   | 2,900         | 580          | 290      | 4.5          | 0.048             | 0.24     | 2,900         | 460          | 230      | 4.5          | 0.048 | 0.24 |
| 60                                                                                                                                 | 20            | 2,300             | 500   | 250                                                                                                                                                                     | 4.5          | 0.024    | 0.12         | 2,300    | 420                    | 210           | 4.5          | 0.024    | 0.12         | 2,300             | 330      | 160           | 4.5          | 0.024    | 0.12         |       |      |
| 4                                                                                                                                  | 6(d4)         | —                 | 1.5   | 4,900                                                                                                                                                                   | 1,910        | 950      | 6            | 0.8      | 4                      | 4,900         | 1,590        | 790      | 6            | 0.8               | 4        | 4,900         | 1,270        | 630      | 6            | 0.8   | 4    |
|                                                                                                                                    | 6(d6)         | —                 | 1.5   | 4,900                                                                                                                                                                   | 1,910        | 950      | 6            | 0.8      | 4                      | 4,900         | 1,590        | 790      | 6            | 0.8               | 4        | 4,900         | 1,270        | 630      | 6            | 0.8   | 4    |
|                                                                                                                                    | 10            | 2.5               | 4,900 | 1,910                                                                                                                                                                   | 950          | 6        | 0.8          | 4        | 4,900                  | 1,590         | 790          | 6        | 0.8          | 4                 | 4,900    | 1,270         | 630          | 6        | 0.8          | 4     |      |
|                                                                                                                                    | 15            | 3.8               | 4,800 | 1,810                                                                                                                                                                   | 900          | 6        | 0.65         | 3.2      | 4,800                  | 1,510         | 750          | 6        | 0.65         | 3.2               | 4,800    | 1,200         | 600          | 6        | 0.65         | 3.2   |      |
|                                                                                                                                    | 20            | 5                 | 4,400 | 1,640                                                                                                                                                                   | 820          | 6        | 0.4          | 2        | 4,400                  | 1,360         | 680          | 6        | 0.4          | 2                 | 4,400    | 1,090         | 540          | 6        | 0.4          | 2     |      |
|                                                                                                                                    | 30            | 7.5               | 3,600 | 1,270                                                                                                                                                                   | 630          | 6        | 0.23         | 1.1      | 3,600                  | 1,060         | 530          | 6        | 0.23         | 1.1               | 3,600    | 850           | 420          | 6        | 0.23         | 1.1   |      |
|                                                                                                                                    | 40            | 10                | 2,700 | 850                                                                                                                                                                     | 420          | 6        | 0.096        | 0.48     | 2,700                  | 710           | 350          | 6        | 0.096        | 0.48              | 2,700    | 570           | 280          | 6        | 0.096        | 0.48  |      |
|                                                                                                                                    | 55            | 13.8              | 2,300 | 690                                                                                                                                                                     | 340          | 6        | 0.072        | 0.36     | 2,300                  | 580           | 290          | 6        | 0.072        | 0.36              | 2,300    | 460           | 230          | 6        | 0.072        | 0.36  |      |
|                                                                                                                                    | 70            | 17.5              | 1,900 | 550                                                                                                                                                                     | 270          | 6        | 0.048        | 0.24     | 1,900                  | 460           | 230          | 6        | 0.048        | 0.24              | 1,900    | 370           | 180          | 6        | 0.048        | 0.24  |      |
| 5                                                                                                                                  | 7.5           | —                 | 1.5   | 3,900                                                                                                                                                                   | 1,820        | 910      | 7.5          | 1        | 5                      | 3,900         | 1,510        | 750      | 7.5          | 1                 | 5        | 3,900         | 1,210        | 600      | 7.5          | 1     | 5    |
|                                                                                                                                    |               | 30                | 6     | 3,300                                                                                                                                                                   | 1,410        | 700      | 7.5          | 0.41     | 2                      | 3,300         | 1,180        | 590      | 7.5          | 0.41              | 2        | 3,300         | 940          | 470      | 7.5          | 0.41  | 2    |
|                                                                                                                                    |               | 40                | 8     | 2,700                                                                                                                                                                   | 1,140        | 570      | 7.5          | 0.25     | 1.2                    | 2,700         | 950          | 470      | 7.5          | 0.25              | 1.2      | 2,700         | 760          | 380      | 7.5          | 0.25  | 1.2  |
|                                                                                                                                    |               | 55                | 11    | 2,100                                                                                                                                                                   | 770          | 380      | 7.5          | 0.11     | 0.56                   | 2,100         | 640          | 320      | 7.5          | 0.11              | 0.56     | 2,100         | 510          | 250      | 7.5          | 0.11  | 0.56 |
|                                                                                                                                    |               | 70                | 14    | 1,800                                                                                                                                                                   | 650          | 320      | 7.5          | 0.088    | 0.44                   | 1,800         | 540          | 270      | 7.5          | 0.088             | 0.44     | 1,800         | 430          | 210      | 7.5          | 0.088 | 0.44 |
| 6                                                                                                                                  | 9             | —                 | 1.5   | 3,300                                                                                                                                                                   | 1,750        | 870      | 9            | 1.2      | 6                      | 3,300         | 1,460        | 730      | 9            | 1.2               | 6        | 3,300         | 1,170        | 580      | 9            | 1.2   | 6    |
|                                                                                                                                    |               | 40                | 6.7   | 2,600                                                                                                                                                                   | 1,270        | 630      | 9            | 0.43     | 2.1                    | 2,600         | 1,060        | 530      | 9            | 0.43              | 2.1      | 2,600         | 850          | 420      | 9            | 0.43  | 2.1  |
|                                                                                                                                    |               | 60                | 10    | 1,800                                                                                                                                                                   | 780          | 390      | 9            | 0.14     | 0.72                   | 1,800         | 650          | 320      | 9            | 0.14              | 0.72     | 1,800         | 520          | 260      | 9            | 0.14  | 0.72 |
|                                                                                                                                    |               | 80                | 13.3  | 1,600                                                                                                                                                                   | 650          | 320      | 9            | 0.11     | 0.56                   | 1,600         | 540          | 270      | 9            | 0.11              | 0.56     | 1,600         | 430          | 210      | 9            | 0.11  | 0.56 |
| Notes                                                                                                                              |               |                   |       | ※1 These recommended cutting conditions indicate just reference for roughing. It should be adjusted according to milling shape and machine type.                        |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
|                                                                                                                                    |               |                   |       | ※2 For finishing process, please adjust to the optimized condition to meet the requirement of machining accuracy.                                                       |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
|                                                                                                                                    |               |                   |       | ※3 Necessary to adjust the cutting condition at the parts overloading against the tools such as inner corner parts.                                                     |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
|                                                                                                                                    |               |                   |       | ※4 When a tool with L/D 10 times and longer deflects on milling, please reduce Feed or Depth of Cut.                                                                    |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
|                                                                                                                                    |               |                   |       | ※5 For a tool with L/D longer than 20 times, reduce spindle speed, feed rate and depth of cut at sufficient values by referring the cutting conditions of L/D 20 times. |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
|                                                                                                                                    |               |                   |       | ※6 Air blow is recommended.                                                                                                                                             |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
| ※7 Care for chip removal to avoid being stuck or caught during process for better surface quality.                                 |               |                   |       |                                                                                                                                                                         |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
| ※8 Minimize chucking runoff.                                                                                                       |               |                   |       |                                                                                                                                                                         |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
| ※9 Pay keen attention for tool length measurement with contact-type equipment for the tools under ϕ1 to avoid cutting edge damage. |               |                   |       |                                                                                                                                                                         |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |
| ※10 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.           |               |                   |       |                                                                                                                                                                         |              |          |              |          |                        |               |              |          |              |                   |          |               |              |          |              |       |      |



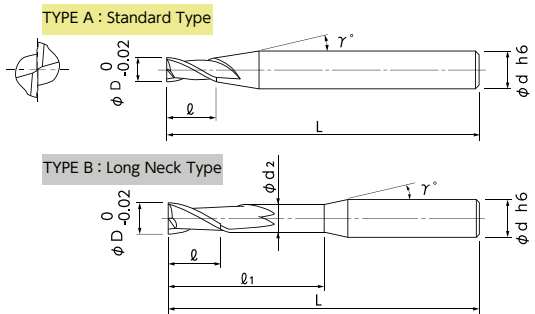
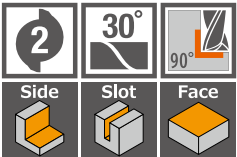
RSE230

Size  $\phi$  0.1 ~  $\phi$  6



End Mill for Resin

Square end mill for resin.  
Maximum L/D=10 for standard type, maximum L/D=35 for long neck type



- Available for the suitable L/D (3D, 5D and 10D) Length of cut with Extra Long Neck or without Under Neck Length!
- Applicable to nonferrous material such as Aluminium and Copper.
- Total 135 size!

| Unit : mm      |          |                   |                        |      |                |                      |                |                    |
|----------------|----------|-------------------|------------------------|------|----------------|----------------------|----------------|--------------------|
| Code No.       | Dia. (D) | Length of Cut (L) | Under neck Length (L1) | Type | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| 01-00644-00100 | 0.1      | 0.3               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00108 |          |                   | 0.8                    | B    | 0.085          | 12°                  | 4              | 45                 |
| 01-00644-00110 |          |                   | 1                      |      | 0.085          | 12°                  | 4              | 45                 |
| 01-00644-00150 | 0.15     | 0.45              | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00151 |          |                   | 1                      | B    | 0.13           | 12°                  | 4              | 45                 |
| 01-00644-00152 |          |                   | 1.5                    |      | 0.13           | 12°                  | 4              | 45                 |
| 01-00644-00200 | 0.2      | 0.6               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00201 |          | 1                 | —                      |      | —              | 10°                  | 4              | 45                 |
| 01-00644-00203 |          | 0.6               | 1                      | B    | 0.18           | 12°                  | 4              | 45                 |
| 01-00644-00204 |          |                   | 1.5                    |      | 0.18           | 12°                  | 4              | 45                 |
| 01-00644-00202 |          |                   | 2                      |      | 0.18           | 12°                  | 4              | 45                 |
| 01-00644-00300 | 0.3      | 0.9               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00301 |          | 1.5               | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00302 |          | 2                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00304 |          | 0.9               | 1.5                    | B    | 0.28           | 12°                  | 4              | 45                 |
| 01-00644-00305 |          |                   | 2                      |      | 0.28           | 12°                  | 4              | 45                 |
| 01-00644-00306 |          |                   | 2.5                    |      | 0.28           | 12°                  | 4              | 45                 |
| 01-00644-00303 |          |                   | 3                      |      | 0.28           | 12°                  | 4              | 45                 |
| 01-00644-00400 | 0.4      | 1.2               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00401 |          | 2                 | —                      |      | —              | 10°                  | 4              | 45                 |
| 01-00644-00402 |          | 3                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00403 |          | 1.2               | 2                      | B    | 0.37           | 12°                  | 4              | 45                 |

How to Order

When you order, indicate RSE230 (D)×(L) [(×(L1))] Choose Shank Dia. (d) for TypeA of Dia. 3×9ℓ・15ℓ and Dia. 4×12ℓ・20ℓ.  
※(γ) is reference value.

RSE230

End Mill for Resin

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (L) | Under neck Length (L1) | Type | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|------------------------|------|----------------|----------------------|----------------|--------------------|
| 01-00644-00406 | 0.4      | 1.2               | 2.5                    | B    | 0.37           | 12°                  | 4              | 45                 |
| 01-00644-00407 |          |                   | 3                      |      | 0.37           | 12°                  | 4              | 45                 |
| 01-00644-00404 |          |                   | 4                      |      | 0.37           | 12°                  | 4              | 45                 |
| 01-00644-00405 |          |                   | 5                      |      | 0.37           | 12°                  | 4              | 45                 |
| 01-00644-00500 | 0.5      | 1.5               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00501 |          | 2.5               | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00502 |          | 5                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00503 |          | 1.5               | 3                      | B    | 0.46           | 12°                  | 4              | 45                 |
| 01-00644-00504 |          |                   | 4                      |      | 0.46           | 12°                  | 4              | 45                 |
| 01-00644-00506 |          |                   | 6                      |      | 0.46           | 12°                  | 4              | 45                 |
| 01-00644-00508 |          |                   | 8                      |      | 0.46           | 12°                  | 4              | 50                 |
| 01-00644-00510 |          |                   | 10                     |      | 0.46           | 12°                  | 4              | 50                 |
| 01-00644-00512 |          |                   | 12                     |      | 0.46           | 12°                  | 4              | 50                 |
| 01-00644-00515 |          |                   | 15                     |      | 0.46           | 12°                  | 4              | 50                 |
| 01-00644-00520 |          |                   | 20                     |      | 0.46           | 12°                  | 4              | 50                 |
| 01-00644-00600 | 0.6      | 1.8               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00601 |          | 3                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00602 |          | 4                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00604 |          | 1.8               | 4                      | B    | 0.56           | 12°                  | 4              | 45                 |
| 01-00644-00606 |          |                   | 6                      |      | 0.56           | 12°                  | 4              | 45                 |
| 01-00644-00608 |          |                   | 8                      |      | 0.56           | 12°                  | 4              | 50                 |
| 01-00644-00610 |          |                   | 10                     |      | 0.56           | 12°                  | 4              | 50                 |
| 01-00644-00612 |          |                   | 12                     |      | 0.56           | 12°                  | 4              | 50                 |
| 01-00644-00800 | 0.8      | 2.4               | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-00801 |          | 4                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00802 |          | 6                 | —                      |      | —              | 9°                   | 4              | 45                 |
| 01-00644-00806 |          | 2.4               | 6                      | B    | 0.76           | 12°                  | 4              | 45                 |
| 01-00644-00808 |          |                   | 8                      |      | 0.76           | 12°                  | 4              | 50                 |
| 01-00644-00810 |          |                   | 10                     |      | 0.76           | 12°                  | 4              | 50                 |
| 01-00644-00812 |          |                   | 12                     |      | 0.76           | 12°                  | 4              | 50                 |
| 01-00644-00816 |          |                   | 16                     |      | 0.76           | 12°                  | 4              | 60                 |
| 01-00644-01000 | 1        | 3                 | —                      | A    | —              | 9°                   | 4              | 45                 |
| 01-00644-01001 |          | 5                 | —                      |      | —              | 9°                   | 4              | 50                 |
| 01-00644-01003 |          | 7.5               | —                      |      | —              | 9°                   | 4              | 50                 |

RSE230

End Mill for Resin

RSE230

End Mill for Resin

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Aluminium Alloy

N

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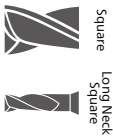
Copper

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Resin

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Aluminium Alloy

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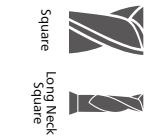
Copper

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Resin

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| Unit : mm      |             |                      |                           |      |                   |                         |                   |                       |
|----------------|-------------|----------------------|---------------------------|------|-------------------|-------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Under neck Length<br>(ℓ1) | Type | Neck Dia.<br>(d2) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00644-01002 | 1           | 10                   | —                         | A    | —                 | 9°                      | 4                 | 50                    |
| 01-00644-01006 |             | 3                    | 6                         | B    | 0.95              | 12°                     | 4                 | 50                    |
| 01-00644-01008 |             |                      | 8                         |      | 0.95              | 12°                     | 4                 | 50                    |
| 01-00644-01010 |             |                      | 10                        |      | 0.95              | 12°                     | 4                 | 50                    |
| 01-00644-01012 |             |                      | 12                        |      | 0.95              | 12°                     | 4                 | 50                    |
| 01-00644-01015 |             |                      | 15                        |      | 0.95              | 12°                     | 4                 | 60                    |
| 01-00644-01020 |             |                      | 20                        |      | 0.95              | 12°                     | 4                 | 60                    |
| 01-00644-01025 |             |                      | 25                        |      | 0.95              | 12°                     | 4                 | 70                    |
| 01-00644-01030 |             |                      | 30                        |      | 0.95              | 12°                     | 4                 | 70                    |
| 01-00644-01035 |             |                      | 35                        |      | 0.95              | 12°                     | 4                 | 80                    |
| 01-00644-01500 | 1.5         | 4.5                  | —                         | A    | —                 | 9°                      | 4                 | 45                    |
| 01-00644-01501 |             | 7.5                  | —                         |      | —                 | 9°                      | 4                 | 50                    |
| 01-00644-01502 |             | 15                   | —                         |      | —                 | 9°                      | 4                 | 60                    |
| 01-00644-01510 |             | 4.5                  | 10                        | B    | 1.45              | 12°                     | 4                 | 50                    |
| 01-00644-01512 |             |                      | 12                        |      | 1.45              | 12°                     | 4                 | 50                    |
| 01-00644-01515 |             |                      | 15                        |      | 1.45              | 12°                     | 4                 | 60                    |
| 01-00644-01518 |             |                      | 18                        |      | 1.45              | 12°                     | 4                 | 60                    |
| 01-00644-01523 |             |                      | 23                        |      | 1.45              | 12°                     | 4                 | 70                    |
| 01-00644-01530 |             |                      | 30                        |      | 1.45              | 12°                     | 4                 | 70                    |
| 01-00644-01538 |             |                      | 38                        |      | 1.45              | 12°                     | 4                 | 80                    |
| 01-00644-01545 |             |                      | 45                        |      | 1.45              | 12°                     | 4                 | 90                    |
| 01-00644-01553 |             |                      | 53                        |      | 1.45              | 12°                     | 4                 | 90                    |
| 01-00644-02000 | 2           | 6                    | —                         | A    | —                 | 9°                      | 4                 | 50                    |
| 01-00644-02001 |             | 10                   | —                         |      | —                 | 9°                      | 4                 | 50                    |
| 01-00644-02003 |             | 15                   | —                         |      | —                 | 9°                      | 4                 | 60                    |
| 01-00644-02002 |             | 20                   | —                         |      | —                 | 9°                      | 4                 | 60                    |
| 01-00644-02012 |             | 6                    | 12                        | B    | 1.94              | 12°                     | 4                 | 60                    |
| 01-00644-02015 |             |                      | 15                        |      | 1.94              | 12°                     | 4                 | 60                    |
| 01-00644-02020 |             |                      | 20                        |      | 1.94              | 12°                     | 4                 | 60                    |
| 01-00644-02024 |             |                      | 24                        |      | 1.94              | 12°                     | 4                 | 70                    |
| 01-00644-02030 |             |                      | 30                        |      | 1.94              | 12°                     | 4                 | 80                    |
| 01-00644-02040 |             |                      | 40                        |      | 1.94              | 12°                     | 4                 | 90                    |
| 01-00644-02050 |             |                      | 50                        |      | 1.94              | 12°                     | 4                 | 110                   |
| 01-00644-02060 |             |                      | 60                        |      | 1.94              | 12°                     | 4                 | 110                   |
| 01-00644-02070 |             |                      | 70                        |      | 1.94              | 12°                     | 4                 | 110                   |

**How to Order** When you order, indicate RSE230 (D)×(ℓ) [(×(ℓ1)] Choose Shank Dia. (d) for TypeA of Dia. 3×9ℓ・15ℓ and Dia. 4×12ℓ・20ℓ.  
※(γ) is reference value.

| Unit : mm      |             |                      |                           |      |                   |                         |                   |                       |
|----------------|-------------|----------------------|---------------------------|------|-------------------|-------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Under neck Length<br>(ℓ1) | Type | Neck Dia.<br>(d2) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 01-00644-03000 | 3           | 9                    | —                         | A    | —                 | —                       | 3                 | 100                   |
| 01-00644-03001 |             |                      | —                         |      | —                 | 9°                      | 6                 | 50                    |
| 01-00644-03003 |             | 15                   | —                         |      | —                 | —                       | 3                 | 100                   |
| 01-00644-03002 |             |                      | —                         |      | —                 | 9°                      | 6                 | 60                    |
| 01-00644-03004 |             |                      | —                         |      | —                 | 9°                      | 6                 | 60                    |
| 01-00644-03005 |             |                      | —                         |      | —                 | 9°                      | 6                 | 70                    |
| 01-00644-03006 |             | 30                   | —                         |      | —                 | 9°                      | 6                 | 70                    |
| 01-00644-03015 |             | 9                    | 15                        | B    | 2.85              | 12°                     | 6                 | 60                    |
| 01-00644-03020 |             |                      | 20                        |      | 2.85              | 12°                     | 6                 | 60                    |
| 01-00644-03024 |             |                      | 24                        |      | 2.85              | 12°                     | 6                 | 70                    |
| 01-00644-03030 |             |                      | 30                        |      | 2.85              | 12°                     | 6                 | 70                    |
| 01-00644-03036 |             |                      | 36                        |      | 2.85              | 12°                     | 6                 | 80                    |
| 01-00644-03045 |             |                      | 45                        |      | 2.85              | 12°                     | 6                 | 90                    |
| 01-00644-03060 |             |                      | 60                        |      | 2.85              | 12°                     | 6                 | 110                   |
| 01-00644-03075 |             |                      | 75                        |      | 2.85              | 12°                     | 6                 | 120                   |
| 01-00644-04000 | 4           | 12                   | —                         | A    | —                 | —                       | 4                 | 120                   |
| 01-00644-04001 |             |                      | —                         |      | —                 | 9°                      | 6                 | 50                    |
| 01-00644-04003 |             | 20                   | —                         |      | —                 | —                       | 4                 | 120                   |
| 01-00644-04002 |             |                      | —                         |      | —                 | 9°                      | 6                 | 60                    |
| 01-00644-04004 |             |                      | —                         |      | —                 | 9°                      | 6                 | 70                    |
| 01-00644-04005 |             | 40                   | —                         |      | —                 | 9°                      | 6                 | 90                    |
| 01-00644-04020 |             | 12                   | 20                        | B    | 3.8               | 12°                     | 6                 | 60                    |
| 01-00644-04030 |             |                      | 30                        |      | 3.8               | 12°                     | 6                 | 70                    |
| 01-00644-04040 |             |                      | 40                        |      | 3.8               | 12°                     | 6                 | 90                    |
| 01-00644-04055 |             |                      | 55                        |      | 3.8               | 12°                     | 6                 | 110                   |
| 01-00644-04070 |             |                      | 70                        |      | 3.8               | 12°                     | 6                 | 120                   |
| 01-00644-05002 | 5           | 10                   | —                         | A    | —                 | 9°                      | 6                 | 60                    |
| 01-00644-05000 |             | 15                   | —                         |      | —                 | 9°                      | 6                 | 70                    |
| 01-00644-05001 |             | 25                   | —                         |      | —                 | 9°                      | 6                 | 80                    |
| 01-00644-05003 |             | 35                   | —                         |      | —                 | 9°                      | 6                 | 90                    |
| 01-00644-05004 |             | 40                   | —                         |      | —                 | 9°                      | 6                 | 100                   |
| 01-00644-05030 |             | 15                   | 30                        | B    | 4.8               | 12°                     | 6                 | 90                    |
| 01-00644-05040 |             |                      | 40                        |      | 4.8               | 12°                     | 6                 | 100                   |
| 01-00644-05055 |             |                      | 55                        |      | 4.8               | 12°                     | 6                 | 120                   |
| 01-00644-05070 |             |                      | 70                        |      | 4.8               | 12°                     | 6                 | 130                   |
| 01-00644-06002 | 6           | 12                   | —                         | A    | —                 | —                       | 6                 | 70                    |
| 01-00644-06000 |             | 18                   | —                         |      | —                 | —                       | 6                 | 80                    |
| 01-00644-06003 |             | 25                   | —                         |      | —                 | —                       | 6                 | 80                    |
| 01-00644-06001 |             | 30                   | —                         |      | —                 | —                       | 6                 | 90                    |
| 01-00644-06004 |             | 40                   | —                         |      | —                 | —                       | 6                 | 100                   |
| 01-00644-06005 |             | 50                   | —                         |      | —                 | —                       | 6                 | 120                   |
| 01-00644-06040 |             | 18                   | 40                        | B    | 5.8               | —                       | 6                 | 100                   |
| 01-00644-06060 |             |                      | 60                        |      | 5.8               | —                       | 6                 | 120                   |
| 01-00644-06080 |             |                      | 80                        |      | 5.8               | —                       | 6                 | 130                   |

Aluminium Alloy

N

Copper

N

Resin

N



RSE230

Recommended Milling Conditions

| Work Material |               |                   |        | ABS・MC nylon ・PTFE |              |          |              |          |                   | Polycarbonate・POM・PEEK |          |              |              |                   |          | Acrylic・Bakelite |              |          |              |       |       |      |
|---------------|---------------|-------------------|--------|--------------------|--------------|----------|--------------|----------|-------------------|------------------------|----------|--------------|--------------|-------------------|----------|------------------|--------------|----------|--------------|-------|-------|------|
| Dia.          | Length of Cut | Under neck Length | L/D    | Spindle Speed      | Feed         |          | Depth of Cut |          |                   | Spindle Speed          | Feed     |              | Depth of Cut |                   |          | Spindle Speed    | Feed         |          | Depth of Cut |       |       |      |
|               |               |                   |        |                    | Side Milling | Slotting | Side Milling | Slotting | Side Milling      |                        | Slotting | Side Milling | Slotting     | Side Milling      | Slotting |                  | Side Milling | Slotting |              |       |       |      |
|               |               |                   |        | min <sup>-1</sup>  | mm/min       | ap mm    | ae mm        | ap mm    | min <sup>-1</sup> | mm/min                 | ap mm    | ae mm        | ap mm        | min <sup>-1</sup> | mm/min   | ap mm            | ae mm        | ap mm    |              |       |       |      |
| 0.1           | 0.3           | —                 | 3      | 20,000             | 190          | 90       | 0.2          | 0.02     | 0.1               | 20,000                 | 160      | 80           | 0.2          | 0.02              | 0.1      | 20,000           | 120          | 60       | 0.2          | 0.02  | 0.1   |      |
|               |               | 0.8               | 8      | 17,000             | 120          | 60       | 0.2          | 0.005    | 0.025             | 17,000                 | 100      | 50           | 0.2          | 0.005             | 0.025    | 17,000           | 80           | 40       | 0.2          | 0.005 | 0.025 |      |
|               |               | 1                 | 10     | 15,600             | 80           | 40       | 0.2          | 0.003    | 0.012             | 15,600                 | 60       | 30           | 0.2          | 0.003             | 0.012    | 15,600           | 50           | 20       | 0.2          | 0.003 | 0.012 |      |
| 0.15          | 0.45          | —                 | 3      | 20,000             | 400          | 200      | 0.3          | 0.03     | 0.15              | 20,000                 | 340      | 170          | 0.3          | 0.03              | 0.15     | 20,000           | 270          | 130      | 0.3          | 0.03  | 0.15  |      |
|               |               | 1                 | 6.7    | 17,800             | 280          | 140      | 0.3          | 0.011    | 0.055             | 17,800                 | 240      | 120          | 0.3          | 0.011             | 0.055    | 17,800           | 190          | 90       | 0.3          | 0.011 | 0.055 |      |
|               |               | 1.5               | 10     | 15,600             | 170          | 80       | 0.3          | 0.004    | 0.018             | 15,600                 | 140      | 70           | 0.3          | 0.004             | 0.018    | 15,600           | 110          | 50       | 0.3          | 0.004 | 0.018 |      |
| 0.2           | 0.6           | —                 | 3      | 20,000             | 620          | 310      | 0.4          | 0.04     | 0.2               | 20,000                 | 520      | 260          | 0.4          | 0.04              | 0.2      | 20,000           | 410          | 200      | 0.4          | 0.04  | 0.2   |      |
|               |               | 1                 | —      | 5                  | 17,100       | 400      | 200          | 0.4      | 0.02              | 0.1                    | 17,100   | 340          | 170          | 0.4               | 0.02     | 0.1              | 17,100       | 270      | 130          | 0.4   | 0.02  | 0.1  |
|               |               | 1                 | 5      | 19,000             | 500          | 250      | 0.4          | 0.02     | 0.1               | 19,000                 | 410      | 200          | 0.4          | 0.02              | 0.1      | 19,000           | 330          | 160      | 0.4          | 0.02  | 0.1   |      |
|               | 0.6           | 1.5               | 7.5    | 17,300             | 410          | 200      | 0.4          | 0.012    | 0.059             | 17,300                 | 340      | 170          | 0.4          | 0.012             | 0.059    | 17,300           | 270          | 130      | 0.4          | 0.012 | 0.059 |      |
|               |               | 2                 | 10     | 15,600             | 260          | 130      | 0.4          | 0.005    | 0.024             | 15,600                 | 220      | 110          | 0.4          | 0.005             | 0.024    | 15,600           | 170          | 80       | 0.4          | 0.005 | 0.024 |      |
|               |               | —                 | 3      | 20,000             | 1,050        | 520      | 0.6          | 0.06     | 0.3               | 20,000                 | 880      | 440          | 0.6          | 0.06              | 0.3      | 20,000           | 700          | 350      | 0.6          | 0.06  | 0.3   |      |
| 0.3           | 1.5           | —                 | 5      | 17,100             | 690          | 340      | 0.6          | 0.03     | 0.15              | 17,100                 | 570      | 280          | 0.6          | 0.03              | 0.15     | 17,100           | 460          | 230      | 0.6          | 0.03  | 0.15  |      |
|               |               | 2                 | —      | 6.7                | 16,100       | 600      | 300          | 0.6      | 0.022             | 0.1                    | 16,100   | 500          | 250          | 0.6               | 0.022    | 0.1              | 16,100       | 400      | 200          | 0.6   | 0.022 | 0.1  |
|               |               | 1.5               | 5      | 19,000             | 850          | 420      | 0.6          | 0.03     | 0.15              | 19,000                 | 710      | 350          | 0.6          | 0.03              | 0.15     | 19,000           | 560          | 280      | 0.6          | 0.03  | 0.15  |      |
|               | 0.9           | 2                 | 6.7    | 17,800             | 750          | 370      | 0.6          | 0.022    | 0.1               | 17,800                 | 620      | 310          | 0.6          | 0.022             | 0.1      | 17,800           | 500          | 250      | 0.6          | 0.022 | 0.1   |      |
|               |               | 2.5               | 8.3    | 16,700             | 630          | 310      | 0.6          | 0.014    | 0.069             | 16,700                 | 520      | 260          | 0.6          | 0.014             | 0.069    | 16,700           | 420          | 210      | 0.6          | 0.014 | 0.069 |      |
|               |               | 3                 | 10     | 15,600             | 450          | 220      | 0.6          | 0.008    | 0.036             | 15,600                 | 370      | 180          | 0.6          | 0.008             | 0.036    | 15,600           | 300          | 150      | 0.6          | 0.008 | 0.036 |      |
|               |               | —                 | 3      | 20,000             | 1,480        | 740      | 0.8          | 0.08     | 0.4               | 20,000                 | 1,240    | 620          | 0.8          | 0.08              | 0.4      | 20,000           | 990          | 490      | 0.8          | 0.08  | 0.4   |      |
|               | 1.2           | 2                 | —      | 5                  | 17,100       | 970      | 480          | 0.8      | 0.04              | 0.2                    | 17,100   | 810          | 400          | 0.8               | 0.04     | 0.2              | 17,100       | 640      | 320          | 0.8   | 0.04  | 0.2  |
| 3             |               | —                 | 7.5    | 15,600             | 800          | 400      | 0.8          | 0.024    | 0.11              | 15,600                 | 660      | 330          | 0.8          | 0.024             | 0.11     | 15,600           | 530          | 260      | 0.8          | 0.024 | 0.11  |      |
| 2             |               | 5                 | 19,000 | 1,200              | 600          | 0.8      | 0.04         | 0.2      | 19,000            | 1,000                  | 500      | 0.8          | 0.04         | 0.2               | 19,000   | 800              | 400          | 0.8      | 0.04         | 0.2   |       |      |
| 2.5           |               | 6.3               | 18,100 | 1,090              | 540          | 0.8      | 0.032        | 0.15     | 18,100            | 910                    | 450      | 0.8          | 0.032        | 0.15              | 18,100   | 720              | 360          | 0.8      | 0.032        | 0.15  |       |      |
| 3             |               | 7.5               | 17,300 | 980                | 490          | 0.8      | 0.024        | 0.11     | 17,300            | 820                    | 410      | 0.8          | 0.024        | 0.11              | 17,300   | 650              | 320          | 0.8      | 0.024        | 0.11  |       |      |
| 4             |               | 10                | 15,600 | 630                | 310          | 0.8      | 0.01         | 0.048    | 15,600            | 530                    | 260      | 0.8          | 0.01         | 0.048             | 15,600   | 420              | 210          | 0.8      | 0.01         | 0.048 |       |      |
| 0.5           | 1.5           | 5                 | 12.5   | 15,000             | 550          | 270      | 0.8          | 0.008    | 0.04              | 15,000                 | 460      | 230          | 0.8          | 0.008             | 0.04     | 15,000           | 370          | 180      | 0.8          | 0.008 | 0.04  |      |
|               |               | —                 | 3      | 20,000             | 1,920        | 960      | 1            | 0.1      | 0.5               | 20,000                 | 1,600    | 800          | 1            | 0.1               | 0.5      | 20,000           | 1,280        | 640      | 1            | 0.1   | 0.5   |      |
|               |               | 2.5               | —      | 5                  | 17,100       | 1,250    | 620          | 1        | 0.05              | 0.25                   | 17,100   | 1,040        | 520          | 1                 | 0.05     | 0.25             | 17,100       | 830      | 410          | 1     | 0.05  | 0.25 |
|               |               | 5                 | —      | 10                 | 13,000       | 610      | 300          | 1        | 0.012             | 0.06                   | 13,000   | 510          | 250          | 1                 | 0.012    | 0.06             | 13,000       | 410      | 200          | 1     | 0.012 | 0.06 |
|               |               | 3                 | 6      | 18,300             | 1,430        | 710      | 1            | 0.042    | 0.2               | 18,300                 | 1,190    | 590          | 1            | 0.042             | 0.2      | 18,300           | 950          | 470      | 1            | 0.042 | 0.2   |      |
|               | 1.5           | 4                 | 8      | 16,000             | 1,150        | 570      | 1            | 0.025    | 0.12              | 16,000                 | 960      | 480          | 1            | 0.025             | 0.12     | 16,000           | 760          | 380      | 1            | 0.025 | 0.12  |      |
|               |               | 6                 | 12     | 15,200             | 740          | 370      | 1            | 0.011    | 0.052             | 15,200                 | 620      | 310          | 1            | 0.011             | 0.052    | 15,200           | 490          | 240      | 1            | 0.011 | 0.052 |      |
|               |               | 8                 | 16     | 14,300             | 590          | 290      | 1            | 0.008    | 0.036             | 14,300                 | 490      | 240          | 1            | 0.008             | 0.036    | 14,300           | 390          | 190      | 1            | 0.008 | 0.036 |      |
| 0.6           | 1.8           | 10                | 20     | 13,500             | 450          | 220      | 1            | 0.004    | 0.02              | 13,500                 | 370      | 180          | 1            | 0.004             | 0.02     | 13,500           | 300          | 150      | 1            | 0.004 | 0.02  |      |
|               |               | —                 | 3      | 20,000             | 2,160        | 1,080    | 1.2          | 0.12     | 0.6               | 20,000                 | 1,800    | 900          | 1.2          | 0.12              | 0.6      | 20,000           | 1,440        | 720      | 1.2          | 0.12  | 0.6   |      |
|               |               | 3                 | —      | 5                  | 17,100       | 1,410    | 700          | 1.2      | 0.06              | 0.3                    | 17,100   | 1,170        | 580          | 1.2               | 0.06     | 0.3              | 17,100       | 940      | 470          | 1.2   | 0.06  | 0.3  |
|               |               | 4                 | —      | 6.7                | 16,100       | 1,240    | 620          | 1.2      | 0.044             | 0.21                   | 16,100   | 1,030        | 510          | 1.2               | 0.044    | 0.21             | 16,100       | 820      | 410          | 1.2   | 0.044 | 0.21 |
|               |               | 4                 | 6.7    | 17,800             | 1,530        | 760      | 1.2          | 0.044    | 0.21              | 17,800                 | 1,270    | 630          | 1.2          | 0.044             | 0.21     | 17,800           | 1,020        | 510      | 1.2          | 0.044 | 0.21  |      |
|               | 1.8           | 6                 | 10     | 15,000             | 890          | 440      | 1.2          | 0.015    | 0.072             | 15,000                 | 740      | 370          | 1.2          | 0.015             | 0.072    | 15,000           | 590          | 290      | 1.2          | 0.015 | 0.072 |      |
|               |               | 8                 | 13.3   | 14,400             | 750          | 370      | 1.2          | 0.012    | 0.056             | 14,400                 | 620      | 310          | 1.2          | 0.012             | 0.056    | 14,400           | 500          | 250      | 1.2          | 0.012 | 0.056 |      |
|               |               | 10                | 16.7   | 13,700             | 610          | 300      | 1.2          | 0.008    | 0.04              | 13,700                 | 510      | 250          | 1.2          | 0.008             | 0.04     | 13,700           | 410          | 200      | 1.2          | 0.008 | 0.04  |      |
| 0.8           | 2.4           | —                 | 3      | 20,000             | 2,640        | 1,320    | 1.6          | 0.16     | 0.8               | 20,000                 | 2,200    | 1,100        | 1.6          | 0.16              | 0.8      | 20,000           | 1,760        | 880      | 1.6          | 0.16  | 0.8   |      |
|               |               | 4                 | —      | 5                  | 17,100       | 1,720    | 860          | 1.6      | 0.08              | 0.4                    | 17,100   | 1,430        | 710          | 1.6               | 0.08     | 0.4              | 17,100       | 1,150    | 570          | 1.6   | 0.08  | 0.4  |
|               |               | 6                 | —      | 7.5                | 15,600       | 1,420    | 710          | 1.6      | 0.047             | 0.23                   | 15,600   | 1,180        | 590          | 1.6               | 0.047    | 0.23             | 15,600       | 940      | 470          | 1.6   | 0.047 | 0.23 |
|               |               | 6                 | 7.5    | 17,300             | 1,750        | 870      | 1.6          | 0.047    | 0.23              | 17,300                 | 1,460    | 730          | 1.6          | 0.047             | 0.23     | 17,300           | 1,160        | 580      | 1.6          | 0.047 | 0.23  |      |
|               |               | 8                 | 10     | 14,000             | 1,010        | 500      | 1.6          | 0.02     | 0.096             | 14,000                 | 840      | 420          | 1.6          | 0.02              | 0.096    | 14,000           | 670          | 330      | 1.6          | 0.02  | 0.096 |      |
|               | 2.4           | 10                | 12.5   | 13,400             | 880          | 440      | 1.6          | 0.016    | 0.08              | 13,400                 | 730      | 360          | 1.6          | 0.016             | 0.08     | 13,400           | 580          | 290      | 1.6          | 0.016 | 0.08  |      |
|               |               | 12                | 15     | 12,700             | 750          | 370      | 1.6          | 0.013    | 0.064             | 12,700                 | 620      | 310          | 1.6          | 0.013             | 0.064    | 12,700           | 500          | 250      | 1.6          | 0.013 | 0.064 |      |
|               |               | 16                | 20     | 12,000             | 550          | 270      | 1.6          | 0.007    | 0.032             | 12,000                 | 460      | 230          | 1.6          | 0.007             | 0.032    | 12,000           | 360          | 180      | 1.6          | 0.007 | 0.032 |      |

Recommended Milling Conditions

| Work Material |               |                   |       | ABS・MC nylon ・PTFE                                                                                                                                                      |              |          |              |          |                   | Polycarbonate・POM・PEEK |              |          |              |                   |        | Acrylic・Bakelite |              |          |                   |          |       |       |
|---------------|---------------|-------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|--------------|----------|-------------------|------------------------|--------------|----------|--------------|-------------------|--------|------------------|--------------|----------|-------------------|----------|-------|-------|
| Dia.          | Length of Cut | Under neck Length | L/D   | Spindle Speed                                                                                                                                                           | Feed         |          | Depth of Cut |          |                   | Spindle Speed          | Feed         |          | Depth of Cut |                   |        | Spindle Speed    | Feed         |          | Depth of Cut      |          |       |       |
|               |               |                   |       |                                                                                                                                                                         | Side Milling | Slotting | Side Milling | Slotting |                   |                        | Side Milling | Slotting | Side Milling | Slotting          |        |                  | Side Milling | Slotting | Side Milling      | Slotting |       |       |
|               |               |                   |       | min <sup>-1</sup>                                                                                                                                                       | mm/min       | ap mm    | ae mm        | ap mm    | min <sup>-1</sup> | mm/min                 | ap mm        | ae mm    | ap mm        | min <sup>-1</sup> | mm/min | ap mm            | ae mm        | ap mm    | min <sup>-1</sup> | mm/min   | ap mm | ae mm |
| 5             | 10            | —                 | 2     | 3,900                                                                                                                                                                   | 1,820        | 910      | 10           | 1        | 5                 | 3,900                  | 1,510        | 750      | 10           | 1                 | 5      | 3,900            | 1,210        | 600      | 10                | 1        | 5     |       |
|               | 15            | —                 | 3     | 3,900                                                                                                                                                                   | 1,820        | 910      | 10           | 1        | 5                 | 3,900                  | 1,510        | 750      | 10           | 1                 | 5      | 3,900            | 1,210        | 600      | 10                | 1        | 5     |       |
|               | 25            | —                 | 5     | 3,200                                                                                                                                                                   | 1,260        | 630      | 10           | 0.5      | 2.5               | 3,200                  | 1,050        | 520      | 10           | 0.5               | 2.5    | 3,200            | 840          | 420      | 10                | 0.5      | 2.5   |       |
|               | 35            | —                 | 7     | 2,700                                                                                                                                                                   | 1,030        | 510      | 10           | 0.33     | 1.6               | 2,700                  | 860          | 430      | 10           | 0.33              | 1.6    | 2,700            | 690          | 340      | 10                | 0.33     | 1.6   |       |
|               | 40            | —                 | 8     | 2,500                                                                                                                                                                   | 930          | 460      | 10           | 0.25     | 1.2               | 2,500                  | 770          | 380      | 10           | 0.25              | 1.2    | 2,500            | 620          | 310      | 10                | 0.25     | 1.2   |       |
|               | 15            | 30                | 6     | 3,300                                                                                                                                                                   | 1,410        | 700      | 10           | 0.41     | 2                 | 3,300                  | 1,180        | 590      | 10           | 0.41              | 2      | 3,300            | 940          | 470      | 10                | 0.41     | 2     |       |
|               |               | 40                | 8     | 2,700                                                                                                                                                                   | 1,140        | 570      | 10           | 0.25     | 1.2               | 2,700                  | 950          | 470      | 10           | 0.25              | 1.2    | 2,700            | 760          | 380      | 10                | 0.25     | 1.2   |       |
|               |               | 55                | 11    | 2,100                                                                                                                                                                   | 770          | 380      | 10           | 0.11     | 0.56              | 2,100                  | 640          | 320      | 10           | 0.11              | 0.56   | 2,100            | 510          | 250      | 10                | 0.11     | 0.56  |       |
| 70            |               | 14                | 1,800 | 650                                                                                                                                                                     | 320          | 10       | 0.088        | 0.44     | 1,800             | 540                    | 270          | 10       | 0.088        | 0.44              | 1,800  | 430              | 210          | 10       | 0.088             | 0.44     |       |       |
| 6             | 12            | —                 | 2     | 3,300                                                                                                                                                                   | 1,750        | 870      | 12           | 1.2      | 6                 | 3,300                  | 1,460        | 730      | 12           | 1.2               | 6      | 3,300            | 1,170        | 580      | 12                | 1.2      | 6     |       |
|               | 18            | —                 | 3     | 3,300                                                                                                                                                                   | 1,750        | 870      | 12           | 1.2      | 6                 | 3,300                  | 1,460        | 730      | 12           | 1.2               | 6      | 3,300            | 1,170        | 580      | 12                | 1.2      | 6     |       |
|               | 25            | —                 | 4.2   | 2,800                                                                                                                                                                   | 1,300        | 650      | 12           | 0.85     | 4.2               | 2,800                  | 1,080        | 540      | 12           | 0.85              | 4.2    | 2,800            | 860          | 430      | 12                | 0.85     | 4.2   |       |
|               | 30            | —                 | 5     | 2,600                                                                                                                                                                   | 1,210        | 600      | 12           | 0.6      | 3                 | 2,600                  | 1,010        | 500      | 12           | 0.6               | 3      | 2,600            | 810          | 400      | 12                | 0.6      | 3     |       |
|               | 40            | —                 | 6.7   | 2,300                                                                                                                                                                   | 1,030        | 510      | 12           | 0.43     | 2.1               | 2,300                  | 860          | 430      | 12           | 0.43              | 2.1    | 2,300            | 690          | 340      | 12                | 0.43     | 2.1   |       |
|               | 50            | —                 | 8.3   | 2,000                                                                                                                                                                   | 850          | 420      | 12           | 0.27     | 1.3               | 2,000                  | 700          | 350      | 12           | 0.27              | 1.3    | 2,000            | 560          | 280      | 12                | 0.27     | 1.3   |       |
|               | 18            | 40                | 6.7   | 2,600                                                                                                                                                                   | 1,270        | 630      | 12           | 0.43     | 2.1               | 2,600                  | 1,060        | 530      | 12           | 0.43              | 2.1    | 2,600            | 850          | 420      | 12                | 0.43     | 2.1   |       |
|               |               | 60                | 10    | 1,800                                                                                                                                                                   | 780          | 390      | 12           | 0.14     | 0.72              | 1,800                  | 650          | 320      | 12           | 0.14              | 0.72   | 1,800            | 520          | 260      | 12                | 0.14     | 0.72  |       |
|               | 80            | 13.3              | 1,600 | 650                                                                                                                                                                     | 320          | 12       | 0.11         | 0.56     | 1,600             | 540                    | 270          | 12       | 0.11         | 0.56              | 1,600  | 430              | 210          | 12       | 0.11              | 0.56     |       |       |
| Notes         |               |                   |       | ※1 These recommended cutting conditions indicate just reference for roughing. It should be adjusted according to milling shape and machine type.                        |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※2 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.                                                 |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※3 For finishing process, please adjust to the optimized condition to meet the requirement of machining accuracy.                                                       |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※4 Necessary to adjust the cutting condition at the parts overloading against the tools such as inner corner parts.                                                     |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※5 Adjust both spindle speed and feed at the same rate when chattering or abnormal sounds occurred.                                                                     |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※6 When a tool with L/D 10 times and longer deflects on milling, please reduce Feed or Depth of Cut.                                                                    |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※7 For a tool with L/D longer than 20 times, reduce spindle speed, feed rate and depth of cut at sufficient values by referring the cutting conditions of L/D 20 times. |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※8 Air blow is recommended.                                                                                                                                             |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※9 Care for chip removal to avoid being stuck or caught during process for better surface quality.                                                                      |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※10 Minimize chucking runout.                                                                                                                                           |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |
|               |               |                   |       | ※11 Pay keen attention for tool length measurement with contact-type equipment for the tools under ϕ 1 to avoid cutting edge damage.                                    |              |          |              |          |                   |                        |              |          |              |                   |        |                  |              |          |                   |          |       |       |



○ Aluminium Alloy

N

○ Copper

N

⊙ Resin

N

N Aluminium Alloy

○

N Copper

○

N Resin

⊙

 Square

 Long Neck

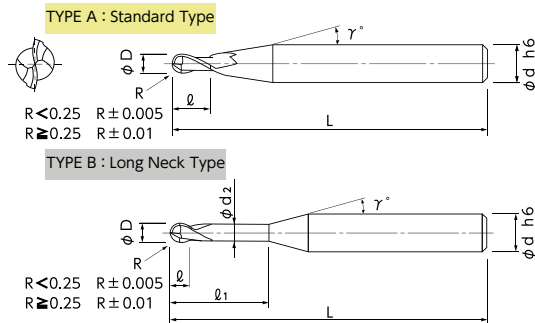
 Square

 Long Neck

Ball End Mill for Resin

Ball End Mill for Resin

Ball end mill for resin.  
Maximum L/D=10 for standard type, maximum L/D=35 for long neck type



- Select the right one for your job, 3D or 5D or 10D Length of cut, with Extra Long-neck or without Under neck length.
- Applicable to nonferrous material such as Aluminium and copper.

Unit : mm

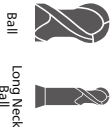
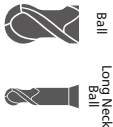
| Code No.       | Radius (R) | Length of Cut (ℓ) | Underneck Length (ℓ <sub>1</sub> ) | Type | Dia. (D) | Neck Taper Angle (γ) | Neck Dia. (d <sub>2</sub> ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|------------------------------------|------|----------|----------------------|-----------------------------|----------------|--------------------|
| 01-00654-01000 | R0.1       | 0.6               | —                                  | A    | 0.2      | 9°                   | —                           | 4              | 50                 |
| 01-00654-01001 |            | 1                 | —                                  | A    | 0.2      | 9°                   | —                           | 4              | 50                 |
| 01-00654-01002 |            | 0.6               | 2                                  | B    | 0.2      | 12°                  | 0.18                        | 4              | 50                 |
| 01-00654-01500 | R0.15      | 0.9               | —                                  | A    | 0.3      | 9°                   | —                           | 4              | 50                 |
| 01-00654-01501 |            | 1.5               | —                                  | A    | 0.3      | 9°                   | —                           | 4              | 50                 |
| 01-00654-01503 |            | 0.9               | 3                                  | B    | 0.3      | 12°                  | 0.28                        | 4              | 50                 |
| 01-00654-02000 | R0.2       | 1.2               | —                                  | A    | 0.4      | 9°                   | —                           | 4              | 50                 |
| 01-00654-02001 |            | 2                 | —                                  | A    | 0.4      | 9°                   | —                           | 4              | 50                 |
| 01-00654-02004 |            | 1.2               | 4                                  | B    | 0.4      | 12°                  | 0.37                        | 4              | 50                 |
| 01-00654-02005 |            |                   | 5                                  | B    | 0.4      | 12°                  | 0.37                        | 4              | 50                 |
| 01-00654-02500 | R0.25      | 1.5               | —                                  | A    | 0.5      | 9°                   | —                           | 4              | 50                 |
| 01-00654-02501 |            | 2.5               | —                                  | A    | 0.5      | 9°                   | —                           | 4              | 50                 |
| 01-00654-02502 |            | 5                 | —                                  | A    | 0.5      | 9°                   | —                           | 4              | 50                 |
| 01-00654-02510 |            | 1.5               | 10                                 | B    | 0.5      | 12°                  | 0.46                        | 4              | 50                 |
| 01-00654-02515 |            |                   | 15                                 | B    | 0.5      | 12°                  | 0.46                        | 4              | 50                 |
| 01-00654-02520 |            |                   | 20                                 | B    | 0.5      | 12°                  | 0.46                        | 4              | 60                 |
| 01-00654-03000 | R0.3       | 1.8               | —                                  | A    | 0.6      | 9°                   | —                           | 4              | 50                 |
| 01-00654-03001 |            | 3                 | —                                  | A    | 0.6      | 9°                   | —                           | 4              | 50                 |
| 01-00654-03006 |            | 1.8               | 6                                  | B    | 0.6      | 12°                  | 0.56                        | 4              | 50                 |
| 01-00654-03010 |            |                   | 10                                 | B    | 0.6      | 12°                  | 0.56                        | 4              | 50                 |
| 01-00654-04000 | R0.4       | 2.4               | —                                  | A    | 0.8      | 9°                   | —                           | 4              | 50                 |
| 01-00654-04001 |            | 4                 | —                                  | A    | 0.8      | 9°                   | —                           | 4              | 50                 |
| 01-00654-04008 |            | 2.4               | 8                                  | B    | 0.8      | 12°                  | 0.76                        | 4              | 50                 |
| 01-00654-04012 |            |                   | 12                                 | B    | 0.8      | 12°                  | 0.76                        | 4              | 50                 |
| 01-00654-05000 | R0.5       | 3                 | —                                  | A    | 1        | 9°                   | —                           | 4              | 50                 |
| 01-00654-05001 |            | 5                 | —                                  | A    | 1        | 9°                   | —                           | 4              | 50                 |
| 01-00654-05002 |            | 10                | —                                  | A    | 1        | 9°                   | —                           | 4              | 50                 |
| 01-00654-05010 |            | 3                 | 10                                 | B    | 1        | 12°                  | 0.95                        | 4              | 50                 |

How to Order

When you order, indicate RSB230 (R)×(ℓ) [×(ℓ<sub>1</sub>)]. Choose Shank Dia. (d) for typeA of R1.5×9ℓ and R2×12ℓ.  
※(γ) is reference value.

Unit : mm

| Code No.       | Radius (R) | Length of Cut (ℓ) | Underneck Length (ℓ <sub>1</sub> ) | Type | Dia. (D) | Neck Taper Angle (γ) | Neck Dia. (d <sub>2</sub> ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-------------------|------------------------------------|------|----------|----------------------|-----------------------------|----------------|--------------------|
| 01-00654-05015 | R0.5       | 3                 | 15                                 | B    | 1        | 12°                  | 0.95                        | 4              | 60                 |
| 01-00654-05020 |            |                   | 20                                 | B    | 1        | 12°                  | 0.95                        | 4              | 60                 |
| 01-00654-05030 |            |                   | 30                                 | B    | 1        | 12°                  | 0.95                        | 4              | 70                 |
| 01-00654-07500 | R0.75      | 4.5               | —                                  | A    | 1.5      | 9°                   | —                           | 4              | 50                 |
| 01-00654-07501 |            | 7.5               | —                                  | A    | 1.5      | 9°                   | —                           | 4              | 50                 |
| 01-00654-07502 |            | 15                | —                                  | A    | 1.5      | 9°                   | —                           | 4              | 60                 |
| 01-00654-07515 |            | 4.5               | 15                                 | B    | 1.5      | 12°                  | 1.45                        | 4              | 60                 |
| 01-00654-07530 |            |                   | 30                                 | B    | 1.5      | 12°                  | 1.45                        | 4              | 70                 |
| 01-00654-07545 |            |                   | 45                                 | B    | 1.5      | 12°                  | 1.45                        | 4              | 90                 |
| 01-00654-10000 | R1         | 6                 | —                                  | A    | 2        | 9°                   | —                           | 4              | 50                 |
| 01-00654-10001 |            | 10                | —                                  | A    | 2        | 9°                   | —                           | 4              | 50                 |
| 01-00654-10002 |            | 20                | —                                  | A    | 2        | 9°                   | —                           | 4              | 60                 |
| 01-00654-10020 |            | 6                 | 20                                 | B    | 2        | 12°                  | 1.94                        | 4              | 60                 |
| 01-00654-10030 |            |                   | 30                                 | B    | 2        | 12°                  | 1.94                        | 4              | 80                 |
| 01-00654-10050 |            |                   | 50                                 | B    | 2        | 12°                  | 1.94                        | 4              | 110                |
| 01-00654-10070 |            |                   | 70                                 | B    | 2        | 12°                  | 1.94                        | 4              | 110                |
| 01-00654-15000 | R1.5       | 9                 | —                                  | A    | 3        | —                    | —                           | 3              | 100                |
| 01-00654-15001 |            |                   | —                                  | A    | 3        | 9°                   | —                           | 6              | 50                 |
| 01-00654-15002 |            | 15                | —                                  | A    | 3        | 9°                   | —                           | 6              | 60                 |
| 01-00654-15030 |            | 9                 | 30                                 | B    | 3        | 12°                  | 2.85                        | 6              | 70                 |
| 01-00654-15045 |            |                   | 45                                 | B    | 3        | 12°                  | 2.85                        | 6              | 90                 |
| 01-00654-15060 |            |                   | 60                                 | B    | 3        | 12°                  | 2.85                        | 6              | 110                |
| 01-00654-20000 | R2         | 12                | —                                  | A    | 4        | —                    | —                           | 4              | 120                |
| 01-00654-20001 |            |                   | —                                  | A    | 4        | 9°                   | —                           | 6              | 50                 |
| 01-00654-20002 |            | 20                | —                                  | A    | 4        | 9°                   | —                           | 6              | 60                 |
| 01-00654-20030 |            | 12                | 30                                 | B    | 4        | 12°                  | 3.8                         | 6              | 70                 |
| 01-00654-20040 |            |                   | 40                                 | B    | 4        | 12°                  | 3.8                         | 6              | 90                 |
| 01-00654-20070 |            |                   | 70                                 | B    | 4        | 12°                  | 3.8                         | 6              | 120                |
| 01-00654-25000 | R2.5       | 15                | —                                  | A    | 5        | 9°                   | —                           | 6              | 70                 |
| 01-00654-25001 |            | 25                | —                                  | A    | 5        | 9°                   | —                           | 6              | 80                 |
| 01-00654-30000 | R3         | 18                | —                                  | A    | 6        | —                    | —                           | 6              | 80                 |
| 01-00654-30001 |            | 30                | —                                  | A    | 6        | —                    | —                           | 6              | 90                 |
| 01-00654-30040 |            | 18                | 40                                 | B    | 6        | —                    | 5.8                         | 6              | 100                |
| 01-00654-30060 |            |                   | 60                                 | B    | 6        | —                    | 5.8                         | 6              | 120                |
| 01-00654-30080 |            |                   | 80                                 | B    | 6        | —                    | 5.8                         | 6              | 130                |



- N Aluminium Alloy ○
- N Copper ○
- N Resin ●



Aluminium Alloy

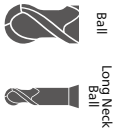
N

Copper

N

Resin

N



RSB230

Recommended Milling Conditions

| Work Material |               |                   |        | ABS・MC nylon ・PTFE |        |              | Polycarbonate・POM・PEEK |        |              | Acrylic・Bakelite  |        |              |
|---------------|---------------|-------------------|--------|--------------------|--------|--------------|------------------------|--------|--------------|-------------------|--------|--------------|
| Radius        | Length of Cut | Under neck Length | L/D    | Spindle Speed      | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut | Spindle Speed     | Feed   | Depth of Cut |
|               |               |                   |        | min <sup>-1</sup>  | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        | min <sup>-1</sup> | mm/min | ap mm        |
| R0.1          | 0.6           | —                 | 3      | 20,000             | 620    | 0.1          | 20,000                 | 520    | 0.1          | 20,000            | 410    | 0.1          |
|               | 1             | —                 | 5      | 17,100             | 400    | 0.05         | 17,100                 | 340    | 0.05         | 17,100            | 270    | 0.05         |
| R0.15         | 0.6           | 2                 | 10     | 15,600             | 260    | 0.012        | 15,600                 | 220    | 0.012        | 15,600            | 170    | 0.012        |
|               | 0.9           | —                 | 3      | 20,000             | 1,050  | 0.15         | 20,000                 | 880    | 0.15         | 20,000            | 700    | 0.15         |
|               | 1.5           | —                 | 5      | 17,100             | 690    | 0.075        | 17,100                 | 570    | 0.075        | 17,100            | 460    | 0.075        |
| R0.2          | 0.9           | 3                 | 10     | 15,600             | 450    | 0.018        | 15,600                 | 370    | 0.018        | 15,600            | 300    | 0.018        |
|               | 1.2           | —                 | 3      | 20,000             | 1,480  | 0.2          | 20,000                 | 1,240  | 0.2          | 20,000            | 990    | 0.2          |
|               | 2             | —                 | 5      | 17,100             | 970    | 0.1          | 17,100                 | 810    | 0.1          | 17,100            | 640    | 0.1          |
|               | 1.2           | 4                 | 10     | 15,600             | 630    | 0.024        | 15,600                 | 530    | 0.024        | 15,600            | 420    | 0.024        |
| 5             |               | 12.5              | 15,000 | 550                | 0.02   | 15,000       | 460                    | 0.02   | 15,000       | 370               | 0.02   |              |
| R0.25         | 1.5           | —                 | 3      | 20,000             | 1,920  | 0.25         | 20,000                 | 1,600  | 0.25         | 20,000            | 1,280  | 0.25         |
|               | 2.5           | —                 | 5      | 17,100             | 1,250  | 0.12         | 17,100                 | 1,040  | 0.12         | 17,100            | 830    | 0.12         |
|               | 5             | —                 | 10     | 14,000             | 660    | 0.03         | 14,000                 | 550    | 0.03         | 14,000            | 440    | 0.03         |
| R0.3          | 1.5           | 10                | 20     | 13,500             | 450    | 0.01         | 13,500                 | 370    | 0.01         | 13,500            | 300    | 0.01         |
|               | 1.8           | —                 | 3      | 20,000             | 2,160  | 0.3          | 20,000                 | 1,800  | 0.3          | 20,000            | 1,440  | 0.3          |
|               | 3             | —                 | 5      | 17,100             | 1,410  | 0.15         | 17,100                 | 1,170  | 0.15         | 17,100            | 940    | 0.15         |
|               |               | 6                 | 10     | 15,000             | 890    | 0.036        | 15,000                 | 740    | 0.036        | 15,000            | 590    | 0.036        |
| 10            | 16.7          |                   | 13,700 | 610                | 0.02   | 13,700       | 510                    | 0.02   | 13,700       | 410               | 0.02   |              |
| R0.4          | 2.4           | —                 | 3      | 20,000             | 2,640  | 0.4          | 20,000                 | 2,200  | 0.4          | 20,000            | 1,760  | 0.4          |
|               | 4             | —                 | 5      | 17,100             | 1,720  | 0.2          | 17,100                 | 1,430  | 0.2          | 17,100            | 1,150  | 0.2          |
|               |               | 8                 | 10     | 14,000             | 1,010  | 0.048        | 14,000                 | 840    | 0.048        | 14,000            | 670    | 0.048        |
|               | 12            |                   | 15     | 12,700             | 750    | 0.032        | 12,700                 | 620    | 0.032        | 12,700            | 500    | 0.032        |
| R0.5          | 3             | —                 | 3      | 17,000             | 2,650  | 0.5          | 17,000                 | 2,210  | 0.5          | 17,000            | 1,760  | 0.5          |
|               | 5             | —                 | 5      | 14,500             | 1,730  | 0.25         | 14,500                 | 1,440  | 0.25         | 14,500            | 1,150  | 0.25         |
|               |               | 10                | —      | 10                 | 12,000 | 920          | 0.06                   | 12,000 | 770          | 0.06              | 12,000 | 610          |
|               | 10            |                   | 10     | 13,000             | 1,110  | 0.06         | 13,000                 | 920    | 0.06         | 13,000            | 740    | 0.06         |
|               |               | 3                 | 15     | 15                 | 11,700 | 820          | 0.04                   | 11,700 | 680          | 0.04              | 11,700 | 540          |
|               | 20            |                   | 20     | 11,000             | 600    | 0.02         | 11,000                 | 500    | 0.02         | 11,000            | 400    | 0.02         |
| R0.75         | 4.5           | —                 | 3      | 13,300             | 2,590  | 0.75         | 13,300                 | 2,150  | 0.75         | 13,300            | 1,720  | 0.75         |
|               | 7.5           | —                 | 5      | 11,100             | 1,710  | 0.37         | 11,100                 | 1,430  | 0.37         | 11,100            | 1,140  | 0.37         |
|               |               | 15                | —      | 10                 | 8,500  | 930          | 0.09                   | 8,500  | 780          | 0.09              | 8,500  | 620          |
|               | 4.5           |                   | 15     | 10                 | 9,400  | 1,150        | 0.09                   | 9,400  | 960          | 0.09              | 9,400  | 770          |
|               |               | 30                | 20     | 7,500              | 690    | 0.03         | 7,500                  | 570    | 0.03         | 7,500             | 460    | 0.03         |
| R1            | 6             | —                 | 3      | 9,900              | 2,320  | 1            | 9,900                  | 1,930  | 1            | 9,900             | 1,550  | 1            |
|               | 10            | —                 | 5      | 8,200              | 1,590  | 0.5          | 8,200                  | 1,320  | 0.5          | 8,200             | 1,060  | 0.5          |
|               |               | 20                | —      | 10                 | 5,600  | 850          | 0.12                   | 5,600  | 710          | 0.12              | 5,600  | 560          |
|               | 6             |                   | 20     | 10                 | 6,200  | 1,050        | 0.12                   | 6,200  | 870          | 0.12              | 6,200  | 700          |
|               |               | 30                | 15     | 5,300              | 810    | 0.08         | 5,300                  | 680    | 0.08         | 5,300             | 540    | 0.08         |
| R1.5          | 9(d3)         | —                 | 3      | 6,600              | 2,060  | 1.5          | 6,600                  | 1,710  | 1.5          | 6,600             | 1,370  | 1.5          |
|               | 9(d6)         | —                 | 3      | 6,600              | 2,060  | 1.5          | 6,600                  | 1,710  | 1.5          | 6,600             | 1,370  | 1.5          |
|               | 15            | —                 | 5      | 5,300              | 1,420  | 0.75         | 5,300                  | 1,190  | 0.75         | 5,300             | 950    | 0.75         |
|               |               | 30                | 10     | 3,700              | 920    | 0.18         | 3,700                  | 770    | 0.18         | 3,700             | 610    | 0.18         |
|               | 9             | 45                | 15     | 2,900              | 690    | 0.12         | 2,900                  | 580    | 0.12         | 2,900             | 460    | 0.12         |
|               |               | 60                | 20     | 2,300              | 500    | 0.06         | 2,300                  | 420    | 0.06         | 2,300             | 330    | 0.06         |

RSB230

Recommended Milling Conditions

| Work Material |               |                   |      | ABS・MC nylon ・PTFE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |              | Polycarbonate・POM・PEEK |        |              | Acrylic・Bakelite  |        |              |
|---------------|---------------|-------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|------------------------|--------|--------------|-------------------|--------|--------------|
| Radius        | Length of Cut | Under neck Length | L/D  | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Depth of Cut | Spindle Speed          | Feed   | Depth of Cut | Spindle Speed     | Feed   | Depth of Cut |
|               |               |                   |      | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | mm/min | ap mm        | min <sup>-1</sup>      | mm/min | ap mm        | min <sup>-1</sup> | mm/min | ap mm        |
| R2            | 12(d4)        | —                 | 3    | 4,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,910  | 2            | 4,900                  | 1,590  | 2            | 4,900             | 1,270  | 2            |
|               | 12(d6)        | —                 | 3    | 4,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,910  | 2            | 4,900                  | 1,590  | 2            | 4,900             | 1,270  | 2            |
|               | 20            | —                 | 5    | 4,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,320  | 1            | 4,000                  | 1,100  | 1            | 4,000             | 880    | 1            |
|               | 12            | 30                | 7.5  | 3,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,270  | 0.58         | 3,600                  | 1,060  | 0.58         | 3,600             | 850    | 0.58         |
|               |               | 40                | 10   | 2,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 850    | 0.24         | 2,700                  | 710    | 0.24         | 2,700             | 570    | 0.24         |
|               |               | 70                | 17.5 | 1,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 550    | 0.12         | 1,900                  | 460    | 0.12         | 1,900             | 370    | 0.12         |
| R2.5          | 15            | —                 | 3    | 3,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,820  | 2.5          | 3,900                  | 1,510  | 2.5          | 3,900             | 1,210  | 2.5          |
|               | 25            | —                 | 5    | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,260  | 1.2          | 3,200                  | 1,050  | 1.2          | 3,200             | 840    | 1.2          |
| R3            | 18            | —                 | 3    | 3,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,750  | 3            | 3,300                  | 1,460  | 3            | 3,300             | 1,170  | 3            |
|               | 30            | —                 | 5    | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,210  | 1.5          | 2,600                  | 1,010  | 1.5          | 2,600             | 810    | 1.5          |
|               | 18            | 40                | 6.7  | 2,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1,270  | 1            | 2,600                  | 1,060  | 1            | 2,600             | 850    | 1            |
|               |               | 60                | 10   | 1,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 780    | 0.36         | 1,800                  | 650    | 0.36         | 1,800             | 520    | 0.36         |
|               |               | 80                | 13.3 | 1,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 650    | 0.28         | 1,600                  | 540    | 0.28         | 1,600             | 430    | 0.28         |
| Notes         |               |                   |      | ※1 These recommended cutting conditions indicate just reference for roughing. It should be adjusted according to milling shape and machine type.<br>※2 Reduce both spindle speed and feed at same rate for chattering and also for insufficient spindle speed of a machine.<br>※3 For finishing process, please adjust to the optimized condition to meet the requirement of machining accuracy.<br>※4 Necessary to adjust the cutting condition at the parts overloading against the tools such as inner corner parts.<br>※5 Adjust both spindle speed and feed at the same rate when chattering or abnormal sounds occurred.<br>※6 When a tool with L/D 10 times and longer deflects on milling, please reduce Feed or Depth of Cut.<br>※7 For a tool with L/D longer than 20 times, reduce spindle speed, feed rate and depth of cut at sufficient values by referring the cutting conditions of L/D 20 times.<br>※8 Air blow is recommended.<br>※9 Care for chip removal to avoid being stuck or caught during process for better surface quality.<br>※10 Minimize chucking runout. |        |              |                        |        |              |                   |        |              |

Aluminium Alloy

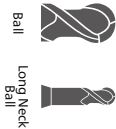
N

Copper

N

Resin

N



| Model                                                                                                       | Size        | Maximum Cutting Depth | Length of Cut | Coating | Number of Flute | Helix Angle    | Side Milling   | Slot Milling | Face Milling | 3D Milling                                                                                        | Work Material |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        | Number of Sizes | Page  |  |
|-------------------------------------------------------------------------------------------------------------|-------------|-----------------------|---------------|---------|-----------------|----------------|----------------|--------------|--------------|---------------------------------------------------------------------------------------------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|------------------------------------------------------------------------------------------------|-----------------------|--------------------------|----------------|--------|--------|-----------------|-------|--|
|                                                                                                             |             |                       |               |         |                 |                |                |              |              |                                                                                                   | P             | P           | P                 | M               | N               | N      | N     | N                                                                                              | S                     | H                        |                |        |        |                 |       |  |
|                                                                                                             |             |                       |               |         |                 |                |                |              |              |                                                                                                   | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite                                                                                       | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |        |        |                 |       |  |
|                                                                                                             |             |                       |               |         |                 |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          | 55 HRC         | 65 HRC | 70 HRC |                 |       |  |
| Long neck Square                                                                                            |             |                       |               |         |                 |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        |                 |       |  |
| <div>DCMS</div> <div></div> | φ 0.3 ~ φ 2 | 4D                    | 0.5D          | DIA     | <div>6</div>    | <div>8</div>   | <div>30°</div> | -            | -            | Face <div></div> | -             | -           | -                 | -               | -               | -      | -     | <div></div> | -                     | -                        | -              | -      | -      | 14              | O-004 |  |
|                                                                                                             |             |                       |               |         | <div>10</div>   |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        |                 |       |  |
| Square end mill for direct milling on cemented carbide, ceramic and glass                                   |             |                       |               |         |                 |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        |                 |       |  |
| Ball • Long Neck Ball                                                                                       |             |                       |               |         |                 |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        |                 |       |  |
| <div>DCMB</div> <div></div> | R0.1 ~ R1   | 2.5D                  | ≒0.7D         | DIA     | <div>2</div>    | <div>20°</div> | -              | -            | -            | 3D <div></div>   | -             | -           | -                 | -               | -               | -      | -     | <div></div> | -                     | -                        | -              | -      | -      | 12              | O-006 |  |
|                                                                                                             |             |                       |               |         |                 |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        |                 |       |  |
| Ball end mill for direct milling on cemented carbide, ceramic and glass                                     |             |                       |               |         |                 |                |                |              |              |                                                                                                   |               |             |                   |                 |                 |        |       |                                                                                                |                       |                          |                |        |        |                 |       |  |

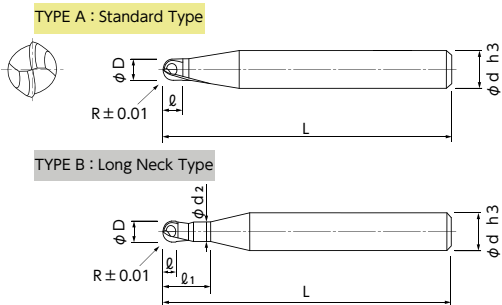




Ball End Mill for Hard Brittle Material

Recommended Milling Conditions

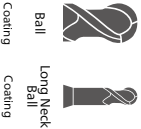
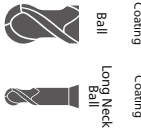
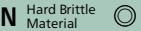
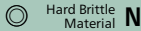
Ball end mill for direct milling on cemented carbide, ceramic and glass



- Spiral ball shape with balanced strength and sharpness of cutting edges adopted newly-developed DIAMOND COATING with enhanced sticking force.

[Neck Profile]

Reference value of interference angle after length of cut is 12°. Actual measurement required, in order to avoid interference between tool and work material.



| Unit : mm      |            |                                     |                   |      |                             |                |                    |
|----------------|------------|-------------------------------------|-------------------|------|-----------------------------|----------------|--------------------|
| Code No.       | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Type | Neck Dia. (d <sub>2</sub> ) | Shank Dia. (d) | Overall Length (L) |
| 05-00500-00100 | R0.1       | —                                   | 0.15              | A    | —                           | 4              | 45                 |
| 05-00500-00101 |            | 0.5                                 | 0.12              | B    | 0.18                        | 4              | 45                 |
| 05-00500-00200 | R0.2       | —                                   | 0.3               | A    | —                           | 4              | 45                 |
| 05-00500-00201 |            | 1                                   | 0.25              | B    | 0.37                        | 4              | 45                 |
| 05-00500-00300 | R0.3       | —                                   | 0.45              | A    | —                           | 4              | 45                 |
| 05-00500-00301 |            | 1.5                                 | 0.35              | B    | 0.56                        | 4              | 45                 |
| 05-00500-00500 | R0.5       | —                                   | 0.75              | A    | —                           | 4              | 45                 |
| 05-00500-00501 |            | 2.5                                 | 0.6               | B    | 0.95                        | 4              | 45                 |
| 05-00500-00750 | R0.75      | —                                   | 1.1               | A    | —                           | 4              | 45                 |
| 05-00500-00751 |            | 3.8                                 | 0.9               | B    | 1.45                        | 4              | 45                 |
| 05-00500-01000 | R1         | —                                   | 1.5               | A    | —                           | 4              | 45                 |
| 05-00500-01001 |            | 5                                   | 1.2               | B    | 1.94                        | 4              | 45                 |

How to Order

When you order, indicate DCMB (R) [×(ℓ<sub>1</sub>)].

Machining Case 1

Work Material : Cemented Carbide (89HRA)

Tool size : DCMB R1



Work size : 20×20×10mm

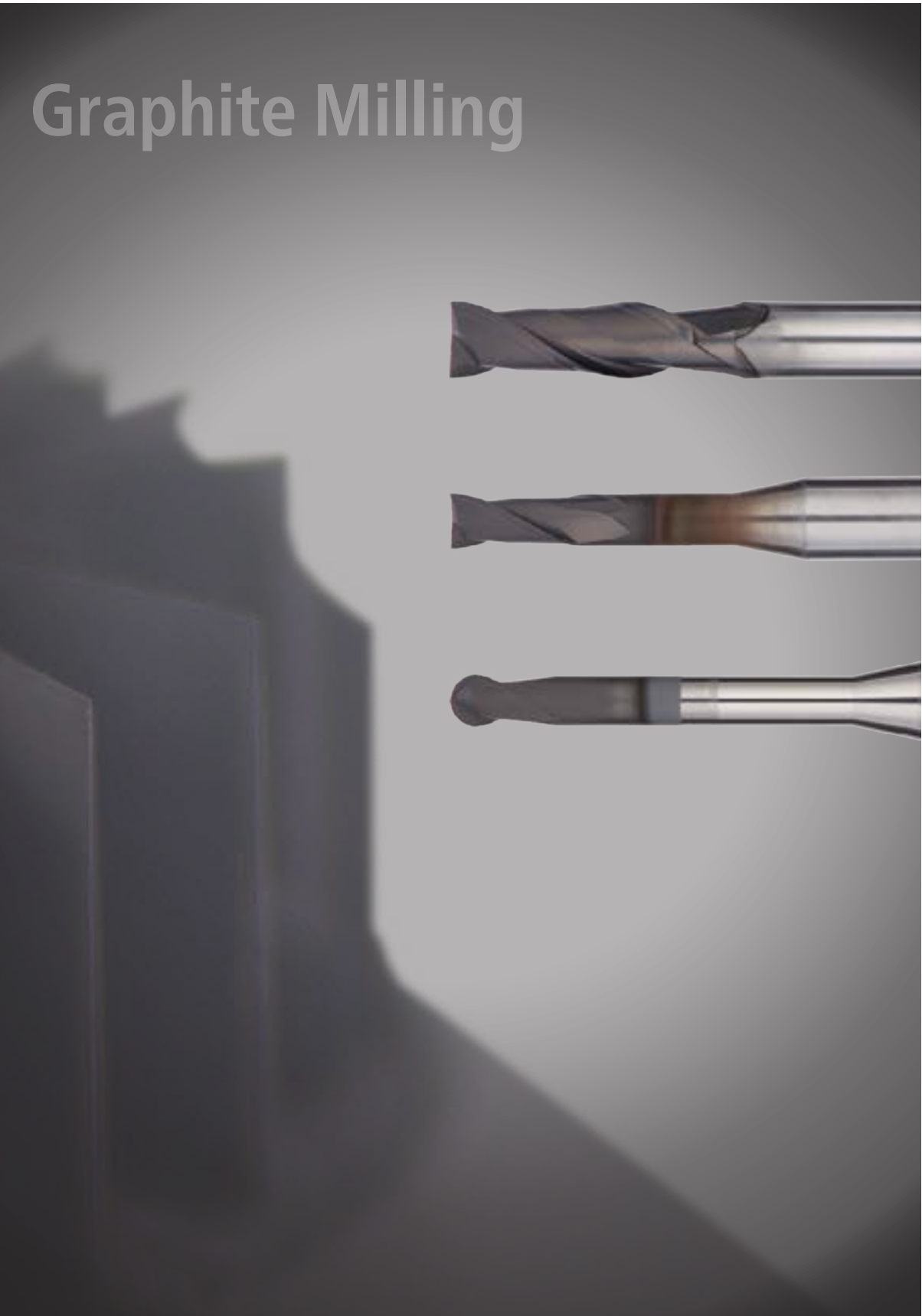
Finishing

|                |                         |
|----------------|-------------------------|
| Spindle speed  | 20,000min <sup>-1</sup> |
| Feed           | 200mm/min               |
| Depth of cut   | 0.005mm×0.01mm (ap×ae)  |
| Machining time | 3hr 55min               |
| Coolant        | Oil mist                |

Surface roughness (R<sub>z</sub>) : 0.51 μm~1.04 μm

| Work Material |                   | Cemented Carbide                                                                                                                                                                                                                                                                                                                                                                                                                     |        |              |       |
|---------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|-------|
| (R) Radius    | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                        | Feed   | Depth of Cut |       |
|               |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                    | mm/min | ap mm        | ae mm |
| R0.1          | —                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 100    | 0.004        | 0.004 |
|               | 0.5               | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 30     | 0.002        | 0.003 |
| R0.2          | —                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 150    | 0.008        | 0.03  |
|               | 1                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 100    | 0.006        | 0.025 |
| R0.3          | —                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 200    | 0.01         | 0.05  |
|               | 1.5               | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 200    | 0.01         | 0.05  |
| R0.5          | —                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.02         | 0.10  |
|               | 2.5               | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.02         | 0.10  |
| R0.75         | —                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.03         | 0.15  |
|               | 3.8               | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.03         | 0.15  |
| R1            | —                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.04         | 0.15  |
|               | 5                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                               | 300    | 0.04         | 0.15  |
| Notes         |                   | ※1 Follow the recommended milling conditions to prevent tool breakage and coating peeling.<br>※2 Minimal tool runout is required to avoid the tool breakage and to increase the work accuracy.<br>※3 Recommend to assess the machine characters, such as expansion of the spindle and others before using the tool.<br>※4 Accurate tool path for approach method, tolerance setting and etc. is required to reduce the cutting load. |        |              |       |

| Model                                                                                                  | Size                                                                               | Maximum Cutting Depth                                                            | Length of Cut | Coating | Number of Flute | Helix Angle | Side Milling | Slot Milling | Face Milling | 3D Milling | Work Material |             |                   |                 |                 |        |       |          |                       |                          |                | Number of Sizes | Page  |        |        |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------|---------|-----------------|-------------|--------------|--------------|--------------|------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|----------|-----------------------|--------------------------|----------------|-----------------|-------|--------|--------|
|                                                                                                        |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            | P             | P           | M                 | N               | N               | N      | N     | N        | S                     | H                        |                |                 |       |        |        |
|                                                                                                        |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |                 |       |        |        |
|                                                                                                        |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          | 55 HRC         |                 |       | 65 HRC | 70 HRC |
| Square                                                                                                 |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| DCSE235                                                                                                |    | φ0.5 ~ φ6                                                                        | 3D            | 3D      | DIA             | 2           | 35°          | Side         | Slot         | Face       | -             | -           | -                 | -               | -               | -      | -     | -        | -                     | -                        | 8              | P-004           |       |        |        |
| 2-flute with helix angle 35°end mill applied diamond coating suitable for graphite, composite material |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| Long Neck Square                                                                                       |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| DCHR230                                                                                                |                                                                                    |  | φ0.5 ~ φ6     | 13D     | 2D              | DIA         | 2            | 30°          | Side         | Slot       | Face          | -           | -                 | -               | -               | -      | -     | -        | -                     | -                        | -              | 19              | P-006 |        |        |
| Long neck square end mill with diamond coating suitable for graphite, composite material               |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| Long Neck Ball                                                                                         |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |
| DCRB230                                                                                                |  |                                                                                  | R0.2 ~ R3     | 20D     | 1D              | DIA         | 2            | 30°          | -            | -          | -             | 3D          | -                 | -               | -               | -      | -     | -        | -                     | -                        | -              | 25              | P-008 |        |        |
| Long neck ball end mill with diamond coating suitable for graphite, composite material                 |                                                                                    |                                                                                  |               |         |                 |             |              |              |              |            |               |             |                   |                 |                 |        |       |          |                       |                          |                |                 |       |        |        |

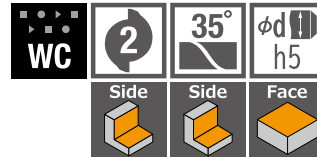




## DIAMOND COATING 2-Flute End Mill

## Recommended Milling Conditions

2-flute with helix angle 35° end mill applied diamond coating  
suitable for graphite, composite material

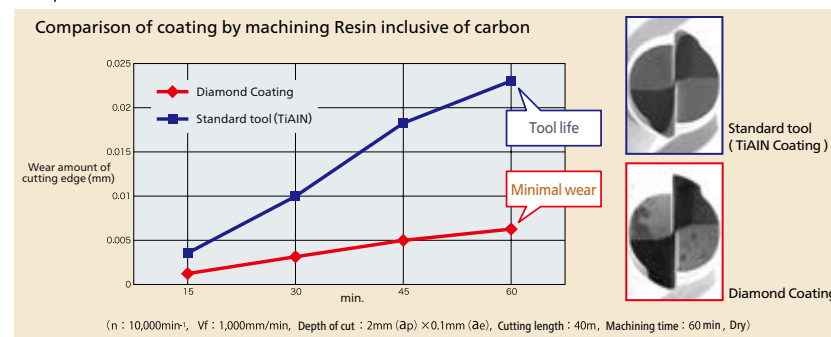


- Original DIAMOND COATING realized a long tool life for the machining of graphite, silicon-aluminum alloy and brittle materials.
- Square design of L/D=3 is suited for the machining of narrow and deep area.

| Unit : mm      |             |                      |                                  |                   |                       |
|----------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 05-00035-00050 | 0.5         | 1.5                  | 12°                              | 4                 | 45                    |
| 05-00035-00100 | 1           | 3                    | 12°                              | 4                 | 45                    |
| 05-00035-00150 | 1.5         | 4.5                  | 12°                              | 4                 | 45                    |
| 05-00035-00200 | 2           | 6                    | 12°                              | 4                 | 45                    |
| 05-00035-00300 | 3           | 9                    | 12°                              | 6                 | 45                    |
| 05-00035-00400 | 4           | 12                   | 12°                              | 6                 | 50                    |
| 05-00035-00500 | 5           | 15                   | 12°                              | 6                 | 55                    |
| 05-00035-00600 | 6           | 18                   | —                                | 6                 | 60                    |

**How to Order** When you order, indicate DCSE235 (D). ※(γ) is reference value.

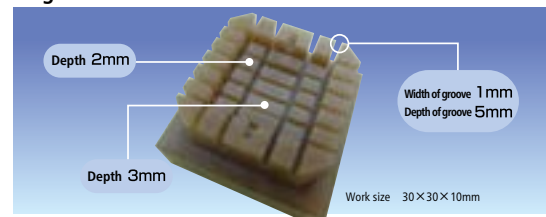
### Comparison of life



## Machining Case 1

**Work Material : Resin inclusive of glass fiber**

| Process        | Outer profile            | Slot                     |
|----------------|--------------------------|--------------------------|
| Tool           | DCSE235<br>ϕ6            | DCHR230<br>ϕ1×6          |
| Spindle speed  | 10,000 min <sup>-1</sup> | 10,000 min <sup>-1</sup> |
| Feed           | 2,000 mm/min             | 1,000 mm/min             |
| Depth of cut   | 10mm×0.5mm<br>( p× e)    | 0.1mm( p)                |
| Cutting length | 2.3m                     | 28m                      |
| Machining time | 3min                     | 50min                    |



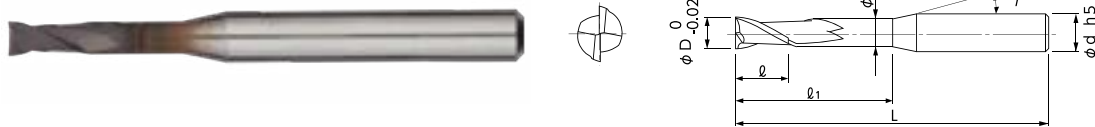
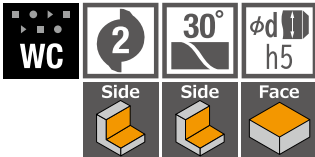
| Work Material | Graphite          |        |              |       |                   |        |              | Aluminium Alloy Die Casting |        |              |       |                   |        |              |
|---------------|-------------------|--------|--------------|-------|-------------------|--------|--------------|-----------------------------|--------|--------------|-------|-------------------|--------|--------------|
|               | Side Milling      |        |              |       | Slotting          |        |              | Side Milling                |        |              |       | Slotting          |        |              |
| Dia.          | Spindle Speed     | Feed   | Depth of Cut |       | Spindle Speed     | Feed   | Depth of Cut | Spindle Speed               | Feed   | Depth of Cut |       | Spindle Speed     | Feed   | Depth of Cut |
|               | min <sup>-1</sup> | mm/min | ap mm        | ae mm | min <sup>-1</sup> | mm/min | ap mm        | min <sup>-1</sup>           | mm/min | ap mm        | ae mm | min <sup>-1</sup> | mm/min | ap mm        |
| 0.5           | 30,000            | 1,000  | 1.5          | 0.03  | 30,000            | 800    | 0.05         | 20,000                      | 600    | 1.5          | 0.01  | 20,000            | 500    | 0.03         |
| 1             | 30,000            | 1,200  | 3            | 0.05  | 30,000            | 1,000  | 0.1          | 20,000                      | 1,000  | 3            | 0.02  | 20,000            | 800    | 0.1          |
| 1.5           | 25,000            | 1,500  | 4.5          | 0.07  | 25,000            | 1,200  | 0.2          | 20,000                      | 1,000  | 4.5          | 0.05  | 20,000            | 800    | 0.2          |
| 2             | 25,000            | 2,000  | 6            | 0.1   | 25,000            | 1,500  | 0.3          | 20,000                      | 1,500  | 6            | 0.07  | 20,000            | 1,200  | 0.3          |
| 3             | 20,000            | 2,500  | 9            | 0.1   | 20,000            | 1,500  | 0.4          | 20,000                      | 1,500  | 9            | 0.07  | 20,000            | 1,200  | 0.4          |
| 4             | 18,000            | 2,500  | 12           | 0.2   | 18,000            | 2,000  | 0.5          | 18,000                      | 2,000  | 12           | 0.15  | 18,000            | 1,500  | 0.5          |
| 5             | 14,000            | 3,000  | 15           | 0.2   | 14,000            | 2,000  | 0.7          | 14,000                      | 2,500  | 15           | 0.15  | 14,000            | 2,000  | 0.7          |
| 6             | 12,000            | 3,000  | 18           | 0.3   | 12,000            | 2,000  | 1            | 12,000                      | 2,500  | 18           | 0.2   | 12,000            | 2,000  | 1            |

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes | <p>※1 Graphite should be machined by the machining center designed for graphite machining.<br/>When handling with graphite material, dust collector and respirator are recommended to protect against graphite dust.</p> <p>※2 Air blow cooling is recommended for the machining of graphite.</p> <p>※3 Slow down the feed for high accurate machining to avoid breakage of work piece.</p> <p>※4 Adjust both spindle speed and feed at the same rate when chattering.</p> |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

DIAMOND COATING 2-Flute Long Neck End Mill

Recommended Milling Conditions

Long neck square end mill with diamond coating suitable for graphite and composite material



- Original DIAMOND COATING realized a long tool life for the machining of graphite, silicon-aluminium alloy and brittle materials.
- Long neck design is suited for the machining of narrow and deep area.

Unit : mm

| Code No.       | Dia. (D) | Under Neck Length (L1) | Length of Cut (L) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| 05-00200-00502 | 0.5      | 2                      | 1                 | 0.46           | 12°                  | 4              | 45                 |
| 05-00200-00504 |          | 4                      | 1                 | 0.46           | 12°                  | 4              | 45                 |
| 05-00200-00506 |          | 6                      | 1                 | 0.46           | 12°                  | 4              | 45                 |
| 05-00200-01004 | 1        | 4                      | 2                 | 0.95           | 12°                  | 4              | 50                 |
| 05-00200-01006 |          | 6                      | 2                 | 0.95           | 12°                  | 4              | 50                 |
| 05-00200-01008 |          | 8                      | 2                 | 0.95           | 12°                  | 4              | 50                 |
| 05-00200-01010 |          | 10                     | 2                 | 0.95           | 12°                  | 4              | 50                 |
| 05-00200-01506 | 1.5      | 6                      | 3                 | 1.45           | 12°                  | 4              | 50                 |
| 05-00200-01512 |          | 12                     | 3                 | 1.45           | 12°                  | 4              | 50                 |
| 05-00200-01520 |          | 20                     | 3                 | 1.45           | 12°                  | 4              | 60                 |
| 05-00200-02006 | 2        | 6                      | 4                 | 1.94           | 12°                  | 4              | 50                 |
| 05-00200-02010 |          | 10                     | 4                 | 1.94           | 12°                  | 4              | 50                 |
| 05-00200-02016 |          | 16                     | 4                 | 1.94           | 12°                  | 4              | 60                 |
| 05-00200-02020 |          | 20                     | 4                 | 1.94           | 12°                  | 4              | 60                 |
| 05-00200-03016 | 3        | 16                     | 6                 | 2.85           | 12°                  | 6              | 60                 |
| 05-00200-03030 |          | 30                     | 6                 | 2.85           | 12°                  | 6              | 70                 |
| 05-00200-04020 | 4        | 20                     | 8                 | 3.8            | 12°                  | 6              | 60                 |
| 05-00200-04040 |          | 40                     | 8                 | 3.8            | 12°                  | 6              | 90                 |
| 05-00200-06030 | 6        | 30                     | 12                | 5.8            | —                    | 6              | 90                 |

**How to Order** When you order, indicate DCHR230 (D)×(L1). ※(γ) is reference value.

**Machining case** W-027

Machining Case 1



propeller

- Work Material : Graphite (TTK-5)
- Total machining time : 1hr 20min
- Coolant : Air blow
- Work Size :  $\phi$  14mm  
(Height of blade : 6mm)

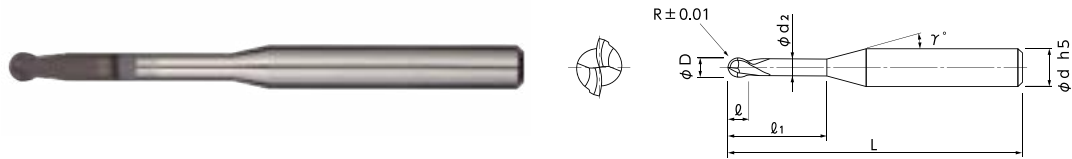
| Process                            | Roughing<br>(Cylinder) | Roughing               | Semi-finishing | Finishing |
|------------------------------------|------------------------|------------------------|----------------|-----------|
| Tool                               | DCSE235<br>$\phi$ 6    | DCHR230<br>$\phi$ 1x10 |                |           |
| Spindle speed [min <sup>-1</sup> ] | 8,000                  | 20,000                 |                |           |
| Feed[mm/min]                       | 600                    | 2,000                  | 1,000          | 800       |
| Depth of cut $a_p \times a_e$ [mm] | 8x0.5                  | 0.2x0.6                | 0.05x0.2       |           |
| Machining length [m]               | 7                      | 67                     |                | 18        |
| Machining time                     | 5min                   | 1hr 5min               |                | 10min     |

| Work Material |                   | Graphite                                                                                                              |        |              |          |                   |        |              | Aluminium Alloy Die Casting |        |              |               |                   |              |          |
|---------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|--------|--------------|----------|-------------------|--------|--------------|-----------------------------|--------|--------------|---------------|-------------------|--------------|----------|
|               |                   | Contour Line Roughing                                                                                                 |        |              | Slotting |                   |        |              | Contour Line Roughing       |        |              | Slotting      |                   |              |          |
| Dia.          | Under Neck Length | Spindle Speed                                                                                                         | Feed   | Depth of Cut |          | Spindle Speed     | Feed   | Depth of Cut | Spindle Speed               | Feed   | Depth of Cut | Spindle Speed | Feed              | Depth of Cut |          |
|               |                   | min <sup>-1</sup>                                                                                                     | mm/min | $a_p$ mm     | $a_e$ mm | min <sup>-1</sup> | mm/min | $a_p$ mm     | min <sup>-1</sup>           | mm/min | $a_p$ mm     | $a_e$ mm      | min <sup>-1</sup> | mm/min       | $a_p$ mm |
| 0.5           | 2                 | 30,000                                                                                                                | 1,200  | 0.1          | 0.3      | 30,000            | 800    | 0.1          | 20,000                      | 1,000  | 0.03         | 0.3           | 20,000            | 500          | 0.03     |
|               | 4                 | 30,000                                                                                                                | 1,000  | 0.05         | 0.3      | 30,000            | 600    | 0.05         | 20,000                      | 800    | 0.01         | 0.3           | 20,000            | 400          | 0.01     |
|               | 6                 | 25,000                                                                                                                | 800    | 0.03         | 0.3      | 25,000            | 500    | 0.03         | 20,000                      | 600    | 0.01         | 0.3           | 20,000            | 300          | 0.01     |
| 1             | 4                 | 30,000                                                                                                                | 2,500  | 0.2          | 0.6      | 30,000            | 1,500  | 0.2          | 20,000                      | 2,000  | 0.15         | 0.6           | 20,000            | 1,200        | 0.15     |
|               | 6                 | 25,000                                                                                                                | 2,000  | 0.2          | 0.6      | 25,000            | 1,200  | 0.2          | 20,000                      | 1,500  | 0.1          | 0.6           | 20,000            | 1,000        | 0.1      |
|               | 8                 | 20,000                                                                                                                | 1,500  | 0.1          | 0.6      | 20,000            | 1,000  | 0.1          | 20,000                      | 1,000  | 0.07         | 0.6           | 20,000            | 700          | 0.07     |
|               | 10                | 20,000                                                                                                                | 1,000  | 0.1          | 0.6      | 20,000            | 600    | 0.1          | 20,000                      | 800    | 0.05         | 0.6           | 20,000            | 500          | 0.05     |
| 1.5           | 6                 | 25,000                                                                                                                | 2,500  | 0.3          | 1        | 25,000            | 1,600  | 0.3          | 20,000                      | 2,000  | 0.2          | 1             | 20,000            | 1,500        | 0.2      |
|               | 12                | 16,000                                                                                                                | 1,800  | 0.2          | 1        | 16,000            | 1,000  | 0.2          | 16,000                      | 1,500  | 0.05         | 1             | 16,000            | 1,000        | 0.05     |
|               | 20                | 12,000                                                                                                                | 1,000  | 0.1          | 1        | 12,000            | 600    | 0.1          | 12,000                      | 800    | 0.02         | 1             | 12,000            | 500          | 0.02     |
| 2             | 6                 | 20,000                                                                                                                | 3,000  | 0.5          | 1.2      | 20,000            | 2,000  | 0.5          | 20,000                      | 2,000  | 0.5          | 1.2           | 20,000            | 1,500        | 0.5      |
|               | 10                | 20,000                                                                                                                | 2,500  | 0.5          | 1.2      | 20,000            | 1,600  | 0.5          | 20,000                      | 1,500  | 0.3          | 1.2           | 20,000            | 1,000        | 0.3      |
|               | 16                | 18,000                                                                                                                | 1,800  | 0.3          | 1.2      | 18,000            | 1,200  | 0.3          | 15,000                      | 1,200  | 0.07         | 1.2           | 15,000            | 800          | 0.07     |
|               | 20                | 15,000                                                                                                                | 1,200  | 0.2          | 1.2      | 15,000            | 800    | 0.2          | 10,000                      | 1,000  | 0.03         | 1.2           | 10,000            | 600          | 0.03     |
| 3             | 16                | 20,000                                                                                                                | 3,000  | 0.5          | 2        | 20,000            | 2,000  | 0.5          | 18,000                      | 2,000  | 0.5          | 2             | 18,000            | 1,500        | 0.5      |
|               | 30                | 15,000                                                                                                                | 1,500  | 0.3          | 2        | 15,000            | 1,000  | 0.3          | 10,000                      | 1,000  | 0.2          | 2             | 10,000            | 600          | 0.2      |
| 4             | 20                | 18,000                                                                                                                | 3,000  | 0.8          | 2.5      | 18,000            | 2,000  | 0.8          | 16,000                      | 2,000  | 0.8          | 2.5           | 16,000            | 1,500        | 0.8      |
|               | 40                | 9,000                                                                                                                 | 1,500  | 0.4          | 2.5      | 9,000             | 1,000  | 0.4          | 8,000                       | 1,000  | 0.4          | 2.5           | 8,000             | 600          | 0.4      |
| 6             | 30                | 16,000                                                                                                                | 3,000  | 1            | 4        | 16,000            | 2,000  | 1            | 12,000                      | 2,000  | 1            | 4             | 12,000            | 1,500        | 1        |
| Notes         |                   | ※1 Graphite should be machined by the machining center designed for graphite machining.                               |        |              |          |                   |        |              |                             |        |              |               |                   |              |          |
|               |                   | When handling with graphite material, dust collector and respirator are recommended to protect against graphite dust. |        |              |          |                   |        |              |                             |        |              |               |                   |              |          |
|               |                   | ※2 Air blow cooling is recommended for the machining of graphite.                                                     |        |              |          |                   |        |              |                             |        |              |               |                   |              |          |
|               |                   | ※3 Slow down the feed for high accurate machining to avoid breakage of work piece.                                    |        |              |          |                   |        |              |                             |        |              |               |                   |              |          |
|               |                   | ※4 Adjust both spindle speed and feed at the same rate when chattering.                                               |        |              |          |                   |        |              |                             |        |              |               |                   |              |          |

DIAMOND COATING 2-Flute Long Neck Ball End Mill

Recommended Milling Conditions

Long neck ball end mill with diamond coating suitable for graphite and composite material



- Original DIAMOND COATING realized a long tool life for the machining of graphite, silicon-aluminium alloy and brittle materials.
- Long neck design is suited for the machining of narrow and deep area.

Unit : mm

| Code No.       | Radius (R) | Under Neck Length (L1) | Length of Cut (L) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| 05-00520-00201 | R0.2       | 1                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 |
| 05-00520-00202 |            | 2                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 |
| 05-00520-00204 |            | 4                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 |
| 05-00520-00206 |            | 6                      | 0.3               | 0.4      | 0.37           | 12°                  | 4              | 45                 |
| 05-00520-00303 | R0.3       | 3                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 |
| 05-00520-00306 |            | 6                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 |
| 05-00520-00309 |            | 9                      | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 |
| 05-00520-00312 |            | 12                     | 0.45              | 0.6      | 0.56           | 12°                  | 4              | 45                 |
| 05-00520-00504 | R0.5       | 4                      | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 |
| 05-00520-00506 |            | 6                      | 0.75              | 1        | 0.95           | 12°                  | 4              | 45                 |
| 05-00520-00510 |            | 10                     | 0.75              | 1        | 0.95           | 12°                  | 4              | 50                 |
| 05-00520-00516 |            | 16                     | 0.75              | 1        | 0.95           | 12°                  | 4              | 50                 |
| 05-00520-00520 | R1         | 20                     | 0.75              | 1        | 0.95           | 12°                  | 4              | 55                 |
| 05-00520-01006 |            | 6                      | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 |
| 05-00520-01010 |            | 10                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 45                 |
| 05-00520-01016 |            | 16                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 50                 |
| 05-00520-01020 |            | 20                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 70                 |
| 05-00520-01030 | R1.5       | 30                     | 1.5               | 2        | 1.94           | 12°                  | 4              | 70                 |
| 05-00520-01520 |            | 20                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 65                 |
| 05-00520-01540 | R2         | 40                     | 2.5               | 3        | 2.85           | 12°                  | 6              | 90                 |
| 05-00520-02015 |            | 15                     | 3                 | 4        | 3.8            | 12°                  | 6              | 65                 |
| 05-00520-02030 |            | 30                     | 3                 | 4        | 3.8            | 12°                  | 6              | 70                 |
| 05-00520-02040 | R3         | 40                     | 3                 | 4        | 3.8            | 12°                  | 6              | 90                 |
| 05-00520-03030 |            | 30                     | 6                 | 6        | 5.8            | —                    | 6              | 80                 |
| 05-00520-03060 |            | 60                     | 6                 | 6        | 5.8            | —                    | 6              | 120                |

How to Order

When you order, indicate DCRB230 (R)x(L1). ※(γ) is reference value.

| Work Material |                   | Graphite                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                   |                   | Aluminium Alloy Die Casting |        |                   |                   |
|---------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|-------------------|-----------------------------|--------|-------------------|-------------------|
| Radius        | Under Neck Length | Spindle Speed                                                                                                                                                                                                                                                                                                                                                                                                                                           | Feed   | Depth of Cut      |                   | Spindle Speed               | Feed   | Depth of Cut      |                   |
|               |                   | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                       | mm/min | a <sub>p</sub> mm | a <sub>e</sub> mm | min <sup>-1</sup>           | mm/min | a <sub>p</sub> mm | a <sub>e</sub> mm |
| 0.2           | 1                 | 40,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,500  | 0.08              | 0.1               | 20,000                      | 800    | 0.05              | 0.08              |
|               | 2                 | 40,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,200  | 0.05              | 0.1               | 20,000                      | 600    | 0.02              | 0.05              |
|               | 4                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 0.05              | 0.1               | 20,000                      | 200    | 0.01              | 0.02              |
|               | 6                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 800    | 0.03              | 0.1               | 20,000                      | 120    | 0.01              | 0.01              |
| 0.3           | 3                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,500  | 0.1               | 0.2               | 20,000                      | 1,000  | 0.05              | 0.1               |
|               | 6                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,200  | 0.08              | 0.2               | 20,000                      | 600    | 0.03              | 0.05              |
|               | 9                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 0.07              | 0.15              | 18,000                      | 400    | 0.01              | 0.02              |
|               | 12                | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 800    | 0.05              | 0.1               | 15,000                      | 200    | 0.01              | 0.01              |
| 0.5           | 4                 | 30,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,500  | 0.2               | 0.3               | 20,000                      | 2,000  | 0.2               | 0.3               |
|               | 6                 | 25,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,000  | 0.15              | 0.3               | 20,000                      | 1,500  | 0.1               | 0.3               |
|               | 10                | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,800  | 0.1               | 0.3               | 15,000                      | 800    | 0.05              | 0.1               |
|               | 16                | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,200  | 0.08              | 0.2               | 12,000                      | 500    | 0.03              | 0.08              |
|               | 20                | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 0.07              | 0.2               | 8,000                       | 300    | 0.02              | 0.05              |
| 1             | 6                 | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3,000  | 0.5               | 0.6               | 20,000                      | 2,000  | 0.3               | 0.6               |
|               | 10                | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,500  | 0.3               | 0.6               | 20,000                      | 1,500  | 0.3               | 0.6               |
|               | 16                | 18,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,000  | 0.2               | 0.6               | 15,000                      | 1,200  | 0.2               | 0.5               |
|               | 20                | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,500  | 0.2               | 0.5               | 10,000                      | 1,000  | 0.1               | 0.2               |
|               | 30                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,000  | 0.2               | 0.5               | 8,000                       | 500    | 0.05              | 0.1               |
| 1.5           | 20                | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,500  | 0.5               | 1                 | 15,000                      | 1,500  | 0.5               | 1                 |
|               | 40                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,400  | 0.3               | 0.7               | 7,000                       | 600    | 0.1               | 0.3               |
| 2             | 15                | 20,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3,000  | 0.5               | 1.5               | 16,000                      | 2,000  | 0.5               | 1.5               |
|               | 30                | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,500  | 0.5               | 1.5               | 12,000                      | 1,500  | 0.5               | 1.2               |
| 3             | 40                | 12,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2,000  | 0.3               | 1                 | 8,000                       | 1,000  | 0.2               | 0.7               |
|               | 30                | 16,000                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3,000  | 0.6               | 2                 | 12,000                      | 2,000  | 0.6               | 2                 |
|               | 60                | 8,000                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2,000  | 0.4               | 2                 | 7,000                       | 1,000  | 0.3               | 1                 |
| Notes         |                   | ※1 Graphite should be machined by the machining center designed for graphite machining.<br>When handling with graphite material, dust collector and respirator are recommended to protect against graphite dust.<br>※2 Air blow cooling is recommended for the machining of graphite.<br>※3 Reduce the feed for high accurate machining and to avoid breakage of work piece.<br>※4 Adjust both spindle speed and feed at the same rate when chattering. |        |                   |                   |                             |        |                   |                   |

Drill

Standard lineup from  $\phi$  0.01

| Model | Size | Flute Length | Point Angle | Coating | Work Material |             |                   |                 |                 |        |       |          |                       |                          |                |  |  | Number of Sizes | Page |  |  |
|-------|------|--------------|-------------|---------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|----------|-----------------------|--------------------------|----------------|--|--|-----------------|------|--|--|
|       |      |              |             |         | P             | P           | P                 | M               | N               | N      | N     | N        | S                     | H                        |                |  |  |                 |      |  |  |
|       |      |              |             |         | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |
|       |      |              |             |         |               |             |                   |                 |                 |        |       |          |                       |                          |                |  |  |                 |      |  |  |

Drill

Standard lineup from  $\phi$  0.01

| Model                                                                                      | Size      | Flute Length | Point Angle | Coating                                                                             | Work Material                                                                       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     | Number of Sizes                                                                     | Page |       |  |
|--------------------------------------------------------------------------------------------|-----------|--------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------|-------|--|
|                                                                                            |           |              |             |                                                                                     | P                                                                                   | P                                                                                   | P                                                                                   | M                                                                                   | N                                                                                   | N                                                                                   | N                                                                                   | N                                                                                   | S                                                                                   | H                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |      |       |  |
|                                                                                            |           |              |             |                                                                                     | Carbon Steel                                                                        | Alloy Steel                                                                         | Prehardened Steel                                                                   | Stainless Steel                                                                     | Aluminium Alloy                                                                     | Copper                                                                              | Resin                                                                               | Graphite                                                                            | Hard Brittle Material                                                               | Heat Resistant Alloy etc                                                            | Hardened Steel                                                                      |                                                                                     |                                                                                     |                                                                                     |      |       |  |
|                                                                                            |           |              |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |      |       |  |
| Drill                                                                                      |           |              |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |      |       |  |
|  MDR-R  | φ0.1 ~ φ1 | 10D          | 120°        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 91   | Q-020 |  |
| Miniature pivot drill. Maximum flute length is L/D=10                                      |           |              |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |      |       |  |
|  MDR-PD | φ0.1 ~ φ1 | 2D           | 120°        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 10   | Q-024 |  |
| Miniature point drill for aiming at guide hole which brings stable drilling                |           |              |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |      |       |  |
|  MSDH  | φ0.1 ~ φ1 | 10D          | 150°        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 19   | Q-026 |  |
| Available for drilling on hardened steel which has 65HRC                                   |           |              |             |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |      |       |  |



Drill



Carbon Steel

P

Alloy Steel

P

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

N

Copper

N

Carbon Steel

P

Alloy Steel

P

Prehardened Steel

P

Stainless Steel

M

Aluminium Alloy

N

Copper

N

| Work Material | Carbon Steels S50C |        |                     | Alloy Steels SCM440 |        |                     | Stainless Steels SUS304 |        |                     | Aluminium Alloy A5052 |        |                     | Aluminium Alloy Die Casting ADC |        |                     |
|---------------|--------------------|--------|---------------------|---------------------|--------|---------------------|-------------------------|--------|---------------------|-----------------------|--------|---------------------|---------------------------------|--------|---------------------|
| Dia.          | Spindle Speed      | Feed   | Feed per Revolution | Spindle Speed       | Feed   | Feed per Revolution | Spindle Speed           | Feed   | Feed per Revolution | Spindle Speed         | Feed   | Feed per Revolution | Spindle Speed                   | Feed   | Feed per Revolution |
|               | mim <sup>-1</sup>  | mm/min | mm/rev              | mim <sup>-1</sup>   | mm/min | mm/rev              | mim <sup>-1</sup>       | mm/min | mm/rev              | mim <sup>-1</sup>     | mm/min | mm/rev              | mim <sup>-1</sup>               | mm/min | mm/rev              |
| 0.1           | 36,000             | 15     | 0.0004              | 34,000              | 10     | 0.0003              | 20,000                  | 5      | 0.0003              | 40,000                | 45     | 0.0011              | 40,000                          | 35     | 0.0009              |
| 0.2           | 32,000             | 30     | 0.0009              | 30,000              | 20     | 0.0007              | 17,000                  | 10     | 0.0006              | 36,000                | 90     | 0.0025              | 36,000                          | 70     | 0.0019              |
| 0.3           | 30,000             | 60     | 0.002               | 28,000              | 40     | 0.0014              | 15,000                  | 15     | 0.001               | 34,000                | 140    | 0.0041              | 34,000                          | 110    | 0.0032              |
| 0.4           | 28,000             | 90     | 0.0032              | 26,000              | 60     | 0.0023              | 13,000                  | 15     | 0.0012              | 32,000                | 180    | 0.0056              | 32,000                          | 140    | 0.0044              |
| 0.5           | 26,000             | 120    | 0.0046              | 24,000              | 85     | 0.0035              | 11,000                  | 20     | 0.0018              | 30,000                | 210    | 0.007               | 30,000                          | 170    | 0.0057              |
| 0.6           | 24,000             | 140    | 0.0058              | 22,000              | 100    | 0.0045              | 10,000                  | 20     | 0.002               | 28,000                | 240    | 0.0086              | 28,000                          | 190    | 0.0068              |
| 0.7           | 22,000             | 160    | 0.0073              | 21,000              | 120    | 0.0057              | 9,000                   | 25     | 0.0028              | 26,000                | 260    | 0.01                | 26,000                          | 210    | 0.0081              |
| 0.8           | 21,000             | 180    | 0.0086              | 20,000              | 140    | 0.007               | 8,000                   | 25     | 0.0031              | 24,000                | 280    | 0.0117              | 24,000                          | 220    | 0.0092              |
| 0.9           | 20,000             | 200    | 0.01                | 19,000              | 160    | 0.0084              | 7,000                   | 30     | 0.0043              | 22,000                | 300    | 0.0136              | 22,000                          | 240    | 0.0109              |
| 1             | 19,000             | 250    | 0.013               | 18,000              | 180    | 0.01                | 6,500                   | 35     | 0.005               | 20,000                | 360    | 0.018               | 20,000                          | 300    | 0.015               |
| 2             | 10,500             | 370    | 0.035               | 10,000              | 200    | 0.02                | 3,600                   | 35     | 0.01                | 20,000                | 720    | 0.036               | 20,000                          | 600    | 0.03                |
| 3             | 8,000              | 430    | 0.054               | 6,800               | 300    | 0.044               | 2,500                   | 40     | 0.016               | 15,000                | 1,000  | 0.067               | 13,000                          | 760    | 0.058               |
| 4             | 6,000              | 430    | 0.072               | 5,200               | 320    | 0.062               | 2,400                   | 60     | 0.025               | 11,000                | 1,000  | 0.091               | 10,000                          | 760    | 0.076               |
| 5             | 4,800              | 430    | 0.09                | 4,200               | 320    | 0.076               | 1,900                   | 60     | 0.032               | 9,000                 | 1,000  | 0.111               | 8,000                           | 760    | 0.095               |
| 6             | 4,000              | 430    | 0.108               | 3,600               | 320    | 0.089               | 1,600                   | 80     | 0.05                | 7,500                 | 1,000  | 0.133               | 6,600                           | 760    | 0.115               |

Notes

※1 Recommend drilling depth is 2D.

※2 Coolant must supply correctly to the point of drilling or flute.

※3 Adjust drilling condition conforming to machine rigidity, holder rigidity and clamping condition.

※4 Refer below table for recommended drilling condition in case of drilling on curved surface, inclined surface or semicircular hole.

※5 Minimize chucking runout.

※6 When chip can not be disposed, apply step feed.

※7 Water soluble fluid is recommended.

Recommended Drilling Conditions Depending on Work Shape

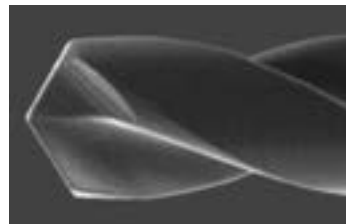
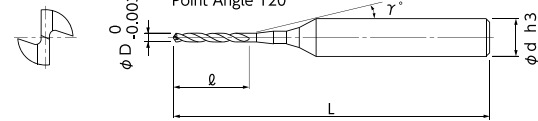
| Slope<br>(Inclination angle 30° lower) |      | Slope<br>(Inclination angle 30° over) |               | Curved Surface |        | Semicircular Hole |          |               |      |
|----------------------------------------|------|---------------------------------------|---------------|----------------|--------|-------------------|----------|---------------|------|
|                                        |      |                                       |               |                |        |                   |          |               |      |
| Dia.                                   | Feed | Dia.                                  | Spindle Speed | Feed           | Dia.   | Feed              | Dia.     | Spindle Speed | Feed |
| φ0.1~4.5                               | 70%  | φ0.1~4.5                              | 80%           | 50%            | φ0.1~6 | 90%               | φ0.1~4.5 | 80%           | 40%  |
| φ4.6~6                                 | 40%  | φ4.6~6                                | 80%           | 30%            |        |                   | φ4.6~6   | 80%           | 30%  |



## MUGEN MICRO COATING Micro Drill Short

## Recommended Milling Conditions

Coated micro drill Dia.0.1mm or smaller to drill hole depth L/D=6



- L/D=6 short type.
- Special thin film coating for Micro Drill exercise high drilling performance on steels include stainless steels.
- Thinning on the cutting edge to reduce cutting load for accurate drilling. (Dia. 0.02~)

| Work Material | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                                    |        |           | Aluminium Alloy<br>A5052 |        |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|--------------------------|--------|-----------|
| Dia.          | Spindle Speed                                                                                                                                                                                                                                                                                                                 | Feed   | Step Feed | Spindle Speed            | Feed   | Step Feed |
|               | mim <sup>-1</sup>                                                                                                                                                                                                                                                                                                             | mm/min | μm        | mim <sup>-1</sup>        | mm/min | μm        |
| 0.01          | 20,000                                                                                                                                                                                                                                                                                                                        | 1      | 0.1       | 30,000                   | 2      | 0.5       |
| 0.03          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 0.5       | 30,000                   | 3      | 1.5       |
| 0.05          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 3         | 30,000                   | 4      | 5         |
| Notes         | ※1 Use appropriate coolant for work material and machining description.<br>※2 Minimize chucking runout by setting spindle speed at minimum oscillation.<br>(Recommend to measure actual runout at activated Spindle Speed.)<br>※3 Set up flat surface before start machining.<br>※4 Take extra care when chucking in and out. |        |           |                          |        |           |

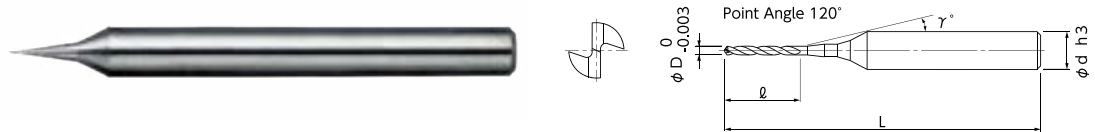
Unit : mm

| Code No.       | Dia.<br>(D) | Flute Length<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|---------------------|-------------------------|-------------------|-----------------------|
| 04-00006-00100 | 0.01        | 0.06                | 15°                     | 4                 | 40                    |
| 04-00006-00150 | 0.015       | 0.09                | 15°                     | 4                 | 40                    |
| 04-00006-00200 | 0.02        | 0.12                | 15°                     | 4                 | 40                    |
| 04-00006-00250 | 0.025       | 0.15                | 15°                     | 4                 | 40                    |
| 04-00006-00300 | 0.03        | 0.18                | 15°                     | 4                 | 40                    |
| 04-00006-00350 | 0.035       | 0.24                | 15°                     | 4                 | 40                    |
| 04-00006-00400 | 0.04        | 0.24                | 15°                     | 4                 | 40                    |
| 04-00006-00450 | 0.045       | 0.3                 | 15°                     | 4                 | 40                    |
| 04-00006-00500 | 0.05        | 0.3                 | 15°                     | 4                 | 40                    |

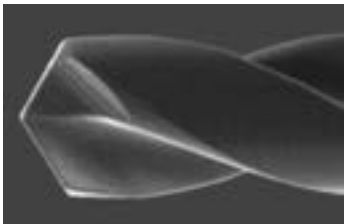
## How to Order

When you order, indicate NSMD-MS (D). ※(γ) is reference value.

Micro drill Dia.0.1mm or smaller to drill hole depth L/D=6



- L/D=6 short type, realized stable drilling.
- Thinning on the cutting edge to reduce cutting load for accurate drilling. (Dia. 0.02~)



NSMD-S  $\phi$ 0.03

| Work Material | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                                    |        |           | Aluminium Alloy<br>A5052 |        |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|--------------------------|--------|-----------|
|               | Spindle Speed                                                                                                                                                                                                                                                                                                                 | Feed   | Step Feed | Spindle Speed            | Feed   | Step Feed |
| Dia.          | mim <sup>-1</sup>                                                                                                                                                                                                                                                                                                             | mm/min | μm        | mim <sup>-1</sup>        | mm/min | μm        |
| 0.01          | 20,000                                                                                                                                                                                                                                                                                                                        | 1      | 0.1       | 30,000                   | 2      | 0.5       |
| 0.03          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 0.5       | 30,000                   | 3      | 1.5       |
| 0.05          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 3         | 30,000                   | 4      | 5         |
| Notes         | ※1 Use appropriate coolant for work material and machining description.<br>※2 Minimize chucking runout by setting spindle speed at minimum oscillation.<br>(Recommend to measure actual runout at activated Spindle Speed.)<br>※3 Set up flat surface before start machining.<br>※4 Take extra care when chucking in and out. |        |           |                          |        |           |

Unit : mm

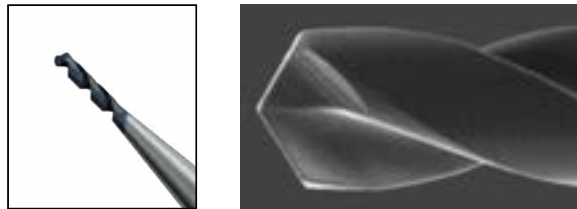
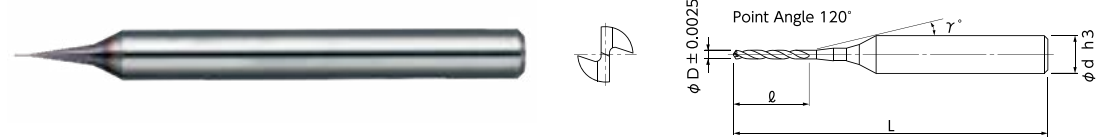
| Code No.       | Dia.<br>(D) | Flute Length<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|---------------------|-------------------------|-------------------|-----------------------|
| 04-00005-00100 | 0.01        | 0.06                | 15°                     | 4                 | 40                    |
| 04-00005-00150 | 0.015       | 0.09                | 15°                     | 4                 | 40                    |
| 04-00005-00200 | 0.02        | 0.12                | 15°                     | 4                 | 40                    |
| 04-00005-00250 | 0.025       | 0.15                | 15°                     | 4                 | 40                    |
| 04-00005-00300 | 0.03        | 0.18                | 15°                     | 4                 | 40                    |
| 04-00005-00400 | 0.04        | 0.24                | 15°                     | 4                 | 40                    |
| 04-00005-00500 | 0.05        | 0.3                 | 15°                     | 4                 | 40                    |

**How to Order** When you order, indicate NSMD-S (D). ※( γ ) is reference value.

## MUGEN MICRO COATING Micro Drill

## Recommended Milling Conditions

Coated micro drill Dia.0.1mm or smaller to drill hole depth  $L/D=10$

NSMD-M  $\phi 0.03$ 

- L/D=10 standard type.
- Special thin film coating for Micro Drill exercise high drilling performance on steels include stainless steels.
- Thinning on the cutting edge to reduce cutting load for accurate drilling. (Dia. 0.02~)

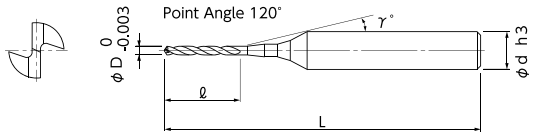
| Unit : mm      |             |                     |                                  |                   |                       |
|----------------|-------------|---------------------|----------------------------------|-------------------|-----------------------|
| Code No.       | Dia.<br>(D) | Flute Length<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
| 04-00002-00100 | 0.01        | 0.1                 | 15°                              | 4                 | 40                    |
| 04-00002-00150 | 0.015       | 0.15                | 15°                              | 4                 | 40                    |
| 04-00002-00200 | 0.02        | 0.2                 | 15°                              | 4                 | 40                    |
| 04-00002-00250 | 0.025       | 0.25                | 15°                              | 4                 | 40                    |
| 04-00002-00300 | 0.03        | 0.3                 | 15°                              | 4                 | 40                    |
| 04-00002-00350 | 0.035       | 0.4                 | 15°                              | 4                 | 40                    |
| 04-00002-00400 | 0.04        | 0.4                 | 15°                              | 4                 | 40                    |
| 04-00002-00450 | 0.045       | 0.5                 | 15°                              | 4                 | 40                    |
| 04-00002-00500 | 0.05        | 0.5                 | 15°                              | 4                 | 40                    |
| 04-00002-00550 | 0.055       | 0.6                 | 15°                              | 4                 | 40                    |
| 04-00002-00600 | 0.06        | 0.6                 | 15°                              | 4                 | 40                    |
| 04-00002-00650 | 0.065       | 0.7                 | 15°                              | 4                 | 40                    |
| 04-00002-00700 | 0.07        | 0.7                 | 15°                              | 4                 | 40                    |
| 04-00002-00750 | 0.075       | 0.8                 | 15°                              | 4                 | 40                    |
| 04-00002-00800 | 0.08        | 0.8                 | 15°                              | 4                 | 40                    |
| 04-00002-00850 | 0.085       | 0.9                 | 15°                              | 4                 | 40                    |
| 04-00002-00900 | 0.09        | 0.9                 | 15°                              | 4                 | 40                    |
| 04-00002-00950 | 0.095       | 1                   | 15°                              | 4                 | 40                    |
| 04-00002-01000 | 0.1         | 1                   | 15°                              | 4                 | 40                    |

**How to Order**

When you order, indicate NSMD-M (D). ※(γ) is reference value.

| Work Material | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                                    |        |           | Aluminium Alloy<br>A5052 |        |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|--------------------------|--------|-----------|
| Dia.          | Spindle Speed                                                                                                                                                                                                                                                                                                                 | Feed   | Step Feed | Spindle Speed            | Feed   | Step Feed |
|               | mim <sup>-1</sup>                                                                                                                                                                                                                                                                                                             | mm/min | μm        | mim <sup>-1</sup>        | mm/min | μm        |
| 0.01          | 20,000                                                                                                                                                                                                                                                                                                                        | 1      | 0.1       | 30,000                   | 2      | 0.5       |
| 0.03          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 0.5       | 30,000                   | 3      | 1.5       |
| 0.05          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 3         | 30,000                   | 4      | 5         |
| 0.1           | 20,000                                                                                                                                                                                                                                                                                                                        | 5      | 5         | 25,000                   | 10     | 10        |
| Notes         | ※1 Use appropriate coolant for work material and machining description.<br>※2 Minimize chucking runout by setting spindle speed at minimum oscillation.<br>(Recommend to measure actual runout at activated Spindle Speed.)<br>※3 Set up flat surface before start machining.<br>※4 Take extra care when chucking in and out. |        |           |                          |        |           |

Micro drill Dia.0.1mm or smaller to drill hole depth L/D=10



NSMD  $\phi$ 0.01



Thinning

- Standardized from dia. 0.01mm by concentrating NS manufacturing technology!
- Micro Drill develops new drilling capability.
- Thinning on the cutting edge to reduce cutting load for accurate drilling.(Dia. 0.02~)
- L/D=10 standard type.

Unit : mm

| Code No.       | Dia.<br>(D) | Flute Length<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|---------------------|----------------------------------|-------------------|-----------------------|
| 04-00001-00100 | 0.01        | 0.1                 | 15°                              | 4                 | 40                    |
| 04-00001-00150 | 0.015       | 0.15                | 15°                              | 4                 | 40                    |
| 04-00001-00200 | 0.02        | 0.2                 | 15°                              | 4                 | 40                    |
| 04-00001-00250 | 0.025       | 0.25                | 15°                              | 4                 | 40                    |
| 04-00001-00300 | 0.03        | 0.3                 | 15°                              | 4                 | 40                    |
| 04-00001-00400 | 0.04        | 0.4                 | 15°                              | 4                 | 40                    |
| 04-00001-00500 | 0.05        | 0.5                 | 15°                              | 4                 | 40                    |
| 04-00001-00600 | 0.06        | 0.6                 | 15°                              | 4                 | 40                    |
| 04-00001-00700 | 0.07        | 0.7                 | 15°                              | 4                 | 40                    |
| 04-00001-00800 | 0.08        | 0.8                 | 15°                              | 4                 | 40                    |
| 04-00001-00900 | 0.09        | 0.9                 | 15°                              | 4                 | 40                    |
| 04-00001-01000 | 0.1         | 1                   | 15°                              | 4                 | 40                    |

How to Order

When you order, indicate NSMD (D). ※( $\gamma$ ) is reference value.

Machining Case 1

Aluminium Alloy

■ Hole description:  $\phi$ 0.01mm (Blind hole) Depth 0.1mm (L/D=10)



|               |                         |
|---------------|-------------------------|
| Spindle speed | 60,000min <sup>-1</sup> |
| Feed          | 2mm/min                 |
| Step feed     | 0.2 $\mu$ m             |
| Coolant       | Oil mist                |



Drill size :  $\phi$  0.01  
Work Material : A5052  
No. of holes: 10holes  
Machining time: 1hr 20min

Machining Case 2

SUS304

■ Hole description:  $\phi$ 0.03mm (Through hole)  
Depth 0.15mm (L/D=5)



|               |                         |
|---------------|-------------------------|
| Spindle speed | 60,000min <sup>-1</sup> |
| Feed          | 1mm/min                 |
| Step feed     | 1 $\mu$ m               |
| Coolant       | Oil mist                |

Drill size :  $\phi$  0.03  
Work Material : SUS304  
No. of holes: 105holes  
Machining time: 16hr

| Work Material | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                                    |        |           | Aluminium Alloy<br>A5052 |        |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|--------------------------|--------|-----------|
|               | Spindle Speed                                                                                                                                                                                                                                                                                                                 | Feed   | Step Feed | Spindle Speed            | Feed   | Step Feed |
| Dia.          | mim <sup>-1</sup>                                                                                                                                                                                                                                                                                                             | mm/min | $\mu$ m   | mim <sup>-1</sup>        | mm/min | $\mu$ m   |
| 0.01          | 20,000                                                                                                                                                                                                                                                                                                                        | 1      | 0.1       | 30,000                   | 2      | 0.5       |
| 0.03          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 0.5       | 30,000                   | 3      | 1.5       |
| 0.05          | 20,000                                                                                                                                                                                                                                                                                                                        | 2      | 3         | 30,000                   | 4      | 5         |
| 0.1           | 20,000                                                                                                                                                                                                                                                                                                                        | 5      | 5         | 25,000                   | 10     | 10        |
| Notes         | ※1 Use appropriate coolant for work material and machining description.<br>※2 Minimize chucking runout by setting spindle speed at minimum oscillation.<br>(Recommend to measure actual runout at activated Spindle Speed.)<br>※3 Set up flat surface before start machining.<br>※4 Take extra care when chucking in and out. |        |           |                          |        |           |

M Stainless Steel

N Aluminium Alloy

N Copper

N Resin





- ☒

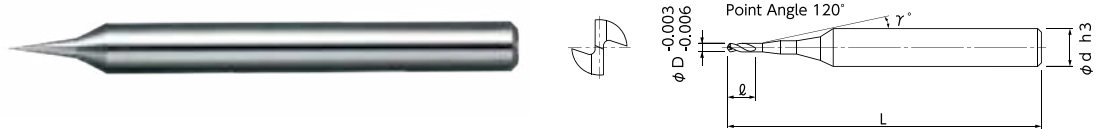
Stainless Steel **M**
- ☐

Aluminium Alloy **N**
- ☐

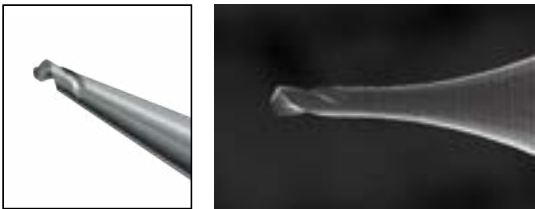
Copper **N**
- ☐

Resin **N**

For making a guide hole for micro drill



- Micro Point Drill for guide hole.
- Thinning on the cutting edge to reduce cutting load for accurate drilling. (Dia. 0.025~)



NSPD  $\phi$  0.03

Unit : mm

| Code No.       | Dia.<br>(D) | Flute Length<br>( $\ell$ ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|----------------------------|----------------------------------|-------------------|-----------------------|
| 04-00010-00100 | 0.01        | 0.015                      | 15°                              | 4                 | 40                    |
| 04-00010-00150 | 0.015       | 0.025                      | 15°                              | 4                 | 40                    |
| 04-00010-00200 | 0.02        | 0.04                       | 15°                              | 4                 | 40                    |
| 04-00010-00250 | 0.025       | 0.05                       | 15°                              | 4                 | 40                    |
| 04-00010-00300 | 0.03        | 0.06                       | 15°                              | 4                 | 40                    |
| 04-00010-00400 | 0.04        | 0.08                       | 15°                              | 4                 | 40                    |
| 04-00010-00500 | 0.05        | 0.1                        | 15°                              | 4                 | 40                    |
| 04-00010-00600 | 0.06        | 0.12                       | 15°                              | 4                 | 40                    |
| 04-00010-00700 | 0.07        | 0.14                       | 15°                              | 4                 | 40                    |
| 04-00010-00800 | 0.08        | 0.16                       | 15°                              | 4                 | 40                    |
| 04-00010-00900 | 0.09        | 0.18                       | 15°                              | 4                 | 40                    |
| 04-00010-01000 | 0.1         | 0.2                        | 15°                              | 4                 | 40                    |

How to Order

When you order, indicate NSPD (D). ※( $\gamma$ ) is reference value.

| Work Material | Stainless Steels<br>SUS304                                                                                                                                                                                                                                                                                         |        |           | Aluminium Alloy<br>A5052 |        |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|--------------------------|--------|-----------|
|               | Spindle Speed                                                                                                                                                                                                                                                                                                      | Feed   | Step Feed | Spindle Speed            | Feed   | Step Feed |
| Dia.          | mim <sup>-1</sup>                                                                                                                                                                                                                                                                                                  | mm/min | μm        | mim <sup>-1</sup>        | mm/min | μm        |
| 0.01          | 20,000                                                                                                                                                                                                                                                                                                             | 1      | 0.1       | 20,000                   | 1      | 0.1       |
| 0.03          | 20,000                                                                                                                                                                                                                                                                                                             | 2      | 0.5       | 20,000                   | 2      | 0.5       |
| 0.05          | 20,000                                                                                                                                                                                                                                                                                                             | 2      | 1         | 20,000                   | 2      | 1         |
| 0.1           | 20,000                                                                                                                                                                                                                                                                                                             | 5      | 2         | 25,000                   | 5      | 2         |
| Notes         | ※1 Use appropriate coolant for work material and machining description.<br>※2 Minimize chucking runout by setting spindle speed at minimum oscillation.<br>(Recommend to measure actual runout at activated rpm)<br>※3 Set up flat surface before start machining.<br>※4 Take extra care when chucking in and out. |        |           |                          |        |           |

- M**

Stainless Steel ☒
- N**

Aluminium Alloy ☐
- N**

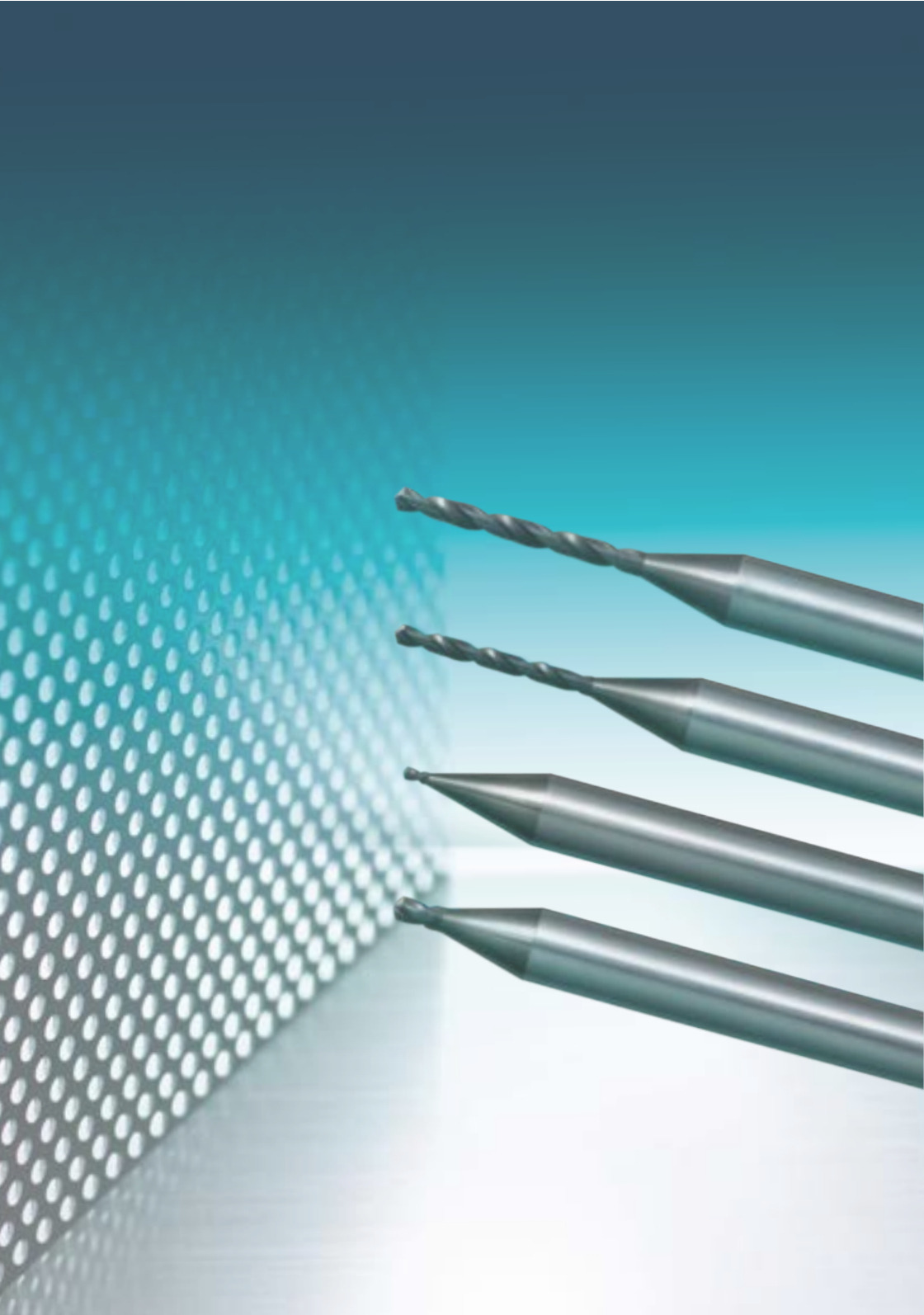
Copper ☐
- N**

Resin ☐



Recommended Milling Conditions

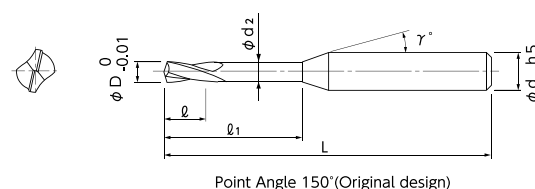
| Work Material | Carbon Steels S50C                                                                                                                                                                                                                                                                                                            |        |           | Alloy Steels SCM-SKD |        |           | Prehardened Steels HPM-NAK (~40HRC) |        |           | Aluminium Alloy A5052 |        |           | Stainless Steels SUS304 |        |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|----------------------|--------|-----------|-------------------------------------|--------|-----------|-----------------------|--------|-----------|-------------------------|--------|-----------|
| Dia.          | Spindle Speed                                                                                                                                                                                                                                                                                                                 | Feed   | Step Feed | Spindle Speed        | Feed   | Step Feed | Spindle Speed                       | Feed   | Step Feed | Spindle Speed         | Feed   | Step Feed | Spindle Speed           | Feed   | Step Feed |
|               | mim <sup>-1</sup>                                                                                                                                                                                                                                                                                                             | mm/min | mm        | mim <sup>-1</sup>    | mm/min | mm        | mim <sup>-1</sup>                   | mm/min | mm        | mim <sup>-1</sup>     | mm/min | mm        | mim <sup>-1</sup>       | mm/min | mm        |
| 0.1           | 25,000                                                                                                                                                                                                                                                                                                                        | 50     | 0.02      | 20,000               | 40     | 0.02      | 17,000                              | 35     | 0.02      | 25,000                | 50     | 0.05      | 15,000                  | 30     | 0.005     |
| 0.15          | 25,000                                                                                                                                                                                                                                                                                                                        | 50     | 0.02      | 20,000               | 40     | 0.02      | 17,000                              | 35     | 0.02      | 25,000                | 50     | 0.05      | 15,000                  | 30     | 0.005     |
| 0.2           | 25,000                                                                                                                                                                                                                                                                                                                        | 75     | 0.04      | 20,000               | 60     | 0.04      | 17,000                              | 50     | 0.04      | 25,000                | 100    | 0.1       | 15,000                  | 45     | 0.01      |
| 0.25          | 25,000                                                                                                                                                                                                                                                                                                                        | 75     | 0.04      | 20,000               | 60     | 0.04      | 17,000                              | 50     | 0.04      | 25,000                | 100    | 0.2       | 15,000                  | 45     | 0.01      |
| 0.3           | 20,000                                                                                                                                                                                                                                                                                                                        | 120    | 0.05      | 15,000               | 60     | 0.05      | 13,000                              | 50     | 0.05      | 22,000                | 400    | 0.3       | 11,000                  | 45     | 0.02      |
| 0.35          | 20,000                                                                                                                                                                                                                                                                                                                        | 120    | 0.05      | 15,000               | 60     | 0.05      | 13,000                              | 50     | 0.05      | 22,000                | 400    | 0.3       | 11,000                  | 45     | 0.02      |
| 0.4           | 20,000                                                                                                                                                                                                                                                                                                                        | 160    | 0.06      | 15,000               | 75     | 0.06      | 13,000                              | 65     | 0.06      | 22,000                | 700    | 0.4       | 8,500                   | 45     | 0.04      |
| 0.45          | 20,000                                                                                                                                                                                                                                                                                                                        | 160    | 0.06      | 15,000               | 75     | 0.06      | 13,000                              | 65     | 0.06      | 22,000                | 700    | 0.4       | 8,500                   | 45     | 0.07      |
| 0.5           | 18,000                                                                                                                                                                                                                                                                                                                        | 180    | 0.1       | 13,000               | 100    | 0.1       | 10,000                              | 80     | 0.1       | 20,000                | 1,000  | 0.5       | 7,000                   | 55     | 0.1       |
| 0.55          | 18,000                                                                                                                                                                                                                                                                                                                        | 180    | 0.1       | 13,000               | 100    | 0.1       | 10,000                              | 80     | 0.1       | 20,000                | 1,000  | 0.5       | 7,000                   | 55     | 0.1       |
| 0.6           | 18,000                                                                                                                                                                                                                                                                                                                        | 360    | 0.15      | 13,000               | 100    | 0.15      | 10,000                              | 80     | 0.15      | 20,000                | 1,000  | 0.6       | 7,000                   | 55     | 0.12      |
| 0.65          | 18,000                                                                                                                                                                                                                                                                                                                        | 360    | 0.15      | 13,000               | 100    | 0.15      | 10,000                              | 80     | 0.15      | 20,000                | 1,000  | 0.6       | 7,000                   | 55     | 0.12      |
| 0.7           | 16,000                                                                                                                                                                                                                                                                                                                        | 480    | 0.2       | 11,000               | 110    | 0.2       | 8,000                               | 80     | 0.2       | 18,000                | 1,100  | 0.7       | 6,000                   | 60     | 0.14      |
| 0.75          | 16,000                                                                                                                                                                                                                                                                                                                        | 480    | 0.2       | 11,000               | 110    | 0.2       | 8,000                               | 80     | 0.2       | 18,000                | 1,100  | 0.7       | 6,000                   | 60     | 0.14      |
| 0.8           | 16,000                                                                                                                                                                                                                                                                                                                        | 640    | 0.3       | 11,000               | 220    | 0.3       | 8,000                               | 160    | 0.3       | 18,000                | 1,100  | 0.8       | 6,000                   | 120    | 0.16      |
| 0.85          | 16,000                                                                                                                                                                                                                                                                                                                        | 640    | 0.3       | 11,000               | 220    | 0.3       | 8,000                               | 160    | 0.3       | 18,000                | 1,100  | 0.8       | 6,000                   | 120    | 0.16      |
| 0.9           | 15,000                                                                                                                                                                                                                                                                                                                        | 750    | 0.4       | 9,000                | 270    | 0.4       | 7,000                               | 210    | 0.4       | 16,000                | 1,200  | 0.8       | 5,000                   | 150    | 0.18      |
| 0.95          | 15,000                                                                                                                                                                                                                                                                                                                        | 750    | 0.4       | 9,000                | 270    | 0.4       | 7,000                               | 210    | 0.4       | 16,000                | 1,200  | 0.8       | 5,000                   | 150    | 0.18      |
| 1             | 15,000                                                                                                                                                                                                                                                                                                                        | 750    | 0.5       | 9,000                | 270    | 0.5       | 7,000                               | 210    | 0.5       | 16,000                | 1,200  | 1         | 5,000                   | 150    | 0.2       |
| Notes         | ※1 Use appropriate coolant for work material and machining description.<br>※2 Minimize chucking runout by setting spindle speed at minimum oscillation.<br>(Recommend to measure actual runout at activated Spindle Speed.)<br>※3 Set up flat surface before start machining.<br>※4 Take extra care when chucking in and out. |        |           |                      |        |           |                                     |        |           |                       |        |           |                         |        |           |







## Recommended Milling Conditions



- Unit : mm

| Code No.       | Dia. (D) | Flute Length (ℓ) | Under Neck Length (ℓ <sub>1</sub> ) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|------------------|-------------------------------------|-----------------------------|----------------------|----------------|--------------------|
| 04-00050-01000 | 0.1      | 0.2              | 1                                   | 0.085                       | 15°                  | 4              | 45                 |
| 04-00050-01500 | 0.15     | 0.3              | 1.5                                 | 0.13                        | 15°                  | 4              | 45                 |
| 04-00050-02000 | 0.2      | 0.4              | 2                                   | 0.18                        | 15°                  | 4              | 45                 |
| 04-00050-02500 | 0.25     | 0.5              | 2.5                                 | 0.23                        | 15°                  | 4              | 45                 |
| 04-00050-03000 | 0.3      | 0.6              | 3                                   | 0.28                        | 15°                  | 4              | 45                 |
| 04-00050-03500 | 0.35     | 0.7              | 3.5                                 | 0.32                        | 15°                  | 4              | 45                 |
| 04-00050-04000 | 0.4      | 0.8              | 4                                   | 0.37                        | 15°                  | 4              | 45                 |
| 04-00050-04500 | 0.45     | 0.9              | 4.5                                 | 0.41                        | 15°                  | 4              | 45                 |
| 04-00050-05000 | 0.5      | 1                | 5                                   | 0.46                        | 15°                  | 4              | 45                 |
| 04-00050-05500 | 0.55     | 1.1              | 5.5                                 | 0.51                        | 15°                  | 4              | 45                 |
| 04-00050-06000 | 0.6      | 1.2              | 6                                   | 0.56                        | 15°                  | 4              | 45                 |
| 04-00050-06500 | 0.65     | 1.3              | 6.5                                 | 0.61                        | 15°                  | 4              | 45                 |
| 04-00050-07000 | 0.7      | 1.4              | 7                                   | 0.66                        | 15°                  | 4              | 45                 |
| 04-00050-07500 | 0.75     | 1.5              | 7.5                                 | 0.71                        | 15°                  | 4              | 45                 |
| 04-00050-08000 | 0.8      | 1.6              | 8                                   | 0.76                        | 15°                  | 4              | 45                 |
| 04-00050-08500 | 0.85     | 1.7              | 8.5                                 | 0.81                        | 15°                  | 4              | 45                 |
| 04-00050-09000 | 0.9      | 1.8              | 9                                   | 0.86                        | 15°                  | 4              | 45                 |
| 04-00050-09500 | 0.95     | 1.9              | 9.5                                 | 0.9                         | 15°                  | 4              | 45                 |
| 04-00050-10000 | 1        | 2                | 10                                  | 0.95                        | 15°                  | 4              | 45                 |

When you order, indicate MSDH (D). ※(γ) is reference value.



A bar chart comparing the number of holes between two categories: Sustainable and Breakage. The y-axis is labeled 'Number of holes' and ranges from 0 to 1,200 in increments of 200. The Sustainable bar is orange and reaches 1,000. The Breakage bar is green and reaches 681. The x-axis labels are 'MSDH' and 'Competitor'.

| Category    | Number of holes |
|-------------|-----------------|
| Sustainable | 1,000           |
| Breakage    | 681             |

|                 |                          |
|-----------------|--------------------------|
| Tool            | MSDH $\phi 0.5$          |
| Spindle speed   | 15,000 min <sup>-1</sup> |
| Feed            | 50 mm/min                |
| Step feed       | 0.025 mm                 |
| Depth of hole   | 4.9 mm (Through)         |
| Coolant         | Oil mist                 |
| Number of holes | 1,000 holes              |
| Machining time  | 1min 25sec / 1 hole      |

[illegible]

Q-027

# Thread Mill

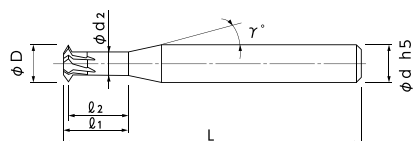
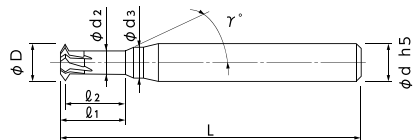
Fine thread milling is realized on different kind of work materials

| Model                                                                                                                                                                              | Size                      | Under Neck Length | Coating                                                                             | Number of Flute                                                                                                                                                        | Work Material                                                                       |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       | Number of Sizes | Page  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------|-------|--|
|                                                                                                                                                                                    |                           |                   |                                                                                     |                                                                                                                                                                        | P                                                                                   | P                                                                                   | P                                                                                   | M                                                                                   | N                                                                                   | N                                                                                    | N                                                                                     | N                                                                                     | N                                                                                     | S                                                                                     | H                                                                                     |                                                                                       |                                                                                       |                 |       |  |
|                                                                                                                                                                                    |                           |                   |                                                                                     |                                                                                                                                                                        | Carbon Steel                                                                        | Alloy Steel                                                                         | Prehardened Steel                                                                   | Stainless Steel                                                                     | Aluminium Alloy                                                                     | Copper                                                                               | Resin                                                                                 | Graphite                                                                              | Hard Brittle Material                                                                 | Heat Resistant Alloy etc                                                              | Hardened Steel                                                                        |                                                                                       |                                                                                       |                 |       |  |
|                                                                                                                                                                                    |                           |                   |                                                                                     |                                                                                                                                                                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       | 55 HRC                                                                                | 65 HRC                                                                                | 70 HRC                                                                                |                 |       |  |
| Thread Mill                                                                                                                                                                        |                           |                   |                                                                                     |                                                                                                                                                                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |  |
| <br>MMTM<br>     | M1 ~ M6                   | ≒3D               |    | <br> |    |    |    |    |    |    |    |    |    |    |    |    |    | 11              | R-004 |  |
| Specialized for metric internal thread. Available for precise micro threading                                                                                                      |                           |                   |                                                                                     |                                                                                                                                                                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |  |
| <br>MMTU<br>     | No.0-80UNF<br>~ 1/4-28UNF | ≒2.5D             |    | <br> |    |    |    |    |    |    |    |    |    |    |    |    |    | 21              | R-006 |  |
| specialized for unify internal thread. Available for precise micro threading                                                                                                       |                           |                   |                                                                                     |                                                                                                                                                                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |  |
| <br>MMTS<br> | S0.1 ~ S1.4               | ≒4D               |  |                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |  | 13              | R-008 |  |
| Specialized for miniature internal thread. NS TOOL original standard of S0.1 and S0.2 for precise micro threading                                                                  |                           |                   |                                                                                     |                                                                                                                                                                        |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                 |       |  |





MG 4 6 ød h5 Thread



Cutting edge shape  
4-Flute

Cutting edge shape  
6-Flute

Unit : mm

- Improvement of cutting accuracy by adoption of tool design focusing on sharpness.
- MUGEN COATING realized long tool life.
- When the tool is broken during thread milling, the wreckage can be easily removed as the tool diameter is smaller than the pilot hole.

※ This Product should be used in the forward rotation.

| Code No.       | Thread Size | Dia. (D) | Under Neck Length (ℓ1) | Effective Thread Length (ℓ2) | Neck Dia. (d2) | Neck Dia. (d3) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Number of Flute | Thread Milling Size |
|----------------|-------------|----------|------------------------|------------------------------|----------------|----------------|----------------------|----------------|--------------------|-----------------|---------------------|
| 06-00002-00100 | M1          | 0.72     | 2.64                   | 2.5                          | 0.36           | 0.75           | 30°                  | 4              | 45                 | 4               | M1 M1.1             |
| 06-00002-00120 | M1.2        | 0.92     | 2.67                   | 2.5                          | 0.56           | 0.95           | 30°                  | 4              | 45                 | 4               | M1.2                |
| 06-00002-00140 | M1.4        | 1.05     | 3.18                   | 3                            | 0.62           | 1.08           | 30°                  | 4              | 45                 | 4               | M1.4                |
| 06-00002-00160 | M1.6        | 1.20     | 3.71                   | 3.5                          | 0.68           | 1.23           | 30°                  | 4              | 45                 | 4               | M1.6                |
| 06-00002-00170 | M1.7        | 1.30     | 3.71                   | 3.5                          | 0.78           | 1.33           | 30°                  | 4              | 45                 | 4               | M1.7 M1.8           |
| 06-00002-00200 | M2          | 1.50     | 5.02                   | 4.8                          | 0.89           | –              | 12°                  | 4              | 45                 | 6               | M2 M2.3             |
| 06-00002-00250 | M2.5        | 1.95     | 5.7                    | 5.4                          | 1.28           | –              | 12°                  | 4              | 45                 | 6               | M2.5 M2.6           |
| 06-00002-00300 | M3          | 2.36     | 6.3                    | 6                            | 1.63           | –              | 12°                  | 4              | 45                 | 6               | M3                  |
| 06-00002-00400 | M4          | 3.08     | 8.8                    | 8.4                          | 2.08           | –              | 12°                  | 6              | 60                 | 6               | M4                  |
| 06-00002-00500 | M5          | 3.97     | 10.1                   | 9.6                          | 2.86           | –              | 12°                  | 6              | 60                 | 6               | M5                  |
| 06-00002-00600 | M6          | 4.72     | 12.6                   | 12                           | 3.35           | –              | 12°                  | 6              | 60                 | 6               | M6                  |

## How to Order

When you order, indicate MMTM Thread Size. ※(γ) is reference value.

## Machining case

W-029

## Notes

- ※1 This Product should be used in the forward rotation.
- ※2 Software for generating NC program Will be provided on NS web site.
- ※3 The above Recommended Milling Conditions is provided as a guide for cutting when the depth of cut is divided into twice with water-soluble fluid.
- ※4 Recommend making pilot hole in advance by using drill, etc.
- ※5 Depending on environment, adjustments of spindle speed based on feed per tooth, feed, number of paths and cutting direction are needed.
- ※6 Helical R, 5H for M1.4 and under and 6H for more than M1.6, is a guideline for thread milling and it is R value in the final cutting.
- ※7 When use helical R in the Recommended Milling Conditions, set pilot hole dia. for avoiding interference between the area of under neck and pilot hole.
- ※8 Add zero-cut process in case completed thread left deflection angle.
- ※9 Choose appropriate coolant for each working material.

NC programming software is available on our website.



**URL**  
[https://www.ns-tool.com/en/download/thread\\_nc\\_maker/](https://www.ns-tool.com/en/download/thread_nc_maker/)

※ Please read the manual before use.





Thread Mill

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

MMTS

Threading Size S0.1 ~ S1.4

MMTS

MUGEN COATING Micro Thread Cutting Tool (for Internal Thread)

Recommended Milling Conditions

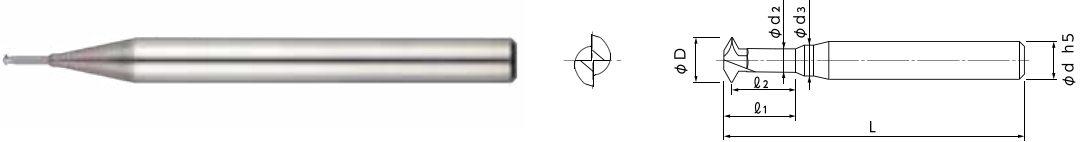
Specialized for miniature internal thread.  
NS TOOL original standard of S0.1 and S0.2 for precise micro threading

MG

2

$\phi d$   
h5

Thread



● World smallest threaded size 0.1mm is possible to cut.

● When the tool is broken during thread milling, the wreckages can be easily removed as the tool diameter is smaller than the pilot hole.

● MUGEN COATING realized long tool life.



Cutting edge shape  
2-Flute

※ This Product should be used in the forward rotation.

Unit : mm

| Code No.       | Thread Size | Dia. (D) | Under Neck Length (ℓ1) | Effective Thread Length (ℓ2) | Neck Dia. (d2) | Neck Dia. (d3) | Shank Dia. (d) | Overall Length (L) | Number of Flute |
|----------------|-------------|----------|------------------------|------------------------------|----------------|----------------|----------------|--------------------|-----------------|
| 06-00001-01000 | S0.1        | 0.066    | 0.15                   | 0.14                         | 0.032          | 0.185          | 4              | 45                 | 2               |
| 06-00001-02000 | S0.2        | 0.14     | 0.31                   | 0.28                         | 0.07           | 0.185          | 4              | 45                 | 2               |
| 06-00001-03000 | S0.3        | 0.2      | 0.48                   | 0.44                         | 0.085          | 0.235          | 4              | 45                 | 2               |
| 06-00001-04000 | S0.4        | 0.28     | 0.61                   | 0.55                         | 0.15           | 0.315          | 4              | 45                 | 2               |
| 06-00001-05000 | S0.5        | 0.35     | 0.77                   | 0.69                         | 0.17           | 0.39           | 4              | 45                 | 2               |
| 06-00001-06000 | S0.6        | 0.43     | 0.93                   | 0.83                         | 0.22           | 0.47           | 4              | 45                 | 2               |
| 06-00001-08000 | S0.8        | 0.58     | 1.24                   | 1.1                          | 0.31           | 0.62           | 4              | 45                 | 2               |
| 06-00001-10000 | S1.0        | 0.73     | 1.55                   | 1.38                         | 0.41           | 0.77           | 4              | 45                 | 2               |
| 06-00001-10001 |             | 0.73     | 3.17                   | 3                            | 0.41           | 0.77           | 4              | 45                 | 2               |
| 06-00001-12000 | S1.2        | 0.93     | 1.6                    | 1.38                         | 0.61           | 0.97           | 4              | 45                 | 2               |
| 06-00001-12001 |             | 0.93     | 3.22                   | 3                            | 0.61           | 0.97           | 4              | 45                 | 2               |
| 06-00001-14000 | S1.4        | 1.08     | 1.9                    | 1.65                         | 0.7            | 1.14           | 4              | 45                 | 2               |
| 06-00001-14001 |             | 1.08     | 3.86                   | 3.6                          | 0.7            | 1.14           | 4              | 45                 | 2               |

How to Order

When you order, indicate MMTS Thread Sizex ( ℓ1 ).

● S0.1 and S0.2 are original standard by NS Tool Co., LTD. as a miniature thread standard of JIS is from S0.3.

NC programming software is available on our website.

URL  
[https://www.ns-tool.com/en/download/thread\\_nc\\_maker/](https://www.ns-tool.com/en/download/thread_nc_maker/)

※ Please read the manual before use.

| Thread Size | Dia.  | Pitch | Recommended pilot hole Dia. | Recommended process Helical R <sup>1</sup> | Carbon Steels S50C |        | Stainless Steels SUS304 |        | Aluminium Alloy A5052 |        | Titanium Ti       |        |
|-------------|-------|-------|-----------------------------|--------------------------------------------|--------------------|--------|-------------------------|--------|-----------------------|--------|-------------------|--------|
|             |       |       |                             |                                            | Spindle Speed      | Feed   | Spindle Speed           | Feed   | Spindle Speed         | Feed   | Spindle Speed     | Feed   |
|             |       |       |                             |                                            | mm                 | mm/min | min <sup>-1</sup>       | mm/min | min <sup>-1</sup>     | mm/min | min <sup>-1</sup> | mm/min |
| S0.1        | 0.066 | 0.025 | 0.075                       | R0.017 <sup>*3</sup>                       | 20,000             | 5      | 20,000                  | 5      | 20,000                | 5      | 20,000            | 5      |
| S0.2        | 0.14  | 0.05  | 0.15                        | R0.035 <sup>*3</sup>                       | 20,000             | 5      | 20,000                  | 5      | 20,000                | 5      | 20,000            | 5      |
| S0.3        | 0.2   | 0.08  | 0.23                        | R0.061 <sup>*3</sup>                       | 20,000             | 5      | 20,000                  | 5      | 20,000                | 5      | 20,000            | 5      |
| S0.4        | 0.28  | 0.1   | 0.32                        | R0.070                                     | 18,000             | 5      | 18,000                  | 5      | 18,000                | 5      | 18,000            | 5      |
| S0.5        | 0.35  | 0.125 | 0.4                         | R0.088                                     | 15,000             | 10     | 15,000                  | 10     | 15,000                | 10     | 15,000            | 10     |
| S0.6        | 0.43  | 0.15  | 0.48                        | R0.110                                     | 12,000             | 10     | 12,000                  | 10     | 12,000                | 10     | 12,000            | 10     |
| S0.8        | 0.58  | 0.2   | 0.64                        | R0.130                                     | 10,000             | 20     | 10,000                  | 20     | 10,000                | 20     | 10,000            | 20     |
| S1.0        | 0.73  | 0.25  | 0.8                         | R0.155                                     | 7,000              | 50     | 7,000                   | 50     | 7,000                 | 50     | 7,000             | 50     |
| S1.2        | 0.93  | 0.25  | 1                           | R0.155                                     | 6,000              | 80     | 6,000                   | 80     | 6,000                 | 80     | 6,000             | 80     |
| S1.4        | 1.08  | 0.3   | 1.15                        | R0.190                                     | 5,000              | 100    | 5,000                   | 100    | 5,000                 | 100    | 5,000             | 100    |

Notes

※ 1 This Product should be used in the forward rotation.  
※ 2 Radial depth of cut may be divided into multiple cutting approaches by condition of spindle runout and machine.  
※ 3 Radial depth of cut must be divided into multiple cutting approaches for the sizes, S0.1, S0.2, and S0.3.  
※ 4 Adjust process helical final value based on measured actual Dia. of the tool if possible.  
※ 5 Care differences of actual pilot hole Dia. caused by runout of a pilot drill and rotation.  
※ 6 Process Helical is a circular radius value of actual tool movement when helical process by MMTS.  
※ 7 Add zero-cut process in case completed thread left deflection angle.  
※ 8 Tool overhang to be as short as possible.  
※ 9 Extra care of handling when tool setting and measuring.  
※ 10 Choose appropriate coolant for each working material.  
※ 11 Care with cutting chip removal.

Thread Mill

Carbon Steel P

Alloy Steel P

Prehardened Steel P

Stainless Steel M

Aluminium Alloy N

Copper N

Resin N

Coating

Thread Milling

R-008

Thread Milling

Coating

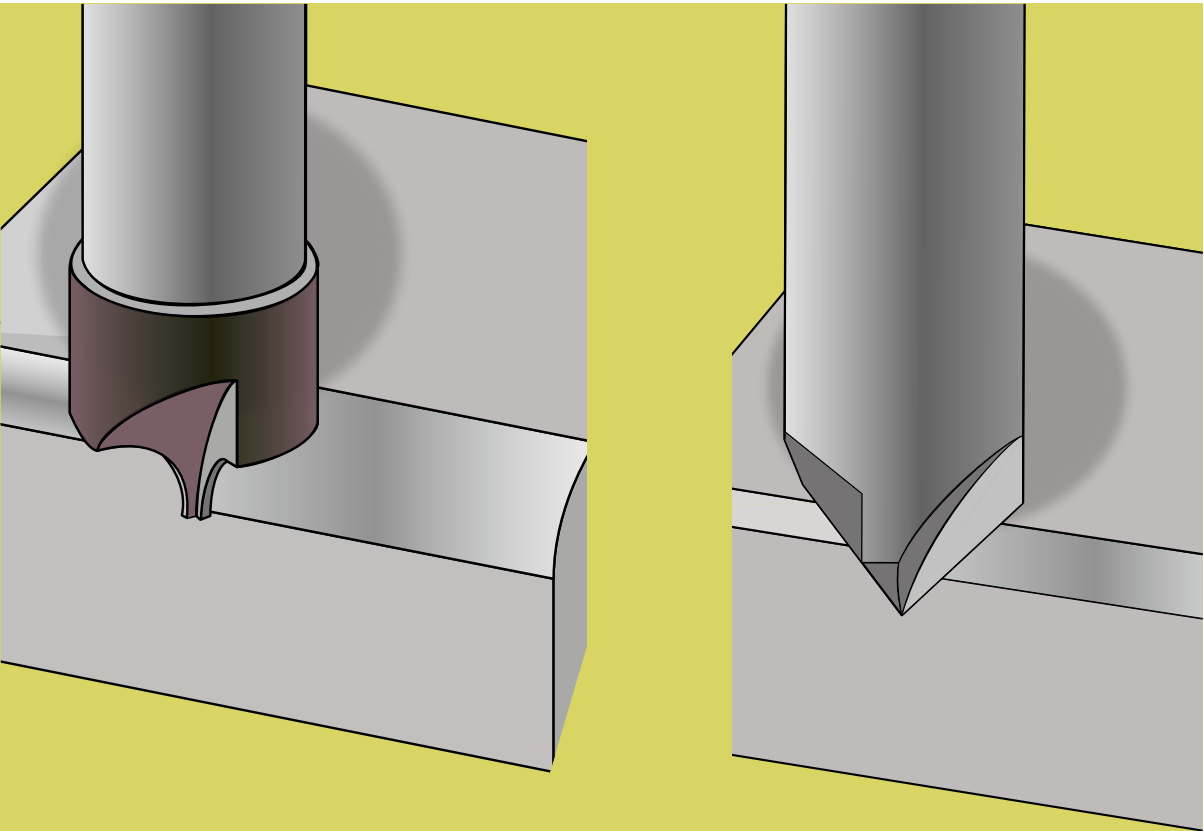
R-009



Chamfering

Chamfering cutter enables R chamfering and C chamfering

| Model                                                                                                                                        | Size      | Length of Cut | Coating | Number of Flute | Chamfering | R Chamfering | Work Material |             |                   |                 |                 |        |       |          |                       |                          |                |        |        | Number of Sizes | Page |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------|---------|-----------------|------------|--------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|----------|-----------------------|--------------------------|----------------|--------|--------|-----------------|------|
|                                                                                                                                              |           |               |         |                 |            |              | P             | P           | P                 | M               | N               | N      | N     | N        | N                     | S                        | H              |        |        |                 |      |
|                                                                                                                                              |           |               |         |                 |            |              | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Graphite | Hard Brittle Material | Heat Resistant Alloy etc | Hardened Steel |        |        |                 |      |
|                                                                                                                                              |           |               |         |                 |            |              |               |             |                   |                 |                 |        |       |          |                       |                          | 55 HRC         | 65 HRC | 70 HRC |                 |      |
| Chamfering                                                                                                                                   |           |               |         |                 |            |              |               |             |                   |                 |                 |        |       |          |                       |                          |                |        |        |                 |      |
| MIR200                                                                                                                                       | R0.1 ~ R5 | -             | ∞       | 2               | -          | R            | ○             | ○           | ○                 | ○               | ○               | ○      | -     | -        | -                     | ○                        | -              | -      | 29     | S-004           |      |
|                                                              |           |               |         |                 |            |              |               |             |                   |                 |                 |        |       |          |                       |                          |                |        |        |                 |      |
| Specialized for cutting at corner radius on various materials                                                                                |           |               |         |                 |            |              |               |             |                   |                 |                 |        |       |          |                       |                          |                |        |        |                 |      |
| NSCV                                                                                                                                         | φ4        | 2             | -       | 3               | C          | -            | -             | -           | -                 | ○               | ○               | ○      | -     | -        | -                     | -                        | -              | -      | 2      | S-006           |      |
|                                                              | φ6        | 3             | -       | 3               | C          | -            | -             | -           | -                 | ○               | ○               | ○      | -     | -        | -                     | -                        | -              |        |        |                 |      |
| Specialized for cutting at chamfering. Sharp edge with high rake angle realizes good surface quality and reduces burr. For non-ferrous metal |           |               |         |                 |            |              |               |             |                   |                 |                 |        |       |          |                       |                          |                |        |        |                 |      |
| NSCV-M                                                                                                                                       | φ4        | 2             | ∞       | 3               | C          | -            | ○             | ○           | ○                 | ○               | -               | -      | -     | -        | -                     | -                        | -              | -      | 2      | S-008           |      |
|                                                              | φ6        | 3             | ∞       | 3               | C          | -            | ○             | ○           | ○                 | ○               | -               | -      | -     | -        | -                     | -                        | -              |        |        |                 |      |
| Specialized for cutting at chamfering. Sharp edge with high rake angle realizes good surface quality and reduces burr. For steel             |           |               |         |                 |            |              |               |             |                   |                 |                 |        |       |          |                       |                          |                |        |        |                 |      |



Chamfering

Carbon Steel

Alloy Steel

Prehardened Steel

Stainless Steel

Aluminium Alloy

Copper

Resin

~ 55 HRC

Hardened Steel

MIR200

Size R0.1 ~ R5

SMG

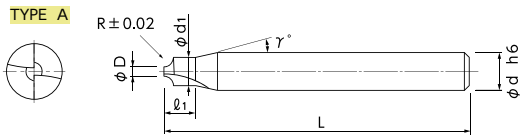
2

R

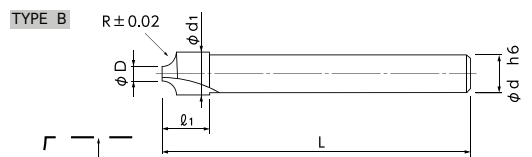
MUGEN COATING 2-Flute Inner Radius Cutter

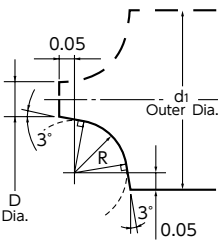
Recommended Milling Conditions

TYPE A



TYPE B





It is suitable for both machining NC and MC and can be cut at the corner radius easily.

Tool life is exceptionally extended as MUGEN COATING provides additional wear resistance.

| Code No.       | Radius (R) | Dia. (D) | Outer Dia. (d1) | Outer Dia. Length (ℓ1) | Neck Taper Angle (γ) | Type | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|----------|-----------------|------------------------|----------------------|------|----------------|--------------------|
| 08-00900-00100 | R0.1       | 0.5      | 0.8             | 3                      | 12°                  | A    | 4              | 45                 |
| 08-00900-00150 | R0.15      | 0.5      | 0.9             | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00200 | R0.2       | 0.5      | 1               | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00250 | R0.25      | 0.5      | 1.1             | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00300 | R0.3       | 0.5      | 1.2             | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00350 | R0.35      | 0.5      | 1.3             | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00400 | R0.4       | 0.5      | 1.4             | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00450 | R0.45      | 0.5      | 1.5             | 3                      | 12°                  |      | 4              | 45                 |
| 08-00900-00500 | R0.5       | 0.5      | 1.6             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00550 | R0.55      | 0.5      | 1.7             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00600 | R0.6       | 0.5      | 1.8             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00650 | R0.65      | 0.5      | 1.9             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00700 | R0.7       | 0.5      | 2               | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00750 | R0.75      | 0.5      | 2.1             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00800 | R0.8       | 0.8      | 2.5             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00850 | R0.85      | 0.8      | 2.6             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00900 | R0.9       | 0.8      | 2.7             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-00950 | R0.95      | 0.8      | 2.8             | 5                      | 12°                  |      | 4              | 45                 |
| 08-00900-01000 | R1         | 0.8      | 2.9             | 8                      | 12°                  |      | 4              | 45                 |
| 08-00900-01250 | R1.25      | 0.8      | 3.4             | 8                      | 12°                  |      | 4              | 45                 |
| 08-00900-01500 | R1.5       | 1.5      | 4.6             | 8                      | —                    | B    | 4              | 45                 |
| 08-00900-01750 | R1.75      | 1.5      | 5.1             | 8                      | —                    |      | 4              | 45                 |
| 08-00900-02000 | R2         | 1.5      | 5.6             | 10                     | —                    |      | 4              | 45                 |
| 08-00900-02500 | R2.5       | 1.5      | 6.6             | 10                     | —                    |      | 6              | 45                 |
| 08-00900-03000 | R3         | 1.5      | 7.6             | 12                     | 45°                  | A    | 8              | 55                 |
| 08-00900-03500 | R3.5       | 2        | 9.1             | 12                     | 45°                  |      | 10             | 55                 |
| 08-00900-04000 | R4         | 2        | 10.1            | 12                     | —                    | B    | 10             | 55                 |
| 08-00900-04500 | R4.5       | 2        | 11.1            | 15                     | 45°                  | A    | 12             | 65                 |
| 08-00900-05000 | R5         | 2        | 12.1            | 15                     | —                    | B    | 12             | 65                 |

Unit : mm

How to Order

When you order, indicate MIR200 (R). ※(γ) is reference value.

| Work Material             | Carbon Steels S50C                                                                                                                                                                                           |          |           | Alloy Steels SCM・SKD・SUS        |          |           | Prehardened Steels HPM・NAK      |          |           |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|---------------------------------|----------|-----------|---------------------------------|----------|-----------|
| Cutting Speed             | 30~40m/min                                                                                                                                                                                                   |          |           | 20~30m/min                      |          |           | 15~25m/min                      |          |           |
| R                         | Spindle Speed min <sup>-1</sup>                                                                                                                                                                              | mm/min   |           | Spindle Speed min <sup>-1</sup> | mm/min   |           | Spindle Speed min <sup>-1</sup> | mm/min   |           |
|                           |                                                                                                                                                                                                              | Roughing | Finishing |                                 | Roughing | Finishing |                                 | Roughing | Finishing |
| 0.1                       | 18,500                                                                                                                                                                                                       | 60       | 100       | 13,300                          | 50       | 70        | 10,600                          | 40       | 60        |
| 0.2                       | 16,000                                                                                                                                                                                                       | 60       | 100       | 11,400                          | 50       | 70        | 9,100                           | 40       | 60        |
| 0.3                       | 14,000                                                                                                                                                                                                       | 60       | 100       | 10,000                          | 50       | 70        | 8,000                           | 40       | 60        |
| 0.4                       | 12,500                                                                                                                                                                                                       | 60       | 100       | 8,800                           | 50       | 70        | 7,100                           | 40       | 60        |
| 0.5                       | 11,000                                                                                                                                                                                                       | 60       | 100       | 8,000                           | 50       | 70        | 6,400                           | 40       | 60        |
| 0.75                      | 9,000                                                                                                                                                                                                        | 60       | 100       | 6,400                           | 50       | 70        | 5,100                           | 40       | 60        |
| 0.8                       | 7,000                                                                                                                                                                                                        | 60       | 100       | 5,000                           | 50       | 70        | 4,900                           | 40       | 60        |
| 1                         | 6,200                                                                                                                                                                                                        | 60       | 100       | 4,400                           | 50       | 70        | 4,200                           | 40       | 60        |
| 1.25                      | 5,400                                                                                                                                                                                                        | 60       | 100       | 3,900                           | 50       | 70        | 3,600                           | 40       | 60        |
| 1.5                       | 3,700                                                                                                                                                                                                        | 60       | 100       | 2,700                           | 50       | 70        | 3,200                           | 40       | 60        |
| 1.75                      | 3,400                                                                                                                                                                                                        | 60       | 100       | 2,400                           | 50       | 70        | 2,800                           | 40       | 60        |
| 2                         | 3,200                                                                                                                                                                                                        | 60       | 100       | 2,300                           | 50       | 70        | 2,500                           | 40       | 60        |
| 2.5                       | 2,800                                                                                                                                                                                                        | 60       | 100       | 2,000                           | 50       | 70        | 2,100                           | 40       | 60        |
| 3                         | 2,500                                                                                                                                                                                                        | 60       | 100       | 1,800                           | 50       | 70        | 1,800                           | 40       | 60        |
| 3.5                       | 2,000                                                                                                                                                                                                        | 60       | 100       | 1,400                           | 50       | 70        | 1,600                           | 40       | 60        |
| 4                         | 1,850                                                                                                                                                                                                        | 60       | 100       | 1,300                           | 50       | 70        | 1,400                           | 40       | 60        |
| 4.5                       | 1,700                                                                                                                                                                                                        | 60       | 100       | 1,200                           | 50       | 70        | 1,300                           | 40       | 60        |
| 5                         | 1,600                                                                                                                                                                                                        | 60       | 100       | 1,100                           | 50       | 70        | 1,200                           | 40       | 60        |
| Depth of Cut (R : Radius) | <div><div>Roughing</div><div>Finishing</div><div><div><div>R+0.05</div><div>R+0.05</div></div><div><div>a</div><div>a</div></div><div><div>R 0.1~0.4=0.02mm</div><div>R 0.5~5=0.05mm</div></div></div></div> |          |           |                                 |          |           |                                 |          |           |
| Notes                     | <div>※ 1 Use cutting fluid.</div> <div>※ 2 Divide the cutting depth into several paths.</div>                                                                                                                |          |           |                                 |          |           |                                 |          |           |

Chamfering

Coating

S-004

Chamfering

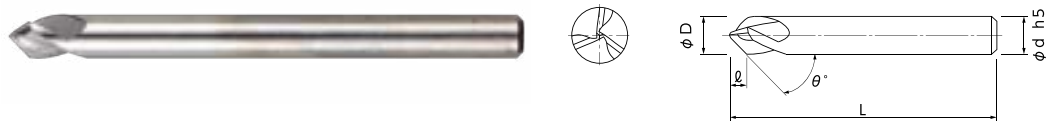
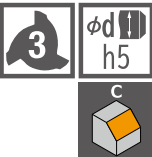
Coating

S-005

Chamfer Cutter

Recommended Milling Conditions

Specialized for cutting at chamfering.  
Sharp edge with high rake angle realizes good surface quality and reduces burr.  
For non-ferrous metal



● It can be cut at the corner easily.

- Aluminium Alloy N
- Copper N
- Resin N

- Aluminium Alloy N
- Copper N
- Resin N

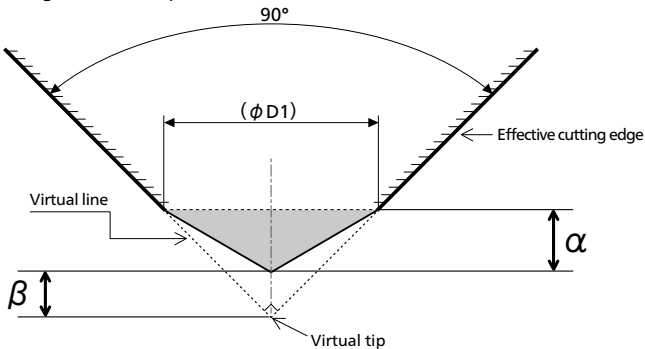
Unit : mm

| Code No.       | Dia.<br>(D) | Taper Angle<br>( $\theta$ ) | Length of Cut<br>( $\ell$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|-----------------------------|-----------------------------|-------------------|-----------------------|
| 04-00250-00400 | 4           | 45°                         | 2                           | 4                 | 60                    |
| 04-00250-00600 | 6           | 45°                         | 3                           | 6                 | 70                    |

How to Order When you order, indicate NSCV (D).

Precaution for use

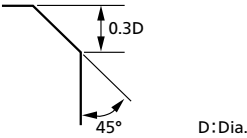
Enlargement of the tip section



Unit : mm

| Dia. | $\alpha$ | $\beta$ | ( $\phi$ D1) |
|------|----------|---------|--------------|
| 4    | 0.15     | 0.06    | 0.42         |
| 6    | 0.45     | 0.15    | 1.2          |

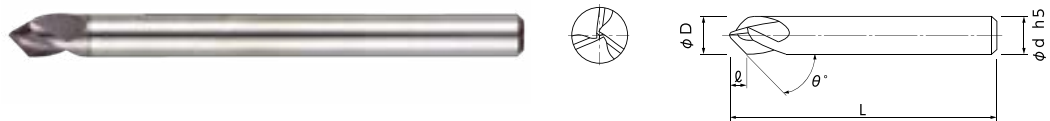
※ Required adjustments of the cut points to avoid using  $\alpha$  part because its tool tip has no cutting edges.  
※ Because the tool tip  $\alpha$  part of point angle is not 90°, the value of  $\beta$  must be offset in the ap direction during machining on virtual tip basis.  
In case of no adjustments, it requires attention because chamfer will be bigger than targeted value.

| Dia.         | Aluminium Alloy<br>A5052                                                                                                                                                                                                                                                                                      |        |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|              | Spindle Speed                                                                                                                                                                                                                                                                                                 | Feed   |
|              | min <sup>-1</sup>                                                                                                                                                                                                                                                                                             | mm/min |
| 4            | 11,000                                                                                                                                                                                                                                                                                                        | 2,400  |
| 6            | 7,500                                                                                                                                                                                                                                                                                                         | 1,800  |
| Depth of Cut |                                                                                                                                                                                                                            |        |
| Notes        | ※ 1 The above milling conditions are the value of reference for 4D, it needs adjustments of the conditions when it is longer.<br>※ 2 Adjust both spindle speed and feed at the same rate.<br>※ 3 Machine, tool chuck must be sufficiently rigid.<br>※ 4 Choose appropriate coolant for each working material. |        |

MUGEN COATING Chamfer Cutter

Recommended Milling Conditions

Specialized for cutting at chamfering.  
Sharp edge with high rake angle realizes good surface quality and reduces burr.  
For steel

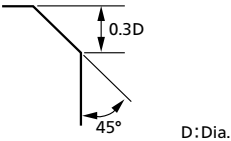


- It can be cut at the corner easily.
- Tool life is exceptionally as MUGEN COATING provides additional wear resistance.

Unit : mm

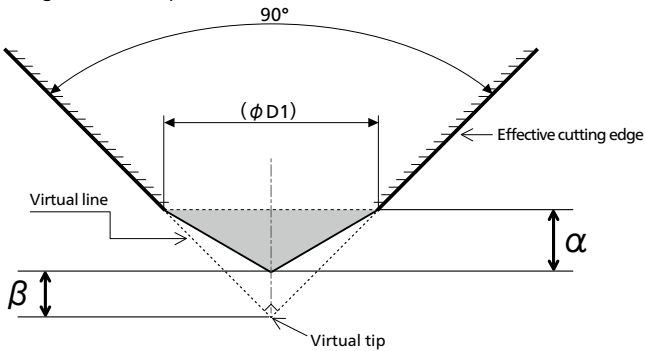
| Code No.       | Dia.<br>(D) | Taper Angle<br>( $\theta$ ) | Length of Cut<br>( $\ell$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|-----------------------------|-----------------------------|-------------------|-----------------------|
| 04-00260-00400 | 4           | 45°                         | 2                           | 4                 | 60                    |
| 04-00260-00600 | 6           | 45°                         | 3                           | 6                 | 70                    |

**How to Order** When you order, indicate NSCV-M (D).

| Dia.         | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                         |        | Stainless Steels<br>SUS304 |        | Prehardened Steels<br>HPM・NAK |        |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------------------|--------|-------------------------------|--------|
|              | Spindle Speed                                                                                                                                                                                                                                                                                                 | Feed   | Spindle Speed              | Feed   | Spindle Speed                 | Feed   |
|              | min <sup>-1</sup>                                                                                                                                                                                                                                                                                             | mm/min | min <sup>-1</sup>          | mm/min | min <sup>-1</sup>             | mm/min |
| 4            | 6,500                                                                                                                                                                                                                                                                                                         | 580    | 6,000                      | 540    | 4,500                         | 400    |
| 6            | 4,300                                                                                                                                                                                                                                                                                                         | 380    | 4,000                      | 360    | 3,000                         | 270    |
| Depth of Cut |                                                                                                                                                                                                                            |        |                            |        |                               |        |
| Notes        | ※ 1 The above milling conditions are the value of reference for 4D, it needs adjustments of the conditions when it is longer.<br>※ 2 Adjust both spindle speed and feed at the same rate.<br>※ 3 Machine, tool chuck must be sufficiently rigid.<br>※ 4 Choose appropriate coolant for each working material. |        |                            |        |                               |        |

Precaution for use

Enlargement of the tip section



Unit : mm

| Dia. | $\alpha$ | $\beta$ | ( $\phi$ D1) |
|------|----------|---------|--------------|
| 4    | 0.15     | 0.06    | 0.42         |
| 6    | 0.45     | 0.15    | 1.2          |

※ Required adjustments of the cut points to avoid using  $\alpha$  part because its tool tip has no cutting edges.  
※ Because the tool tip  $\alpha$  part of point angle is not 90°, the value of  $\beta$  must be offset in the ap direction during machining on virtual tip basis.  
In case of no adjustments, it requires attention because chamfer will be bigger than targeted value.

3

NS TOOL

Semi-Standard Products

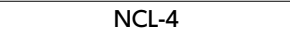
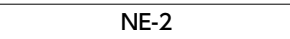
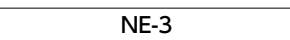
PAGE

Semi-Standard Products

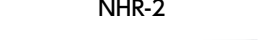
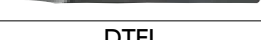
T-002



Semi-Standard  
Products

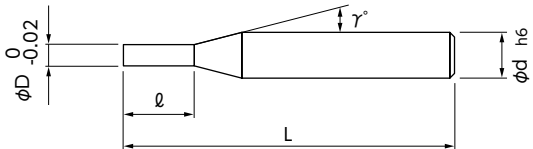
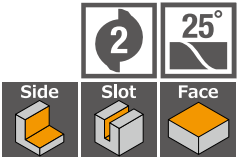
| Model                                                                                       | Size       | Maximum Cutting Depth | Number of Flute | Helix Angle | Work Material |             |                   |                 |                |        |       | Number of Sizes | Page  |
|---------------------------------------------------------------------------------------------|------------|-----------------------|-----------------|-------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|-----------------|-------|
|                                                                                             |            |                       |                 |             | P             | P           | P                 | M               | N              | N      | N     |                 |       |
|                                                                                             |            |                       |                 |             | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin |                 |       |
| Square                                                                                      |            |                       |                 |             |               |             |                   |                 |                |        |       |                 |       |
|  NX-25     | φ0.5 ~ φ12 | 1D                    | 2               | 25°         |               |             |                   |                 |                |        |       | 116             | T-006 |
|  NX-30     | φ0.5 ~ φ12 | 2D                    | 2               | 30°         |               |             |                   |                 |                |        |       | 116             | T-010 |
|  NX-35     | φ0.5 ~ φ12 | 3D                    | 2               | 35°         |               |             |                   |                 |                |        |       | 116             | T-014 |
|  NX-40     | φ0.5 ~ φ12 | 4D                    | 2               | 40°         |               |             |                   |                 |                |        |       | 116             | T-018 |
|  NX-45     | φ0.5 ~ φ12 | 5D                    | 2               | 45°         |               |             |                   |                 |                |        |       | 116             | T-022 |
|  NC-2      | φ0.5 ~ φ20 | 2D                    | 2               | 30°         |               |             |                   |                 |                |        |       | 39              | T-026 |
|  NCM-2    | φ0.5 ~ φ20 | 3D                    | 2               | 30°         |               |             |                   |                 |                |        |       | 39              | T-028 |
|  NCL-2   | φ1 ~ φ12   | 6D                    | 2               | 30°         |               |             |                   |                 |                |        |       | 11              | T-030 |
|  NC-LS-2 | φ1 ~ φ12   | 2D                    | 2               | 30°         |               |             |                   |                 |                |        |       | 14              | T-032 |
|  NC-4    | φ1 ~ φ20   | 2D                    | 4               | 30°         |               |             |                   |                 |                |        |       | 116             | T-034 |
|  NCM-4   | φ1 ~ φ20   | 3D                    | 4               | 30°         |               |             |                   |                 |                |        |       | 26              | T-038 |
|  NCL-4   | φ2 ~ φ12   | 6D                    | 4               | 30°         |               |             |                   |                 |                |        |       | 8               | T-040 |
|  NE-2    | φ1 ~ φ20   | 3D                    | 2               | 45°         |               |             |                   |                 |                |        |       | 26              | T-042 |
|  NE-3    | φ3 ~ φ20   | 2D                    | 3               | 45°         |               |             |                   |                 |                |        |       | 23              | T-044 |
|  NEL-3   | φ6 ~ φ20   | 4D                    | 3               | 45°         |               |             |                   |                 |                |        |       | 8               | T-046 |
|  NE-4    | φ3 ~ φ20   | 2D                    | 4               | 45°         |               |             |                   |                 |                |        |       | 14              | T-048 |

Semi-Standard  
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| Model                                                                                        | Size                                        | Maximum Cutting Depth | Under Neck Length | Number of Flute | Helix Angle                          | Supplement | Work Material |             |                   |                 |                |        |       | Number of Sizes | Page  |
|----------------------------------------------------------------------------------------------|---------------------------------------------|-----------------------|-------------------|-----------------|--------------------------------------|------------|---------------|-------------|-------------------|-----------------|----------------|--------|-------|-----------------|-------|
|                                                                                              |                                             |                       |                   |                 |                                      |            | P             | P           | P                 | M               | N              | N      | N     |                 |       |
|                                                                                              |                                             |                       |                   |                 |                                      |            | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminum Alloy | Copper | Resin |                 |       |
| Square                                                                                       |                                             |                       |                   |                 |                                      |            |               |             |                   |                 |                |        |       |                 |       |
|  NSL-2    | φ1 ~ φ12                                    | 2D                    | -                 | 2               | 0°                                   | 90°        |               |             |                   | -               | -              | -      | -     | 14              | T-050 |
|  DX       | φ0.5 ~ φ20                                  | 2D                    | -                 | 2               | 25°                                  | 90°        | -             | -           | -                 | -               |                |        |       | 15              | T-052 |
|  DXM      | φ3 ~ φ20                                    | 4D                    | -                 | 2               | 25°                                  | 90°        | -             | -           | -                 | -               |                |        |       | 9               | T-054 |
|  DXL      | φ3 ~ φ20                                    | 5D                    | -                 | 2               | 25°                                  | 90°        | -             | -           | -                 | -               |                |        |       | 9               | T-056 |
|  NEA-2    | φ3 ~ φ25                                    | 6D                    | -                 | 2               | 45°                                  |            | -             | -           | -                 | -               |                |        |       | 26              | T-058 |
| Long Neck Square                                                                             |                                             |                       |                   |                 |                                      |            |               |             |                   |                 |                |        |       |                 |       |
|  DSF      | φ1 ~ φ20                                    | 1D                    | 1 ~ 20            | 1               | 12°                                  | 90°        | -             | -           | -                 | -               |                |        |       | 11              | T-060 |
|  NHR-2  | φ0.5 ~ φ5                                   | 13D                   | 2 ~ 40            | 2               | 30°<br>(D < 2.5)<br>45°<br>(D ≥ 2.5) |            | -             |             |                   |                 |                |        |       | 87              | T-062 |
| Tapered Square                                                                               |                                             |                       |                   |                 |                                      |            |               |             |                   |                 |                |        |       |                 |       |
|  NTE-2  | φ0.5×taper angle30°<br>~ φ10×taper angle10° | 4D                    | -                 | 2               | 30°                                  |            | -             |             |                   |                 |                |        |       | 141             | T-066 |
|  NTEM-2 | φ1×taper angle4°<br>~ φ4×taper angle20°     | 5D                    | -                 | 2               | 30°                                  |            | -             |             |                   |                 |                |        |       | 36              | T-070 |
|  NTEL-2 | φ1×taper angle30°<br>~ φ3×taper angle20°    | 10D                   | -                 | 2               | 40°                                  |            | -             |             |                   |                 |                |        |       | 40              | T-072 |
|  NTE-4  | φ3×taper angle30°<br>~ φ16×taper angle10°   | 4D                    | -                 | 4               | 30°                                  |            | -             |             |                   |                 |                |        |       | 81              | T-074 |
|  NTEL-4 | φ3×taper angle30°<br>~ φ6×taper angle5°     | 6D                    | -                 | 4               | 40°                                  |            | -             |             |                   |                 |                |        |       | 32              | T-078 |
|  DTE    | φ1×taper angle30°<br>~ φ10×taper angle5°    | 4D                    | -                 | 2               | 25°                                  | 90°        | -             | -           | -                 | -               |                |        |       | 70              | T-080 |
|  DTEL   | φ1×taper angle30°<br>~ φ8×taper angle5°     | 8D                    | -                 | 2               | 25°                                  | 90°        | -             | -           | -                 | -               |                |        |       | 63              | T-082 |
|  NER-2  | φ2×taper angle7°<br>~ φ6×taper angle15°     | 2.5D                  | -                 | 2               | 30°                                  |            | -             |             |                   |                 |                |        |       | 32              | T-084 |

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| Model                                                                                      | Size                                       | Maximum Cutting Depth | Under Neck Length | Number of Flute | Helix Angle | Work Material |             |                   |                 |                 |        |       | Number of Sizes | Page  |
|--------------------------------------------------------------------------------------------|--------------------------------------------|-----------------------|-------------------|-----------------|-------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|-----------------|-------|
|                                                                                            |                                            |                       |                   |                 |             | P             | P           | P                 | M               | N               | N      | N     |                 |       |
|                                                                                            |                                            |                       |                   |                 |             | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin |                 |       |
| Ball                                                                                       |                                            |                       |                   |                 |             |               |             |                   |                 |                 |        |       |                 |       |
|  NCB-2    | R0.2 ~ R0.9                                | 2D                    | -                 | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 12              | T-086 |
|  NSB-2    | R1 ~ R10                                   | 1D                    | -                 | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 17              | T-088 |
|  NSBL-2   | R3 ~ R10                                   | 2.5D                  | -                 | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 6               | T-090 |
|  NLBL-2   | R0.5 ~ R10                                 | 5D                    | -                 | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 49              | T-092 |
|  DB       | R0.5 ~ R10                                 | 2D                    | -                 | 2               | 25°         | -             | -           | -                 | -               | ◎               | ◎      | ◎     | 14              | T-094 |
| Long Neck Ball                                                                             |                                            |                       |                   |                 |             |               |             |                   |                 |                 |        |       |                 |       |
|  DHB     | R0.5 ~ R6                                  | 11D                   | 4<br>~<br>80      | 2               | 25°         | -             | -           | -                 | -               | ◎               | ◎      | ◎     | 30              | T-096 |
|  NHB-2  | R0.4 ~ R5                                  | 13D                   | 6<br>~<br>70      | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 43              | T-098 |
| Tapered Ball                                                                               |                                            |                       |                   |                 |             |               |             |                   |                 |                 |        |       |                 |       |
|  NTB-2  | R0.5×taper angle30°<br>~ R5×taper angle10° | 10D                   | -                 | 2               | 35°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 90              | T-102 |
|  NERB-2 | R1×taper angle10°<br>~ R3×taper angle20°   | 2D                    | -                 | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 21              | T-104 |
| Corner Radius                                                                              |                                            |                       |                   |                 |             |               |             |                   |                 |                 |        |       |                 |       |
|  NSR-2  | φ1×R0.2<br>~ φ20×R5                        | 3D                    | -                 | 2               | 30°         | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 54              | T-106 |
| Chamfering                                                                                 |                                            |                       |                   |                 |             |               |             |                   |                 |                 |        |       |                 |       |
|  NCR-2  | R0.5 ~ R5                                  | -                     | -                 | 2               | -           | ○             | ○           | ○                 | ○               | ◎               | ◎      | ◎     | 19              | T-108 |
|  DIR    | R0.1 ~ R5                                  | -                     | -                 | 2               | -           | -             | -           | -                 | -               | ◎               | ◎      | ◎     | 29              | T-110 |



● L/D=1 and helix angle 25°, Low helix angle minimize the milling deflection of work piece.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00025-00050 | 0.5      | 0.5               | 9°                   | 4              | 40                 |
| 01-00025-00060 | 0.6      | 0.6               | 9°                   | 4              | 40                 |
| 01-00025-00070 | 0.7      | 0.7               | 9°                   | 4              | 40                 |
| 01-00025-00080 | 0.8      | 0.8               | 9°                   | 4              | 40                 |
| 01-00025-00090 | 0.9      | 0.9               | 9°                   | 4              | 40                 |
| 01-00025-00100 | 1        | 1                 | 9°                   | 4              | 40                 |
| 01-00025-00110 | 1.1      | 1.1               | 9°                   | 4              | 40                 |
| 01-00025-00120 | 1.2      | 1.2               | 9°                   | 4              | 40                 |
| 01-00025-00130 | 1.3      | 1.3               | 9°                   | 4              | 40                 |
| 01-00025-00140 | 1.4      | 1.4               | 9°                   | 4              | 40                 |
| 01-00025-00150 | 1.5      | 1.5               | 9°                   | 4              | 40                 |
| 01-00025-00160 | 1.6      | 1.6               | 9°                   | 4              | 40                 |
| 01-00025-00170 | 1.7      | 1.7               | 9°                   | 4              | 40                 |
| 01-00025-00180 | 1.8      | 1.8               | 9°                   | 4              | 40                 |
| 01-00025-00190 | 1.9      | 1.9               | 9°                   | 4              | 40                 |
| 01-00025-00200 | 2        | 2                 | 9°                   | 4              | 40                 |
| 01-00025-00210 | 2.1      | 2.1               | 9°                   | 4              | 40                 |
| 01-00025-00220 | 2.2      | 2.2               | 9°                   | 4              | 40                 |
| 01-00025-00230 | 2.3      | 2.3               | 9°                   | 4              | 40                 |
| 01-00025-00240 | 2.4      | 2.4               | 9°                   | 4              | 40                 |
| 01-00025-00250 | 2.5      | 2.5               | 9°                   | 4              | 40                 |
| 01-00025-00260 | 2.6      | 2.6               | 9°                   | 6              | 40                 |
| 01-00025-00270 | 2.7      | 2.7               | 9°                   | 6              | 40                 |
| 01-00025-00280 | 2.8      | 2.8               | 9°                   | 6              | 40                 |
| 01-00025-00290 | 2.9      | 2.9               | 9°                   | 6              | 40                 |
| 01-00025-00300 | 3        | 3                 | 9°                   | 6              | 40                 |
| 01-00025-00310 | 3.1      | 3.1               | 9°                   | 6              | 40                 |
| 01-00025-00320 | 3.2      | 3.2               | 9°                   | 6              | 40                 |
| 01-00025-00330 | 3.3      | 3.3               | 9°                   | 6              | 40                 |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00025-00340 | 3.4      | 3.4               | 9°                   | 6              | 40                 |
| 01-00025-00350 | 3.5      | 3.5               | 9°                   | 6              | 40                 |
| 01-00025-00360 | 3.6      | 3.6               | 9°                   | 6              | 40                 |
| 01-00025-00370 | 3.7      | 3.7               | 9°                   | 6              | 40                 |
| 01-00025-00380 | 3.8      | 3.8               | 9°                   | 6              | 40                 |
| 01-00025-00390 | 3.9      | 3.9               | 9°                   | 6              | 40                 |
| 01-00025-00400 | 4        | 4                 | 9°                   | 6              | 40                 |
| 01-00025-00410 | 4.1      | 4.1               | 9°                   | 6              | 45                 |
| 01-00025-00420 | 4.2      | 4.2               | 9°                   | 6              | 45                 |
| 01-00025-00430 | 4.3      | 4.3               | 9°                   | 6              | 45                 |
| 01-00025-00440 | 4.4      | 4.4               | 9°                   | 6              | 45                 |
| 01-00025-00450 | 4.5      | 4.5               | 9°                   | 6              | 45                 |
| 01-00025-00460 | 4.6      | 4.6               | 9°                   | 6              | 45                 |
| 01-00025-00470 | 4.7      | 4.7               | 9°                   | 6              | 45                 |
| 01-00025-00480 | 4.8      | 4.8               | 9°                   | 6              | 45                 |
| 01-00025-00490 | 4.9      | 4.9               | 9°                   | 6              | 45                 |
| 01-00025-00500 | 5        | 5                 | 9°                   | 6              | 45                 |
| 01-00025-00510 | 5.1      | 5.1               | 9°                   | 6              | 50                 |
| 01-00025-00520 | 5.2      | 5.2               | 9°                   | 6              | 50                 |
| 01-00025-00530 | 5.3      | 5.3               | 9°                   | 6              | 50                 |
| 01-00025-00540 | 5.4      | 5.4               | 9°                   | 6              | 50                 |
| 01-00025-00550 | 5.5      | 5.5               | 9°                   | 6              | 50                 |
| 01-00025-00560 | 5.6      | 5.6               | 9°                   | 6              | 50                 |
| 01-00025-00570 | 5.7      | 5.7               | 9°                   | 6              | 50                 |
| 01-00025-00580 | 5.8      | 5.8               | 9°                   | 6              | 50                 |
| 01-00025-00590 | 5.9      | 5.9               | 9°                   | 6              | 50                 |
| 01-00025-00600 | 6        | 6                 | —                    | 6              | 50                 |
| 01-00025-00610 | 6.1      | 6.1               | 9°                   | 8              | 55                 |
| 01-00025-00620 | 6.2      | 6.2               | 9°                   | 8              | 55                 |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00025-00630 | 6.3      | 6.3               | 9°                   | 8              | 55                 |
| 01-00025-00640 | 6.4      | 6.4               | 9°                   | 8              | 55                 |
| 01-00025-00650 | 6.5      | 6.5               | 9°                   | 8              | 55                 |
| 01-00025-00660 | 6.6      | 6.6               | 9°                   | 8              | 55                 |
| 01-00025-00670 | 6.7      | 6.7               | 9°                   | 8              | 55                 |
| 01-00025-00680 | 6.8      | 6.8               | 9°                   | 8              | 55                 |
| 01-00025-00690 | 6.9      | 6.9               | 9°                   | 8              | 55                 |
| 01-00025-00700 | 7        | 7                 | 9°                   | 8              | 55                 |
| 01-00025-00710 | 7.1      | 7.1               | 9°                   | 8              | 55                 |
| 01-00025-00720 | 7.2      | 7.2               | 9°                   | 8              | 55                 |
| 01-00025-00730 | 7.3      | 7.3               | 9°                   | 8              | 55                 |
| 01-00025-00740 | 7.4      | 7.4               | 9°                   | 8              | 55                 |
| 01-00025-00750 | 7.5      | 7.5               | 9°                   | 8              | 55                 |
| 01-00025-00760 | 7.6      | 7.6               | 9°                   | 8              | 55                 |
| 01-00025-00770 | 7.7      | 7.7               | 9°                   | 8              | 55                 |
| 01-00025-00780 | 7.8      | 7.8               | 9°                   | 8              | 55                 |
| 01-00025-00790 | 7.9      | 7.9               | 9°                   | 8              | 55                 |
| 01-00025-00800 | 8        | 8                 | —                    | 8              | 55                 |
| 01-00025-00810 | 8.1      | 8.1               | 9°                   | 10             | 65                 |
| 01-00025-00820 | 8.2      | 8.2               | 9°                   | 10             | 65                 |
| 01-00025-00830 | 8.3      | 8.3               | 9°                   | 10             | 65                 |
| 01-00025-00840 | 8.4      | 8.4               | 9°                   | 10             | 65                 |
| 01-00025-00850 | 8.5      | 8.5               | 9°                   | 10             | 65                 |
| 01-00025-00860 | 8.6      | 8.6               | 9°                   | 10             | 65                 |
| 01-00025-00870 | 8.7      | 8.7               | 9°                   | 10             | 65                 |
| 01-00025-00880 | 8.8      | 8.8               | 9°                   | 10             | 65                 |
| 01-00025-00890 | 8.9      | 8.9               | 9°                   | 10             | 65                 |
| 01-00025-00900 | 9        | 9                 | 9°                   | 10             | 65                 |
| 01-00025-00910 | 9.1      | 9.1               | 9°                   | 10             | 65                 |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00025-00920 | 9.2      | 9.2               | 9°                   | 10             | 65                 |
| 01-00025-00930 | 9.3      | 9.3               | 9°                   | 10             | 65                 |
| 01-00025-00940 | 9.4      | 9.4               | 9°                   | 10             | 65                 |
| 01-00025-00950 | 9.5      | 9.5               | 9°                   | 10             | 65                 |
| 01-00025-00960 | 9.6      | 9.6               | 9°                   | 10             | 65                 |
| 01-00025-00970 | 9.7      | 9.7               | 9°                   | 10             | 65                 |
| 01-00025-00980 | 9.8      | 9.8               | 9°                   | 10             | 65                 |
| 01-00025-00990 | 9.9      | 9.9               | 9°                   | 10             | 65                 |
| 01-00025-01000 | 10       | 10                | —                    | 10             | 65                 |
| 01-00025-01010 | 10.1     | 10.1              | 9°                   | 12             | 70                 |
| 01-00025-01020 | 10.2     | 10.2              | 9°                   | 12             | 70                 |
| 01-00025-01030 | 10.3     | 10.3              | 9°                   | 12             | 70                 |
| 01-00025-01040 | 10.4     | 10.4              | 9°                   | 12             | 70                 |
| 01-00025-01050 | 10.5     | 10.5              | 9°                   | 12             | 70                 |
| 01-00025-01060 | 10.6     | 10.6              | 9°                   | 12             | 70                 |
| 01-00025-01070 | 10.7     | 10.7              | 9°                   | 12             | 70                 |
| 01-00025-01080 | 10.8     | 10.8              | 9°                   | 12             | 70                 |
| 01-00025-01090 | 10.9     | 10.9              | 9°                   | 12             | 70                 |
| 01-00025-01100 | 11       | 11                | 9°                   | 12             | 70                 |
| 01-00025-01110 | 11.1     | 11.1              | 9°                   | 12             | 70                 |
| 01-00025-01120 | 11.2     | 11.2              | 9°                   | 12             | 70                 |
| 01-00025-01130 | 11.3     | 11.3              | 9°                   | 12             | 70                 |
| 01-00025-01140 | 11.4     | 11.4              | 9°                   | 12             | 70                 |
| 01-00025-01150 | 11.5     | 11.5              | 9°                   | 12             | 70                 |
| 01-00025-01160 | 11.6     | 11.6              | 9°                   | 12             | 70                 |
| 01-00025-01170 | 11.7     | 11.7              | 9°                   | 12             | 70                 |
| 01-00025-01180 | 11.8     | 11.8              | 9°                   | 12             | 70                 |
| 01-00025-01190 | 11.9     | 11.9              | 9°                   | 12             | 70                 |
| 01-00025-01200 | 12       | 12                | —                    | 12             | 70                 |

How to Order

When you order, indicate NX-25 (D). ※(γ) is reference value.

● : Semi-standard Products, please inquire for price and delivery.

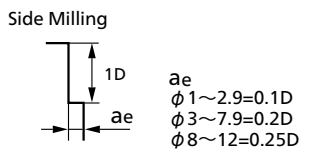
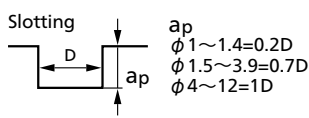
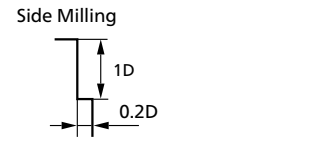
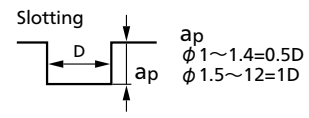


Square



Square

Recommended Milling Conditions

| Work Material | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |          | Alloy Steels<br>SCM・SKD・SUS |                 |          | Prehardened Steels<br>HPM・NAK |                 |          | Aluminium Alloy   |                 |          | Copper            |                 |          |  |  |  |  |  |  |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|-------------------------------|-----------------|----------|-------------------|-----------------|----------|-------------------|-----------------|----------|--|--|--|--|--|--|
| Cutting Speed | 40～50m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |          | 35～45m/min                  |                 |          | 25～35m/min                    |                 |          | 100～200m/min      |                 |          | 60～80m/min        |                 |          |  |  |  |  |  |  |
| Dia.          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed              | Feed            |          | Spindle<br>Speed  | Feed            |          | Spindle<br>Speed  | Feed            |          |  |  |  |  |  |  |
|               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>             | mm/min          |          | min <sup>-1</sup> | mm/min          |          | min <sup>-1</sup> | mm/min          |          |  |  |  |  |  |  |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                               | Side<br>Milling | Slotting |                   | Side<br>Milling | Slotting |                   | Side<br>Milling | Slotting |  |  |  |  |  |  |
| 1             | 14,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 140             | 70       | 12,700                      | 100             | 35       | 9,500                         | 80              | 40       | 47,700            | 570             | 200      | 22,300            | 270             | 95       |  |  |  |  |  |  |
| 1.5           | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 140             | 70       | 8,500                       | 100             | 35       | 6,400                         | 80              | 40       | 31,800            | 640             | 220      | 14,900            | 300             | 100      |  |  |  |  |  |  |
| 2             | 7,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 140             | 70       | 6,400                       | 120             | 40       | 4,800                         | 90              | 45       | 23,900            | 720             | 250      | 11,100            | 330             | 120      |  |  |  |  |  |  |
| 2.5           | 5,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 170             | 85       | 5,100                       | 120             | 45       | 3,800                         | 95              | 50       | 19,100            | 760             | 270      | 8,900             | 360             | 120      |  |  |  |  |  |  |
| 3             | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 190             | 95       | 4,200                       | 130             | 45       | 3,200                         | 100             | 50       | 15,900            | 800             | 270      | 7,400             | 370             | 130      |  |  |  |  |  |  |
| 4             | 3,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 220             | 110      | 3,200                       | 130             | 45       | 2,400                         | 100             | 50       | 11,900            | 830             | 270      | 5,600             | 390             | 130      |  |  |  |  |  |  |
| 5             | 2,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 230             | 120      | 2,500                       | 150             | 50       | 1,900                         | 130             | 65       | 9,500             | 860             | 280      | 4,500             | 410             | 130      |  |  |  |  |  |  |
| 6             | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 240             | 120      | 2,100                       | 170             | 55       | 1,600                         | 140             | 70       | 8,000             | 880             | 290      | 3,700             | 410             | 130      |  |  |  |  |  |  |
| 8             | 1,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 220             | 110      | 1,600                       | 160             | 50       | 1,200                         | 130             | 65       | 6,000             | 780             | 260      | 2,800             | 360             | 120      |  |  |  |  |  |  |
| 10            | 1,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 200             | 100      | 1,300                       | 160             | 50       | 1,000                         | 130             | 65       | 4,800             | 720             | 240      | 2,200             | 330             | 110      |  |  |  |  |  |  |
| 12            | 1,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 190             | 95       | 1,100                       | 150             | 50       | 800                           | 120             | 60       | 4,000             | 680             | 220      | 1,900             | 320             | 110      |  |  |  |  |  |  |
| Depth of Cut  | <div><div>Side Milling</div><div></div><div>Slotting</div><div></div></div> <div><div>Side Milling</div><div></div><div>Slotting</div><div></div></div> |                 |          |                             |                 |          |                               |                 |          |                   |                 |          |                   |                 |          |  |  |  |  |  |  |
| (D: Dia.)     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |          |                             |                 |          |                               |                 |          |                   |                 |          |                   |                 |          |  |  |  |  |  |  |
| Notes         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                                                                                                                                                                                                                                                                 |                 |          |                             |                 |          |                               |                 |          |                   |                 |          |                   |                 |          |  |  |  |  |  |  |



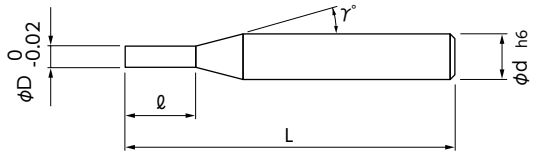
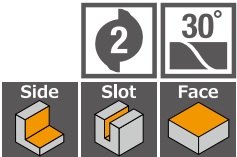
Square



Square

LEAD 30 End Mill

LEAD 30 End Mill



● L/D=2 and helix angle 30° Standard type applicable from roughing to finishing process.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00030-00050 | 0.5      | 1                 | 9°                   | 4              | 40                 |
| 01-00030-00060 | 0.6      | 1.2               | 9°                   | 4              | 40                 |
| 01-00030-00070 | 0.7      | 1.4               | 9°                   | 4              | 40                 |
| 01-00030-00080 | 0.8      | 1.6               | 9°                   | 4              | 40                 |
| 01-00030-00090 | 0.9      | 1.8               | 9°                   | 4              | 40                 |
| 01-00030-00100 | 1        | 2                 | 9°                   | 4              | 40                 |
| 01-00030-00110 | 1.1      | 2.2               | 9°                   | 4              | 40                 |
| 01-00030-00120 | 1.2      | 2.4               | 9°                   | 4              | 40                 |
| 01-00030-00130 | 1.3      | 2.6               | 9°                   | 4              | 40                 |
| 01-00030-00140 | 1.4      | 2.8               | 9°                   | 4              | 40                 |
| 01-00030-00150 | 1.5      | 3                 | 9°                   | 4              | 40                 |
| 01-00030-00160 | 1.6      | 3.2               | 9°                   | 4              | 40                 |
| 01-00030-00170 | 1.7      | 3.4               | 9°                   | 4              | 40                 |
| 01-00030-00180 | 1.8      | 3.6               | 9°                   | 4              | 40                 |
| 01-00030-00190 | 1.9      | 3.8               | 9°                   | 4              | 40                 |
| 01-00030-00200 | 2        | 4                 | 9°                   | 4              | 40                 |
| 01-00030-00210 | 2.1      | 4.2               | 9°                   | 4              | 40                 |
| 01-00030-00220 | 2.2      | 4.4               | 9°                   | 4              | 40                 |
| 01-00030-00230 | 2.3      | 4.6               | 9°                   | 4              | 40                 |
| 01-00030-00240 | 2.4      | 4.8               | 9°                   | 4              | 40                 |
| 01-00030-00250 | 2.5      | 5                 | 9°                   | 4              | 40                 |
| 01-00030-00260 | 2.6      | 5.2               | 9°                   | 6              | 45                 |
| 01-00030-00270 | 2.7      | 5.4               | 9°                   | 6              | 45                 |
| 01-00030-00280 | 2.8      | 5.6               | 9°                   | 6              | 45                 |
| 01-00030-00290 | 2.9      | 5.8               | 9°                   | 6              | 45                 |
| 01-00030-00300 | 3        | 6                 | 9°                   | 6              | 45                 |
| 01-00030-00310 | 3.1      | 6.2               | 9°                   | 6              | 45                 |
| 01-00030-00320 | 3.2      | 6.4               | 9°                   | 6              | 45                 |
| 01-00030-00330 | 3.3      | 6.6               | 9°                   | 6              | 45                 |

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00030-00340 | 3.4      | 6.8               | 9°                   | 6              | 45                 |
| 01-00030-00350 | 3.5      | 7                 | 9°                   | 6              | 45                 |
| 01-00030-00360 | 3.6      | 7.2               | 9°                   | 6              | 45                 |
| 01-00030-00370 | 3.7      | 7.4               | 9°                   | 6              | 45                 |
| 01-00030-00380 | 3.8      | 7.6               | 9°                   | 6              | 45                 |
| 01-00030-00390 | 3.9      | 7.8               | 9°                   | 6              | 45                 |
| 01-00030-00400 | 4        | 8                 | 9°                   | 6              | 45                 |
| 01-00030-00410 | 4.1      | 8.2               | 9°                   | 6              | 50                 |
| 01-00030-00420 | 4.2      | 8.4               | 9°                   | 6              | 50                 |
| 01-00030-00430 | 4.3      | 8.6               | 9°                   | 6              | 50                 |
| 01-00030-00440 | 4.4      | 8.8               | 9°                   | 6              | 50                 |
| 01-00030-00450 | 4.5      | 9                 | 9°                   | 6              | 50                 |
| 01-00030-00460 | 4.6      | 9.2               | 9°                   | 6              | 50                 |
| 01-00030-00470 | 4.7      | 9.4               | 9°                   | 6              | 50                 |
| 01-00030-00480 | 4.8      | 9.6               | 9°                   | 6              | 50                 |
| 01-00030-00490 | 4.9      | 9.8               | 9°                   | 6              | 50                 |
| 01-00030-00500 | 5        | 10                | 9°                   | 6              | 50                 |
| 01-00030-00510 | 5.1      | 10.2              | 9°                   | 6              | 50                 |
| 01-00030-00520 | 5.2      | 10.4              | 9°                   | 6              | 50                 |
| 01-00030-00530 | 5.3      | 10.6              | 9°                   | 6              | 50                 |
| 01-00030-00540 | 5.4      | 10.8              | 9°                   | 6              | 50                 |
| 01-00030-00550 | 5.5      | 11                | 9°                   | 6              | 50                 |
| 01-00030-00560 | 5.6      | 11.2              | 9°                   | 6              | 50                 |
| 01-00030-00570 | 5.7      | 11.4              | 9°                   | 6              | 50                 |
| 01-00030-00580 | 5.8      | 11.6              | 9°                   | 6              | 50                 |
| 01-00030-00590 | 5.9      | 11.8              | 9°                   | 6              | 50                 |
| 01-00030-00600 | 6        | 12                | —                    | 6              | 50                 |
| 01-00030-00610 | 6.1      | 12.2              | 9°                   | 8              | 60                 |
| 01-00030-00620 | 6.2      | 12.4              | 9°                   | 8              | 60                 |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00030-00630 | 6.3      | 12.6              | 9°                   | 8              | 60                 |
| 01-00030-00640 | 6.4      | 12.8              | 9°                   | 8              | 60                 |
| 01-00030-00650 | 6.5      | 13                | 9°                   | 8              | 60                 |
| 01-00030-00660 | 6.6      | 13.2              | 9°                   | 8              | 60                 |
| 01-00030-00670 | 6.7      | 13.4              | 9°                   | 8              | 60                 |
| 01-00030-00680 | 6.8      | 13.6              | 9°                   | 8              | 60                 |
| 01-00030-00690 | 6.9      | 13.8              | 9°                   | 8              | 60                 |
| 01-00030-00700 | 7        | 14                | 9°                   | 8              | 60                 |
| 01-00030-00710 | 7.1      | 14.2              | 9°                   | 8              | 60                 |
| 01-00030-00720 | 7.2      | 14.4              | 9°                   | 8              | 60                 |
| 01-00030-00730 | 7.3      | 14.6              | 9°                   | 8              | 60                 |
| 01-00030-00740 | 7.4      | 14.8              | 9°                   | 8              | 60                 |
| 01-00030-00750 | 7.5      | 15                | 9°                   | 8              | 60                 |
| 01-00030-00760 | 7.6      | 15.2              | 9°                   | 8              | 60                 |
| 01-00030-00770 | 7.7      | 15.4              | 9°                   | 8              | 60                 |
| 01-00030-00780 | 7.8      | 15.6              | 9°                   | 8              | 60                 |
| 01-00030-00790 | 7.9      | 15.8              | 9°                   | 8              | 60                 |
| 01-00030-00800 | 8        | 16                | —                    | 8              | 60                 |
| 01-00030-00810 | 8.1      | 16.2              | 9°                   | 10             | 70                 |
| 01-00030-00820 | 8.2      | 16.4              | 9°                   | 10             | 70                 |
| 01-00030-00830 | 8.3      | 16.6              | 9°                   | 10             | 70                 |
| 01-00030-00840 | 8.4      | 16.8              | 9°                   | 10             | 70                 |
| 01-00030-00850 | 8.5      | 17                | 9°                   | 10             | 70                 |
| 01-00030-00860 | 8.6      | 17.2              | 9°                   | 10             | 70                 |
| 01-00030-00870 | 8.7      | 17.4              | 9°                   | 10             | 70                 |
| 01-00030-00880 | 8.8      | 17.6              | 9°                   | 10             | 70                 |
| 01-00030-00890 | 8.9      | 17.8              | 9°                   | 10             | 70                 |
| 01-00030-00900 | 9        | 18                | 9°                   | 10             | 70                 |
| 01-00030-00910 | 9.1      | 18.2              | 9°                   | 10             | 70                 |

| Code No.       | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00030-00920 | 9.2      | 18.4              | 9°                   | 10             | 70                 |
| 01-00030-00930 | 9.3      | 18.6              | 9°                   | 10             | 70                 |
| 01-00030-00940 | 9.4      | 18.8              | 9°                   | 10             | 70                 |
| 01-00030-00950 | 9.5      | 19                | 9°                   | 10             | 70                 |
| 01-00030-00960 | 9.6      | 19.2              | 9°                   | 10             | 70                 |
| 01-00030-00970 | 9.7      | 19.4              | 9°                   | 10             | 70                 |
| 01-00030-00980 | 9.8      | 19.6              | 9°                   | 10             | 70                 |
| 01-00030-00990 | 9.9      | 19.8              | 9°                   | 10             | 70                 |
| 01-00030-01000 | 10       | 20                | —                    | 10             | 70                 |
| 01-00030-01010 | 10.1     | 20.2              | 9°                   | 12             | 75                 |
| 01-00030-01020 | 10.2     | 20.4              | 9°                   | 12             | 75                 |
| 01-00030-01030 | 10.3     | 20.6              | 9°                   | 12             | 75                 |
| 01-00030-01040 | 10.4     | 20.8              | 9°                   | 12             | 75                 |
| 01-00030-01050 | 10.5     | 21                | 9°                   | 12             | 75                 |
| 01-00030-01060 | 10.6     | 21.2              | 9°                   | 12             | 75                 |
| 01-00030-01070 | 10.7     | 21.4              | 9°                   | 12             | 75                 |
| 01-00030-01080 | 10.8     | 21.6              | 9°                   | 12             | 75                 |
| 01-00030-01090 | 10.9     | 21.8              | 9°                   | 12             | 75                 |
| 01-00030-01100 | 11       | 22                | 9°                   | 12             | 75                 |
| 01-00030-01110 | 11.1     | 22.2              | 9°                   | 12             | 75                 |
| 01-00030-01120 | 11.2     | 22.4              | 9°                   | 12             | 75                 |
| 01-00030-01130 | 11.3     | 22.6              | 9°                   | 12             | 75                 |
| 01-00030-01140 | 11.4     | 22.8              | 9°                   | 12             | 75                 |
| 01-00030-01150 | 11.5     | 23                | 9°                   | 12             | 75                 |
| 01-00030-01160 | 11.6     | 23.2              | 9°                   | 12             | 75                 |
| 01-00030-01170 | 11.7     | 23.4              | 9°                   | 12             | 75                 |
| 01-00030-01180 | 11.8     | 23.6              | 9°                   | 12             | 75                 |
| 01-00030-01190 | 11.9     | 23.8              | 9°                   | 12             | 75                 |
| 01-00030-01200 | 12       | 24                | —                    | 12             | 75                 |

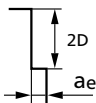
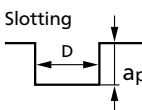
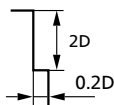
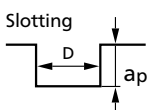
How to Order

When you order, indicate NX-30 (D). ※( γ ) is reference value.

● : Semi-standard Products, please inquire for price and delivery.



Recommended Milling Conditions

| Work Material | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |          | Alloy Steels<br>SCM・SKD・SUS |                 |          | Prehardened Steels<br>HPM・NAK |                 |          | Aluminium Alloy                                                                                                                                                                                                                                                                                                                                                          |                 |          | Copper            |                 |          |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|-------------------------------|-----------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-------------------|-----------------|----------|
| Cutting Speed | 40～50m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |          | 35～45m/min                  |                 |          | 25～35m/min                    |                 |          | 100～200m/min                                                                                                                                                                                                                                                                                                                                                             |                 |          | 60～80m/min        |                 |          |
| Dia.          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed              | Feed            |          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                         | Feed            |          | Spindle<br>Speed  | Feed            |          |
|               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>             | mm/min          |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                        | mm/min          |          | min <sup>-1</sup> | mm/min          |          |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                               | Side<br>Milling | Slotting |                                                                                                                                                                                                                                                                                                                                                                          | Side<br>Milling | Slotting |                   | Side<br>Milling | Slotting |
| 1             | 14,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 140             | 70       | 12,700                      | 100             | 35       | 9,500                         | 80              | 40       | 47,700                                                                                                                                                                                                                                                                                                                                                                   | 570             | 200      | 22,300            | 270             | 95       |
| 1.5           | 9,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 140             | 70       | 8,500                       | 100             | 35       | 6,400                         | 80              | 40       | 31,800                                                                                                                                                                                                                                                                                                                                                                   | 640             | 220      | 14,900            | 300             | 100      |
| 2             | 7,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 140             | 70       | 6,400                       | 120             | 40       | 4,800                         | 90              | 45       | 23,900                                                                                                                                                                                                                                                                                                                                                                   | 720             | 250      | 11,100            | 330             | 120      |
| 2.5           | 5,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 170             | 85       | 5,100                       | 120             | 40       | 3,800                         | 95              | 50       | 19,100                                                                                                                                                                                                                                                                                                                                                                   | 760             | 270      | 8,900             | 360             | 120      |
| 3             | 4,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 190             | 95       | 4,200                       | 130             | 45       | 3,200                         | 100             | 50       | 15,900                                                                                                                                                                                                                                                                                                                                                                   | 800             | 270      | 7,400             | 370             | 130      |
| 4             | 3,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 220             | 110      | 3,200                       | 130             | 45       | 2,400                         | 100             | 50       | 11,900                                                                                                                                                                                                                                                                                                                                                                   | 830             | 270      | 5,600             | 390             | 130      |
| 5             | 2,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 230             | 120      | 2,500                       | 150             | 50       | 1,900                         | 130             | 65       | 9,500                                                                                                                                                                                                                                                                                                                                                                    | 860             | 280      | 4,500             | 410             | 130      |
| 6             | 2,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 240             | 120      | 2,100                       | 170             | 55       | 1,600                         | 140             | 70       | 8,000                                                                                                                                                                                                                                                                                                                                                                    | 880             | 290      | 3,700             | 410             | 130      |
| 8             | 1,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 220             | 110      | 1,600                       | 160             | 50       | 1,200                         | 130             | 65       | 6,000                                                                                                                                                                                                                                                                                                                                                                    | 780             | 260      | 2,800             | 360             | 120      |
| 10            | 1,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 200             | 100      | 1,300                       | 160             | 50       | 1,000                         | 130             | 65       | 4,800                                                                                                                                                                                                                                                                                                                                                                    | 720             | 240      | 2,200             | 330             | 110      |
| 12            | 1,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 190             | 95       | 1,100                       | 150             | 50       | 800                           | 120             | 60       | 4,000                                                                                                                                                                                                                                                                                                                                                                    | 680             | 220      | 1,900             | 320             | 110      |
| Depth of Cut  | <div>Side Milling</div> <div></div> <div><math>a_e</math><br/><math>\phi 1 \sim 2.9 = 0.07D</math><br/><math>\phi 3 \sim 12 = 0.15D</math></div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 1 \sim 1.4 = 0.15D</math><br/><math>\phi 1.5 \sim 3.9 = 0.5D</math><br/><math>\phi 4 \sim 12 = 0.75D</math></div> |                 |          |                             |                 |          |                               |                 |          | <div>Side Milling</div> <div></div> <div>0.2D</div> <div>Slotting</div> <div></div> <div><math>a_p</math><br/><math>\phi 1 \sim 1.4 = 0.4D</math><br/><math>\phi 1.5 \sim 12 = 0.75D</math></div> |                 |          |                   |                 |          |
| (D: Dia.)     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |          |                             |                 |          |                               |                 |          |                                                                                                                                                                                                                                                                                                                                                                          |                 |          |                   |                 |          |
| Notes         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                                                                                                                                                                                                                                                                         |                 |          |                             |                 |          |                               |                 |          |                                                                                                                                                                                                                                                                                                                                                                          |                 |          |                   |                 |          |



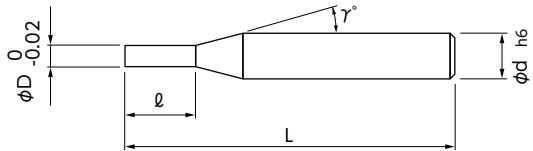
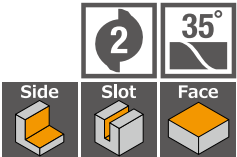
Square



Square

LEAD 35 End Mill

LEAD 35 End Mill



● L/D=3 and helix angle 35°, Higher efficient cutting is possible compared with standard helix angle.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00035-00050 | 0.5      | 1.5               | 9°                   | 4              | 40                 |
| 01-00035-00060 | 0.6      | 1.8               | 9°                   | 4              | 40                 |
| 01-00035-00070 | 0.7      | 2.1               | 9°                   | 4              | 40                 |
| 01-00035-00080 | 0.8      | 2.4               | 9°                   | 4              | 40                 |
| 01-00035-00090 | 0.9      | 2.7               | 9°                   | 4              | 40                 |
| 01-00035-00100 | 1        | 3                 | 9°                   | 4              | 45                 |
| 01-00035-00110 | 1.1      | 3.3               | 9°                   | 4              | 45                 |
| 01-00035-00120 | 1.2      | 3.6               | 9°                   | 4              | 45                 |
| 01-00035-00130 | 1.3      | 3.9               | 9°                   | 4              | 45                 |
| 01-00035-00140 | 1.4      | 4.2               | 9°                   | 4              | 45                 |
| 01-00035-00150 | 1.5      | 4.5               | 9°                   | 4              | 45                 |
| 01-00035-00160 | 1.6      | 4.8               | 9°                   | 4              | 45                 |
| 01-00035-00170 | 1.7      | 5.1               | 9°                   | 4              | 45                 |
| 01-00035-00180 | 1.8      | 5.4               | 9°                   | 4              | 45                 |
| 01-00035-00190 | 1.9      | 5.7               | 9°                   | 4              | 45                 |
| 01-00035-00200 | 2        | 6                 | 9°                   | 4              | 45                 |
| 01-00035-00210 | 2.1      | 6.3               | 9°                   | 4              | 45                 |
| 01-00035-00220 | 2.2      | 6.6               | 9°                   | 4              | 45                 |
| 01-00035-00230 | 2.3      | 6.9               | 9°                   | 4              | 45                 |
| 01-00035-00240 | 2.4      | 7.2               | 9°                   | 4              | 45                 |
| 01-00035-00250 | 2.5      | 7.5               | 9°                   | 4              | 45                 |
| 01-00035-00260 | 2.6      | 7.8               | 9°                   | 6              | 45                 |
| 01-00035-00270 | 2.7      | 8.1               | 9°                   | 6              | 45                 |
| 01-00035-00280 | 2.8      | 8.4               | 9°                   | 6              | 45                 |
| 01-00035-00290 | 2.9      | 8.7               | 9°                   | 6              | 45                 |
| 01-00035-00300 | 3        | 9                 | 9°                   | 6              | 45                 |
| 01-00035-00310 | 3.1      | 9.3               | 9°                   | 6              | 50                 |
| 01-00035-00320 | 3.2      | 9.6               | 9°                   | 6              | 50                 |
| 01-00035-00330 | 3.3      | 9.9               | 9°                   | 6              | 50                 |

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00035-00340 | 3.4      | 10.2              | 9°                   | 6              | 50                 |
| 01-00035-00350 | 3.5      | 10.5              | 9°                   | 6              | 50                 |
| 01-00035-00360 | 3.6      | 10.8              | 9°                   | 6              | 50                 |
| 01-00035-00370 | 3.7      | 11.1              | 9°                   | 6              | 50                 |
| 01-00035-00380 | 3.8      | 11.4              | 9°                   | 6              | 50                 |
| 01-00035-00390 | 3.9      | 11.7              | 9°                   | 6              | 50                 |
| 01-00035-00400 | 4        | 12                | 9°                   | 6              | 50                 |
| 01-00035-00410 | 4.1      | 12.3              | 9°                   | 6              | 55                 |
| 01-00035-00420 | 4.2      | 12.6              | 9°                   | 6              | 55                 |
| 01-00035-00430 | 4.3      | 12.9              | 9°                   | 6              | 55                 |
| 01-00035-00440 | 4.4      | 13.2              | 9°                   | 6              | 55                 |
| 01-00035-00450 | 4.5      | 13.5              | 9°                   | 6              | 55                 |
| 01-00035-00460 | 4.6      | 13.8              | 9°                   | 6              | 55                 |
| 01-00035-00470 | 4.7      | 14.1              | 9°                   | 6              | 55                 |
| 01-00035-00480 | 4.8      | 14.4              | 9°                   | 6              | 55                 |
| 01-00035-00490 | 4.9      | 14.7              | 9°                   | 6              | 55                 |
| 01-00035-00500 | 5        | 15                | 9°                   | 6              | 55                 |
| 01-00035-00510 | 5.1      | 15.3              | 9°                   | 6              | 60                 |
| 01-00035-00520 | 5.2      | 15.6              | 9°                   | 6              | 60                 |
| 01-00035-00530 | 5.3      | 15.9              | 9°                   | 6              | 60                 |
| 01-00035-00540 | 5.4      | 16.2              | 9°                   | 6              | 60                 |
| 01-00035-00550 | 5.5      | 16.5              | 9°                   | 6              | 60                 |
| 01-00035-00560 | 5.6      | 16.8              | 9°                   | 6              | 60                 |
| 01-00035-00570 | 5.7      | 17.1              | 9°                   | 6              | 60                 |
| 01-00035-00580 | 5.8      | 17.4              | 9°                   | 6              | 60                 |
| 01-00035-00590 | 5.9      | 17.7              | 9°                   | 6              | 60                 |
| 01-00035-00600 | 6        | 18                | —                    | 6              | 60                 |
| 01-00035-00610 | 6.1      | 18.3              | 9°                   | 8              | 70                 |
| 01-00035-00620 | 6.2      | 18.6              | 9°                   | 8              | 70                 |

Unit : mm

| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00035-00630 | 6.3      | 18.9              | 9°                   | 8              | 70                 |
| 01-00035-00640 | 6.4      | 19.2              | 9°                   | 8              | 70                 |
| 01-00035-00650 | 6.5      | 19.5              | 9°                   | 8              | 70                 |
| 01-00035-00660 | 6.6      | 19.8              | 9°                   | 8              | 70                 |
| 01-00035-00670 | 6.7      | 20.1              | 9°                   | 8              | 70                 |
| 01-00035-00680 | 6.8      | 20.4              | 9°                   | 8              | 70                 |
| 01-00035-00690 | 6.9      | 20.7              | 9°                   | 8              | 70                 |
| 01-00035-00700 | 7        | 21                | 9°                   | 8              | 70                 |
| 01-00035-00710 | 7.1      | 21.3              | 9°                   | 8              | 70                 |
| 01-00035-00720 | 7.2      | 21.6              | 9°                   | 8              | 70                 |
| 01-00035-00730 | 7.3      | 21.9              | 9°                   | 8              | 70                 |
| 01-00035-00740 | 7.4      | 22.2              | 9°                   | 8              | 70                 |
| 01-00035-00750 | 7.5      | 22.5              | 9°                   | 8              | 70                 |
| 01-00035-00760 | 7.6      | 22.8              | 9°                   | 8              | 70                 |
| 01-00035-00770 | 7.7      | 23.1              | 9°                   | 8              | 70                 |
| 01-00035-00780 | 7.8      | 23.4              | 9°                   | 8              | 70                 |
| 01-00035-00790 | 7.9      | 23.7              | 9°                   | 8              | 70                 |
| 01-00035-00800 | 8        | 24                | —                    | 8              | 70                 |
| 01-00035-00810 | 8.1      | 24.3              | 9°                   | 10             | 80                 |
| 01-00035-00820 | 8.2      | 24.6              | 9°                   | 10             | 80                 |
| 01-00035-00830 | 8.3      | 24.9              | 9°                   | 10             | 80                 |
| 01-00035-00840 | 8.4      | 25.2              | 9°                   | 10             | 80                 |
| 01-00035-00850 | 8.5      | 25.5              | 9°                   | 10             | 80                 |
| 01-00035-00860 | 8.6      | 25.8              | 9°                   | 10             | 80                 |
| 01-00035-00870 | 8.7      | 26.1              | 9°                   | 10             | 80                 |
| 01-00035-00880 | 8.8      | 26.4              | 9°                   | 10             | 80                 |
| 01-00035-00890 | 8.9      | 26.7              | 9°                   | 10             | 80                 |
| 01-00035-00900 | 9        | 27                | 9°                   | 10             | 80                 |
| 01-00035-00910 | 9.1      | 27.3              | 9°                   | 10             | 80                 |

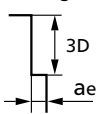
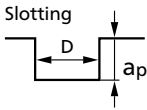
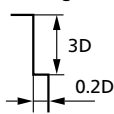
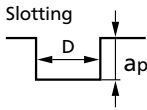
| Code No.       | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-------------------|----------------------|----------------|--------------------|
| 01-00035-00920 | 9.2      | 27.6              | 9°                   | 10             | 80                 |
| 01-00035-00930 | 9.3      | 27.9              | 9°                   | 10             | 80                 |
| 01-00035-00940 | 9.4      | 28.2              | 9°                   | 10             | 80                 |
| 01-00035-00950 | 9.5      | 28.5              | 9°                   | 10             | 80                 |
| 01-00035-00960 | 9.6      | 28.8              | 9°                   | 10             | 80                 |
| 01-00035-00970 | 9.7      | 29.1              | 9°                   | 10             | 80                 |
| 01-00035-00980 | 9.8      | 29.4              | 9°                   | 10             | 80                 |
| 01-00035-00990 | 9.9      | 29.7              | 9°                   | 10             | 80                 |
| 01-00035-01000 | 10       | 30                | —                    | 10             | 80                 |
| 01-00035-01010 | 10.1     | 30.3              | 9°                   | 12             | 80                 |
| 01-00035-01020 | 10.2     | 30.6              | 9°                   | 12             | 80                 |
| 01-00035-01030 | 10.3     | 30.9              | 9°                   | 12             | 80                 |
| 01-00035-01040 | 10.4     | 31.2              | 9°                   | 12             | 80                 |
| 01-00035-01050 | 10.5     | 31.5              | 9°                   | 12             | 80                 |
| 01-00035-01060 | 10.6     | 31.8              | 9°                   | 12             | 80                 |
| 01-00035-01070 | 10.7     | 32.1              | 9°                   | 12             | 80                 |
| 01-00035-01080 | 10.8     | 32.4              | 9°                   | 12             | 80                 |
| 01-00035-01090 | 10.9     | 32.7              | 9°                   | 12             | 80                 |
| 01-00035-01100 | 11       | 33                | 9°                   | 12             | 80                 |
| 01-00035-01110 | 11.1     | 33.3              | 9°                   | 12             | 80                 |
| 01-00035-01120 | 11.2     | 33.6              | 9°                   | 12             | 80                 |
| 01-00035-01130 | 11.3     | 33.9              | 9°                   | 12             | 80                 |
| 01-00035-01140 | 11.4     | 34.2              | 9°                   | 12             | 80                 |
| 01-00035-01150 | 11.5     | 34.5              | 9°                   | 12             | 80                 |
| 01-00035-01160 | 11.6     | 34.8              | 9°                   | 12             | 80                 |
| 01-00035-01170 | 11.7     | 35.1              | 9°                   | 12             | 80                 |
| 01-00035-01180 | 11.8     | 35.4              | 9°                   | 12             | 80                 |
| 01-00035-01190 | 11.9     | 35.7              | 9°                   | 12             | 80                 |
| 01-00035-01200 | 12       | 36                | —                    | 12             | 85                 |

How to Order

When you order, indicate NX-35 (D). ※(γ) is reference value.

● : Semi-standard Products, please inquire for price and delivery.

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |          | Alloy Steels<br>SCM・SKD・SUS |                 |          | Prehardened Steels<br>HPM・NAK |                 |          | Aluminium Alloy                                                                                                                                                                                                                                                                                                                                                                                |                 |          | Copper            |                 |          |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|-------------------------------|-----------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-------------------|-----------------|----------|
| Cutting Speed                 | 35~45m/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |          | 30~40m/min                  |                 |          | 20~30m/min                    |                 |          | 70~150m/min                                                                                                                                                                                                                                                                                                                                                                                    |                 |          | 55~75m/min        |                 |          |
| Dia.                          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed              | Feed            |          | Spindle<br>Speed                                                                                                                                                                                                                                                                                                                                                                               | Feed            |          | Spindle<br>Speed  | Feed            |          |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>             | mm/min          |          | min <sup>-1</sup>                                                                                                                                                                                                                                                                                                                                                                              | mm/min          |          | min <sup>-1</sup> | mm/min          |          |
|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                               | Side<br>Milling | Slotting |                                                                                                                                                                                                                                                                                                                                                                                                | Side<br>Milling | Slotting |                   | Side<br>Milling | Slotting |
| 1                             | 12,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 130             | 65       | 11,100                      | 90              | 30       | 8,000                         | 65              | 30       | 38,200                                                                                                                                                                                                                                                                                                                                                                                         | 460             | 160      | 20,700            | 250             | 90       |
| 1.5                           | 8,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 130             | 65       | 7,400                       | 90              | 30       | 5,300                         | 65              | 30       | 25,500                                                                                                                                                                                                                                                                                                                                                                                         | 510             | 180      | 13,800            | 280             | 100      |
| 2                             | 6,400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 130             | 65       | 5,600                       | 100             | 35       | 4,000                         | 75              | 40       | 19,100                                                                                                                                                                                                                                                                                                                                                                                         | 570             | 200      | 10,300            | 310             | 110      |
| 2.5                           | 5,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 150             | 75       | 4,500                       | 110             | 40       | 3,200                         | 80              | 40       | 15,300                                                                                                                                                                                                                                                                                                                                                                                         | 610             | 210      | 8,300             | 330             | 120      |
| 3                             | 4,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 170             | 85       | 3,700                       | 110             | 40       | 2,700                         | 85              | 40       | 12,700                                                                                                                                                                                                                                                                                                                                                                                         | 640             | 220      | 6,900             | 350             | 120      |
| 4                             | 3,200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 190             | 95       | 2,800                       | 110             | 40       | 2,000                         | 85              | 40       | 9,500                                                                                                                                                                                                                                                                                                                                                                                          | 670             | 220      | 5,200             | 360             | 120      |
| 5                             | 2,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 200             | 100      | 2,200                       | 130             | 45       | 1,600                         | 110             | 50       | 7,600                                                                                                                                                                                                                                                                                                                                                                                          | 680             | 230      | 4,100             | 370             | 120      |
| 6                             | 2,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 210             | 110      | 1,900                       | 150             | 50       | 1,300                         | 110             | 60       | 6,400                                                                                                                                                                                                                                                                                                                                                                                          | 700             | 230      | 3,400             | 370             | 120      |
| 8                             | 1,600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 190             | 95       | 1,400                       | 140             | 45       | 1,000                         | 110             | 55       | 4,800                                                                                                                                                                                                                                                                                                                                                                                          | 620             | 210      | 2,600             | 340             | 110      |
| 10                            | 1,300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 180             | 90       | 1,100                       | 130             | 40       | 800                           | 100             | 50       | 3,800                                                                                                                                                                                                                                                                                                                                                                                          | 570             | 190      | 2,100             | 320             | 100      |
| 12                            | 1,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 180             | 90       | 900                         | 130             | 40       | 700                           | 100             | 50       | 3,200                                                                                                                                                                                                                                                                                                                                                                                          | 540             | 180      | 1,700             | 290             | 95       |
| Depth of Cut<br><br>(D: Dia.) | <div><div>Side Milling</div><div><div><math>ae</math><br/><math>\phi 1\sim 2.9=0.05D</math><br/><math>\phi 3\sim 12=0.1D</math></div></div><div><div>Slotting</div><div><div><math>ap</math><br/><math>\phi 1\sim 1.4=0.08D</math><br/><math>\phi 1.5\sim 3.9=0.25D</math><br/><math>\phi 4\sim 12=0.4D</math></div></div></div></div> |                 |          |                             |                 |          |                               |                 |          | <div><div>Side Milling</div><div><div><math>0.2D</math></div></div><div><div>Slotting</div><div><div><math>ap</math><br/><math>\phi 1\sim 1.4=0.3D</math><br/><math>\phi 1.5\sim 12=0.5D</math></div></div></div></div> |                 |          |                   |                 |          |
| Notes                         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine.                                                                                                                                                                                                                                                                                                                       |                 |          |                             |                 |          |                               |                 |          |                                                                                                                                                                                                                                                                                                                                                                                                |                 |          |                   |                 |          |



Square



Square

NX-40

Size  $\phi$  0.5 ~  $\phi$  12

MG

≤40

HRC

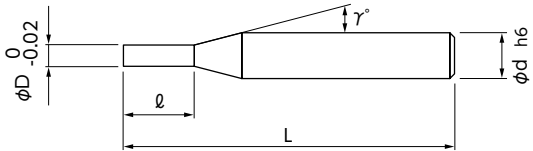
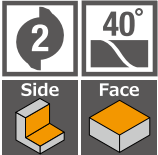
NX-40

LEAD 40 End Mill

LEAD 40 End Mill



Square



● L/D=4 and helix angle 40 °, Chips are easily removed by high helix angle.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| 01-00040-00050 | 0.5         | 2                       | 9°                          | 4                    | 40                       |
| 01-00040-00060 | 0.6         | 2.4                     | 9°                          | 4                    | 40                       |
| 01-00040-00070 | 0.7         | 2.8                     | 9°                          | 4                    | 40                       |
| 01-00040-00080 | 0.8         | 3.2                     | 9°                          | 4                    | 40                       |
| 01-00040-00090 | 0.9         | 3.6                     | 9°                          | 4                    | 40                       |
| 01-00040-00100 | 1           | 4                       | 9°                          | 4                    | 45                       |
| 01-00040-00110 | 1.1         | 4.4                     | 9°                          | 4                    | 45                       |
| 01-00040-00120 | 1.2         | 4.8                     | 9°                          | 4                    | 45                       |
| 01-00040-00130 | 1.3         | 5.2                     | 9°                          | 4                    | 45                       |
| 01-00040-00140 | 1.4         | 5.6                     | 9°                          | 4                    | 45                       |
| 01-00040-00150 | 1.5         | 6                       | 9°                          | 4                    | 45                       |
| 01-00040-00160 | 1.6         | 6.4                     | 9°                          | 4                    | 50                       |
| 01-00040-00170 | 1.7         | 6.8                     | 9°                          | 4                    | 50                       |
| 01-00040-00180 | 1.8         | 7.2                     | 9°                          | 4                    | 50                       |
| 01-00040-00190 | 1.9         | 7.6                     | 9°                          | 4                    | 50                       |
| 01-00040-00200 | 2           | 8                       | 9°                          | 4                    | 50                       |
| 01-00040-00210 | 2.1         | 8.4                     | 9°                          | 4                    | 50                       |
| 01-00040-00220 | 2.2         | 8.8                     | 9°                          | 4                    | 50                       |
| 01-00040-00230 | 2.3         | 9.2                     | 9°                          | 4                    | 50                       |
| 01-00040-00240 | 2.4         | 9.6                     | 9°                          | 4                    | 50                       |
| 01-00040-00250 | 2.5         | 10                      | 9°                          | 4                    | 50                       |
| 01-00040-00260 | 2.6         | 10.4                    | 9°                          | 6                    | 50                       |
| 01-00040-00270 | 2.7         | 10.8                    | 9°                          | 6                    | 50                       |
| 01-00040-00280 | 2.8         | 11.2                    | 9°                          | 6                    | 50                       |
| 01-00040-00290 | 2.9         | 11.6                    | 9°                          | 6                    | 50                       |
| 01-00040-00300 | 3           | 12                      | 9°                          | 6                    | 50                       |
| 01-00040-00310 | 3.1         | 12.4                    | 9°                          | 6                    | 55                       |
| 01-00040-00320 | 3.2         | 12.8                    | 9°                          | 6                    | 55                       |
| 01-00040-00330 | 3.3         | 13.2                    | 9°                          | 6                    | 55                       |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| 01-00040-00340 | 3.4         | 13.6                    | 9°                          | 6                    | 55                       |
| 01-00040-00350 | 3.5         | 14                      | 9°                          | 6                    | 55                       |
| 01-00040-00360 | 3.6         | 14.4                    | 9°                          | 6                    | 55                       |
| 01-00040-00370 | 3.7         | 14.8                    | 9°                          | 6                    | 55                       |
| 01-00040-00380 | 3.8         | 15.2                    | 9°                          | 6                    | 55                       |
| 01-00040-00390 | 3.9         | 15.6                    | 9°                          | 6                    | 55                       |
| 01-00040-00400 | 4           | 16                      | 9°                          | 6                    | 55                       |
| 01-00040-00410 | 4.1         | 16.4                    | 9°                          | 6                    | 60                       |
| 01-00040-00420 | 4.2         | 16.8                    | 9°                          | 6                    | 60                       |
| 01-00040-00430 | 4.3         | 17.2                    | 9°                          | 6                    | 60                       |
| 01-00040-00440 | 4.4         | 17.6                    | 9°                          | 6                    | 60                       |
| 01-00040-00450 | 4.5         | 18                      | 9°                          | 6                    | 60                       |
| 01-00040-00460 | 4.6         | 18.4                    | 9°                          | 6                    | 60                       |
| 01-00040-00470 | 4.7         | 18.8                    | 9°                          | 6                    | 60                       |
| 01-00040-00480 | 4.8         | 19.2                    | 9°                          | 6                    | 60                       |
| 01-00040-00490 | 4.9         | 19.6                    | 9°                          | 6                    | 60                       |
| 01-00040-00500 | 5           | 20                      | 9°                          | 6                    | 60                       |
| 01-00040-00510 | 5.1         | 20.4                    | 9°                          | 6                    | 65                       |
| 01-00040-00520 | 5.2         | 20.8                    | 9°                          | 6                    | 65                       |
| 01-00040-00530 | 5.3         | 21.2                    | 9°                          | 6                    | 65                       |
| 01-00040-00540 | 5.4         | 21.6                    | 9°                          | 6                    | 65                       |
| 01-00040-00550 | 5.5         | 22                      | 9°                          | 6                    | 65                       |
| 01-00040-00560 | 5.6         | 22.4                    | 9°                          | 6                    | 65                       |
| 01-00040-00570 | 5.7         | 22.8                    | 9°                          | 6                    | 65                       |
| 01-00040-00580 | 5.8         | 23.2                    | 9°                          | 6                    | 65                       |
| 01-00040-00590 | 5.9         | 23.6                    | 9°                          | 6                    | 65                       |
| 01-00040-00600 | 6           | 24                      | —                           | 6                    | 65                       |
| 01-00040-00610 | 6.1         | 24.4                    | 9°                          | 8                    | 80                       |
| 01-00040-00620 | 6.2         | 24.8                    | 9°                          | 8                    | 80                       |

Unit : mm

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| 01-00040-00630 | 6.3         | 25.2                    | 9°                          | 8                    | 80                       |
| 01-00040-00640 | 6.4         | 25.6                    | 9°                          | 8                    | 80                       |
| 01-00040-00650 | 6.5         | 26                      | 9°                          | 8                    | 80                       |
| 01-00040-00660 | 6.6         | 26.4                    | 9°                          | 8                    | 80                       |
| 01-00040-00670 | 6.7         | 26.8                    | 9°                          | 8                    | 80                       |
| 01-00040-00680 | 6.8         | 27.2                    | 9°                          | 8                    | 80                       |
| 01-00040-00690 | 6.9         | 27.6                    | 9°                          | 8                    | 80                       |
| 01-00040-00700 | 7           | 28                      | 9°                          | 8                    | 80                       |
| 01-00040-00710 | 7.1         | 28.4                    | 9°                          | 8                    | 80                       |
| 01-00040-00720 | 7.2         | 28.8                    | 9°                          | 8                    | 80                       |
| 01-00040-00730 | 7.3         | 29.2                    | 9°                          | 8                    | 80                       |
| 01-00040-00740 | 7.4         | 29.6                    | 9°                          | 8                    | 80                       |
| 01-00040-00750 | 7.5         | 30                      | 9°                          | 8                    | 80                       |
| 01-00040-00760 | 7.6         | 30.4                    | 9°                          | 8                    | 80                       |
| 01-00040-00770 | 7.7         | 30.8                    | 9°                          | 8                    | 80                       |
| 01-00040-00780 | 7.8         | 31.2                    | 9°                          | 8                    | 80                       |
| 01-00040-00790 | 7.9         | 31.6                    | 9°                          | 8                    | 80                       |
| 01-00040-00800 | 8           | 32                      | —                           | 8                    | 80                       |
| 01-00040-00810 | 8.1         | 32.4                    | 9°                          | 10                   | 100                      |
| 01-00040-00820 | 8.2         | 32.8                    | 9°                          | 10                   | 100                      |
| 01-00040-00830 | 8.3         | 33.2                    | 9°                          | 10                   | 100                      |
| 01-00040-00840 | 8.4         | 33.6                    | 9°                          | 10                   | 100                      |
| 01-00040-00850 | 8.5         | 34                      | 9°                          | 10                   | 100                      |
| 01-00040-00860 | 8.6         | 34.4                    | 9°                          | 10                   | 100                      |
| 01-00040-00870 | 8.7         | 34.8                    | 9°                          | 10                   | 100                      |
| 01-00040-00880 | 8.8         | 35.2                    | 9°                          | 10                   | 100                      |
| 01-00040-00890 | 8.9         | 35.6                    | 9°                          | 10                   | 100                      |
| 01-00040-00900 | 9           | 36                      | 9°                          | 10                   | 100                      |
| 01-00040-00910 | 9.1         | 36.4                    | 9°                          | 10                   | 100                      |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ°) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-----------------------------|----------------------|--------------------------|
| 01-00040-00920 | 9.2         | 36.8                    | 9°                          | 10                   | 100                      |
| 01-00040-00930 | 9.3         | 37.2                    | 9°                          | 10                   | 100                      |
| 01-00040-00940 | 9.4         | 37.6                    | 9°                          | 10                   | 100                      |
| 01-00040-00950 | 9.5         | 38                      | 9°                          | 10                   | 100                      |
| 01-00040-00960 | 9.6         | 38.4                    | 9°                          | 10                   | 100                      |
| 01-00040-00970 | 9.7         | 38.8                    | 9°                          | 10                   | 100                      |
| 01-00040-00980 | 9.8         | 39.2                    | 9°                          | 10                   | 100                      |
| 01-00040-00990 | 9.9         | 39.6                    | 9°                          | 10                   | 100                      |
| 01-00040-01000 | 10          | 40                      | —                           | 10                   | 100                      |
| 01-00040-01010 | 10.1        | 40.4                    | 9°                          | 12                   | 105                      |
| 01-00040-01020 | 10.2        | 40.8                    | 9°                          | 12                   | 105                      |
| 01-00040-01030 | 10.3        | 41.2                    | 9°                          | 12                   | 105                      |
| 01-00040-01040 | 10.4        | 41.6                    | 9°                          | 12                   | 105                      |
| 01-00040-01050 | 10.5        | 42                      | 9°                          | 12                   | 105                      |
| 01-00040-01060 | 10.6        | 42.4                    | 9°                          | 12                   | 105                      |
| 01-00040-01070 | 10.7        | 42.8                    | 9°                          | 12                   | 105                      |
| 01-00040-01080 | 10.8        | 43.2                    | 9°                          | 12                   | 105                      |
| 01-00040-01090 | 10.9        | 43.6                    | 9°                          | 12                   | 105                      |
| 01-00040-01100 | 11          | 44                      | 9°                          | 12                   | 105                      |
| 01-00040-01110 | 11.1        | 44.4                    | 9°                          | 12                   | 105                      |
| 01-00040-01120 | 11.2        | 44.8                    | 9°                          | 12                   | 105                      |
| 01-00040-01130 | 11.3        | 45.2                    | 9°                          | 12                   | 105                      |
| 01-00040-01140 | 11.4        | 45.6                    | 9°                          | 12                   | 105                      |
| 01-00040-01150 | 11.5        | 46                      | 9°                          | 12                   | 105                      |
| 01-00040-01160 | 11.6        | 46.4                    | 9°                          | 12                   | 105                      |
| 01-00040-01170 | 11.7        | 46.8                    | 9°                          | 12                   | 105                      |
| 01-00040-01180 | 11.8        | 47.2                    | 9°                          | 12                   | 105                      |
| 01-00040-01190 | 11.9        | 47.6                    | 9°                          | 12                   | 105                      |
| 01-00040-01200 | 12          | 48                      | —                           | 12                   | 105                      |

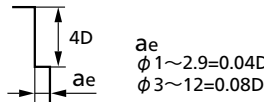
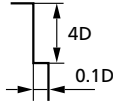


Square

How to Order When you order, indicate NX-40 (D). ※( γ ) is reference value.

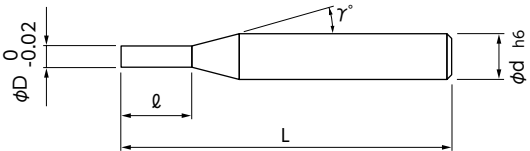
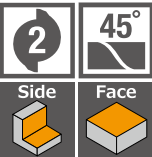
● : Semi-standard Products, please inquire for price and delivery.

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                              |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Aluminium Alloy                                                                                                         |        | Copper            |        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed                 | 20～30m/min                                                                                                                                                                                                                         |        | 15～25m/min                  |        | 15～20m/min                    |        | 60～80m/min                                                                                                              |        | 20～40m/min        |        |
| Dia.                          | Spindle<br>Speed                                                                                                                                                                                                                   | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                                                                                                        | Feed   | Spindle<br>Speed  | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                  | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                                                                                                       | mm/min | min <sup>-1</sup> | mm/min |
| 1                             | 8,000                                                                                                                                                                                                                              | 80     | 6,400                       | 50     | 5,600                         | 45     | 22,300                                                                                                                  | 270    | 9,500             | 110    |
| 1.5                           | 5,300                                                                                                                                                                                                                              | 80     | 4,200                       | 50     | 3,700                         | 45     | 14,900                                                                                                                  | 300    | 6,400             | 130    |
| 2                             | 4,000                                                                                                                                                                                                                              | 80     | 3,200                       | 60     | 2,800                         | 50     | 11,100                                                                                                                  | 330    | 4,800             | 140    |
| 2.5                           | 3,200                                                                                                                                                                                                                              | 100    | 2,500                       | 60     | 2,200                         | 55     | 8,900                                                                                                                   | 360    | 3,800             | 150    |
| 3                             | 2,700                                                                                                                                                                                                                              | 110    | 2,100                       | 60     | 1,900                         | 60     | 7,400                                                                                                                   | 370    | 3,200             | 160    |
| 4                             | 2,000                                                                                                                                                                                                                              | 120    | 1,600                       | 65     | 1,400                         | 60     | 5,600                                                                                                                   | 390    | 2,400             | 170    |
| 5                             | 1,600                                                                                                                                                                                                                              | 130    | 1,300                       | 80     | 1,100                         | 70     | 4,500                                                                                                                   | 410    | 1,900             | 170    |
| 6                             | 1,300                                                                                                                                                                                                                              | 130    | 1,100                       | 90     | 900                           | 80     | 3,700                                                                                                                   | 410    | 1,600             | 180    |
| 8                             | 1,000                                                                                                                                                                                                                              | 120    | 800                         | 80     | 700                           | 75     | 2,800                                                                                                                   | 360    | 1,200             | 160    |
| 10                            | 800                                                                                                                                                                                                                                | 110    | 600                         | 70     | 600                           | 75     | 2,200                                                                                                                   | 330    | 1,000             | 150    |
| 12                            | 700                                                                                                                                                                                                                                | 110    | 500                         | 70     | 500                           | 75     | 1,900                                                                                                                   | 320    | 800               | 140    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div>                                                                                                              |        |                             |        |                               |        | <div>Side Milling</div> <div></div> |        |                   |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 It is available only for side milling.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |        |                             |        |                               |        |                                                                                                                         |        |                   |        |







● L/D=5 and helix angle 45°, Deep side milling is available by sharp cutting edge.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|----------------------------|----------------------|--------------------------|
| 01-00045-00050 | 0.5         | 2.5                     | 9°                         | 4                    | 40                       |
| 01-00045-00060 | 0.6         | 3                       | 9°                         | 4                    | 40                       |
| 01-00045-00070 | 0.7         | 3.5                     | 9°                         | 4                    | 40                       |
| 01-00045-00080 | 0.8         | 4                       | 9°                         | 4                    | 40                       |
| 01-00045-00090 | 0.9         | 4.5                     | 9°                         | 4                    | 40                       |
| 01-00045-00100 | 1           | 5                       | 9°                         | 4                    | 45                       |
| 01-00045-00110 | 1.1         | 5.5                     | 9°                         | 4                    | 50                       |
| 01-00045-00120 | 1.2         | 6                       | 9°                         | 4                    | 50                       |
| 01-00045-00130 | 1.3         | 6.5                     | 9°                         | 4                    | 50                       |
| 01-00045-00140 | 1.4         | 7                       | 9°                         | 4                    | 50                       |
| 01-00045-00150 | 1.5         | 7.5                     | 9°                         | 4                    | 50                       |
| 01-00045-00160 | 1.6         | 8                       | 9°                         | 4                    | 50                       |
| 01-00045-00170 | 1.7         | 8.5                     | 9°                         | 4                    | 50                       |
| 01-00045-00180 | 1.8         | 9                       | 9°                         | 4                    | 50                       |
| 01-00045-00190 | 1.9         | 9.5                     | 9°                         | 4                    | 50                       |
| 01-00045-00200 | 2           | 10                      | 9°                         | 4                    | 50                       |
| 01-00045-00210 | 2.1         | 10.5                    | 9°                         | 4                    | 50                       |
| 01-00045-00220 | 2.2         | 11                      | 9°                         | 4                    | 50                       |
| 01-00045-00230 | 2.3         | 11.5                    | 9°                         | 4                    | 50                       |
| 01-00045-00240 | 2.4         | 12                      | 9°                         | 4                    | 50                       |
| 01-00045-00250 | 2.5         | 12.5                    | 9°                         | 4                    | 50                       |
| 01-00045-00260 | 2.6         | 13                      | 9°                         | 6                    | 55                       |
| 01-00045-00270 | 2.7         | 13.5                    | 9°                         | 6                    | 55                       |
| 01-00045-00280 | 2.8         | 14                      | 9°                         | 6                    | 55                       |
| 01-00045-00290 | 2.9         | 14.5                    | 9°                         | 6                    | 55                       |
| 01-00045-00300 | 3           | 15                      | 9°                         | 6                    | 55                       |
| 01-00045-00310 | 3.1         | 15.5                    | 9°                         | 6                    | 60                       |
| 01-00045-00320 | 3.2         | 16                      | 9°                         | 6                    | 60                       |
| 01-00045-00330 | 3.3         | 16.5                    | 9°                         | 6                    | 60                       |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|----------------------------|----------------------|--------------------------|
| 01-00045-00340 | 3.4         | 17                      | 9°                         | 6                    | 60                       |
| 01-00045-00350 | 3.5         | 17.5                    | 9°                         | 6                    | 60                       |
| 01-00045-00360 | 3.6         | 18                      | 9°                         | 6                    | 60                       |
| 01-00045-00370 | 3.7         | 18.5                    | 9°                         | 6                    | 60                       |
| 01-00045-00380 | 3.8         | 19                      | 9°                         | 6                    | 60                       |
| 01-00045-00390 | 3.9         | 19.5                    | 9°                         | 6                    | 60                       |
| 01-00045-00400 | 4           | 20                      | 9°                         | 6                    | 60                       |
| 01-00045-00410 | 4.1         | 20.5                    | 9°                         | 6                    | 65                       |
| 01-00045-00420 | 4.2         | 21                      | 9°                         | 6                    | 65                       |
| 01-00045-00430 | 4.3         | 21.5                    | 9°                         | 6                    | 65                       |
| 01-00045-00440 | 4.4         | 22                      | 9°                         | 6                    | 65                       |
| 01-00045-00450 | 4.5         | 22.5                    | 9°                         | 6                    | 65                       |
| 01-00045-00460 | 4.6         | 23                      | 9°                         | 6                    | 65                       |
| 01-00045-00470 | 4.7         | 23.5                    | 9°                         | 6                    | 65                       |
| 01-00045-00480 | 4.8         | 24                      | 9°                         | 6                    | 65                       |
| 01-00045-00490 | 4.9         | 24.5                    | 9°                         | 6                    | 65                       |
| 01-00045-00500 | 5           | 25                      | 9°                         | 6                    | 65                       |
| 01-00045-00510 | 5.1         | 25.5                    | 9°                         | 6                    | 75                       |
| 01-00045-00520 | 5.2         | 26                      | 9°                         | 6                    | 75                       |
| 01-00045-00530 | 5.3         | 26.5                    | 9°                         | 6                    | 75                       |
| 01-00045-00540 | 5.4         | 27                      | 9°                         | 6                    | 75                       |
| 01-00045-00550 | 5.5         | 27.5                    | 9°                         | 6                    | 75                       |
| 01-00045-00560 | 5.6         | 28                      | 9°                         | 6                    | 75                       |
| 01-00045-00570 | 5.7         | 28.5                    | 9°                         | 6                    | 75                       |
| 01-00045-00580 | 5.8         | 29                      | 9°                         | 6                    | 75                       |
| 01-00045-00590 | 5.9         | 29.5                    | 9°                         | 6                    | 75                       |
| 01-00045-00600 | 6           | 30                      | —                          | 6                    | 75                       |
| 01-00045-00610 | 6.1         | 30.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00620 | 6.2         | 31                      | 9°                         | 8                    | 90                       |

Unit : mm

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|----------------------------|----------------------|--------------------------|
| 01-00045-00630 | 6.3         | 31.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00640 | 6.4         | 32                      | 9°                         | 8                    | 90                       |
| 01-00045-00650 | 6.5         | 32.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00660 | 6.6         | 33                      | 9°                         | 8                    | 90                       |
| 01-00045-00670 | 6.7         | 33.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00680 | 6.8         | 34                      | 9°                         | 8                    | 90                       |
| 01-00045-00690 | 6.9         | 34.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00700 | 7           | 35                      | 9°                         | 8                    | 90                       |
| 01-00045-00710 | 7.1         | 35.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00720 | 7.2         | 36                      | 9°                         | 8                    | 90                       |
| 01-00045-00730 | 7.3         | 36.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00740 | 7.4         | 37                      | 9°                         | 8                    | 90                       |
| 01-00045-00750 | 7.5         | 37.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00760 | 7.6         | 38                      | 9°                         | 8                    | 90                       |
| 01-00045-00770 | 7.7         | 38.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00780 | 7.8         | 39                      | 9°                         | 8                    | 90                       |
| 01-00045-00790 | 7.9         | 39.5                    | 9°                         | 8                    | 90                       |
| 01-00045-00800 | 8           | 40                      | —                          | 8                    | 90                       |
| 01-00045-00810 | 8.1         | 40.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00820 | 8.2         | 41                      | 9°                         | 10                   | 100                      |
| 01-00045-00830 | 8.3         | 41.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00840 | 8.4         | 42                      | 9°                         | 10                   | 100                      |
| 01-00045-00850 | 8.5         | 42.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00860 | 8.6         | 43                      | 9°                         | 10                   | 100                      |
| 01-00045-00870 | 8.7         | 43.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00880 | 8.8         | 44                      | 9°                         | 10                   | 100                      |
| 01-00045-00890 | 8.9         | 44.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00900 | 9           | 45                      | 9°                         | 10                   | 100                      |
| 01-00045-00910 | 9.1         | 45.5                    | 9°                         | 10                   | 100                      |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|----------------------------|----------------------|--------------------------|
| 01-00045-00920 | 9.2         | 46                      | 9°                         | 10                   | 100                      |
| 01-00045-00930 | 9.3         | 46.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00940 | 9.4         | 47                      | 9°                         | 10                   | 100                      |
| 01-00045-00950 | 9.5         | 47.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00960 | 9.6         | 48                      | 9°                         | 10                   | 100                      |
| 01-00045-00970 | 9.7         | 48.5                    | 9°                         | 10                   | 100                      |
| 01-00045-00980 | 9.8         | 49                      | 9°                         | 10                   | 100                      |
| 01-00045-00990 | 9.9         | 49.5                    | 9°                         | 10                   | 100                      |
| 01-00045-01000 | 10          | 50                      | —                          | 10                   | 100                      |
| 01-00045-01010 | 10.1        | 50.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01020 | 10.2        | 51                      | 9°                         | 12                   | 110                      |
| 01-00045-01030 | 10.3        | 51.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01040 | 10.4        | 52                      | 9°                         | 12                   | 110                      |
| 01-00045-01050 | 10.5        | 52.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01060 | 10.6        | 53                      | 9°                         | 12                   | 110                      |
| 01-00045-01070 | 10.7        | 53.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01080 | 10.8        | 54                      | 9°                         | 12                   | 110                      |
| 01-00045-01090 | 10.9        | 54.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01100 | 11          | 55                      | 9°                         | 12                   | 110                      |
| 01-00045-01110 | 11.1        | 55.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01120 | 11.2        | 56                      | 9°                         | 12                   | 110                      |
| 01-00045-01130 | 11.3        | 56.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01140 | 11.4        | 57                      | 9°                         | 12                   | 110                      |
| 01-00045-01150 | 11.5        | 57.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01160 | 11.6        | 58                      | 9°                         | 12                   | 110                      |
| 01-00045-01170 | 11.7        | 58.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01180 | 11.8        | 59                      | 9°                         | 12                   | 110                      |
| 01-00045-01190 | 11.9        | 59.5                    | 9°                         | 12                   | 110                      |
| 01-00045-01200 | 12          | 60                      | —                          | 12                   | 110                      |

How to Order

When you order, indicate NX-45 (D). ※( γ ) is reference value.

● : Semi-standard Products, please inquire for price and delivery.



Square



Square



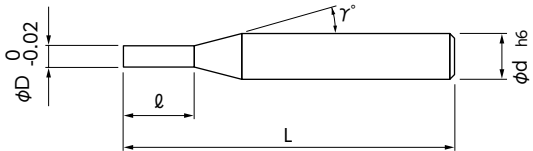
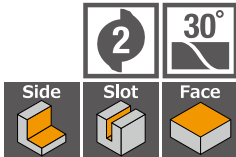
Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                                                                                              |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        | Aluminium Alloy                     |        | Copper            |        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-------------------------------------|--------|-------------------|--------|
| Cutting Speed                 | 15～25m/min                                                                                                                                                                                                                         |        | 10～20m/min                  |        | 10～15m/min                    |        | 55～65m/min                          |        | 15～35m/min        |        |
| Dia.                          | Spindle<br>Speed                                                                                                                                                                                                                   | Feed   | Spindle<br>Speed            | Feed   | Spindle<br>Speed              | Feed   | Spindle<br>Speed                    | Feed   | Spindle<br>Speed  | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                                                                                                  | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup>                   | mm/min | min <sup>-1</sup> | mm/min |
| 1                             | 6,400                                                                                                                                                                                                                              | 65     | 4,800                       | 40     | 4,000                         | 35     | 19,100                              | 230    | 8,000             | 100    |
| 1.5                           | 4,200                                                                                                                                                                                                                              | 65     | 3,200                       | 40     | 2,700                         | 35     | 12,700                              | 250    | 5,300             | 110    |
| 2                             | 3,200                                                                                                                                                                                                                              | 65     | 2,400                       | 45     | 2,000                         | 40     | 9,500                               | 290    | 4,000             | 120    |
| 2.5                           | 2,500                                                                                                                                                                                                                              | 75     | 1,900                       | 45     | 1,600                         | 40     | 7,600                               | 300    | 3,200             | 130    |
| 3                             | 2,100                                                                                                                                                                                                                              | 85     | 1,600                       | 50     | 1,300                         | 45     | 6,400                               | 320    | 2,700             | 140    |
| 4                             | 1,600                                                                                                                                                                                                                              | 95     | 1,200                       | 50     | 1,000                         | 45     | 4,800                               | 340    | 2,000             | 140    |
| 5                             | 1,300                                                                                                                                                                                                                              | 100    | 1,000                       | 60     | 800                           | 55     | 3,800                               | 340    | 1,600             | 140    |
| 6                             | 1,100                                                                                                                                                                                                                              | 110    | 800                         | 65     | 700                           | 60     | 3,200                               | 350    | 1,300             | 140    |
| 8                             | 800                                                                                                                                                                                                                                | 95     | 600                         | 60     | 500                           | 55     | 2,400                               | 310    | 1,000             | 130    |
| 10                            | 600                                                                                                                                                                                                                                | 85     | 500                         | 60     | 400                           | 50     | 1,900                               | 290    | 800               | 120    |
| 12                            | 500                                                                                                                                                                                                                                | 80     | 400                         | 55     | 300                           | 45     | 1,600                               | 270    | 700               | 120    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div> <div></div>                                                                                                                                                                                                |        |                             |        |                               |        | <div>Side Milling</div> <div></div> |        |                   |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 It is available only for side milling.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Adjust milling conditions according to the volume of Depth of Cut and rigidity of the machine. |        |                             |        |                               |        |                                     |        |                   |        |



CHAMPION SOLID 2-Flute End Mill

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

| Code No.         | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|------------------|-------------|-------------------------|----------------------------|----------------------|--------------------------|
| ■ 01-00212-00050 | 0.5         | 1                       | 9°                         | 3                    | 35                       |
| ■ 01-00212-00060 | 0.6         | 1.2                     | 9°                         | 3                    | 35                       |
| ■ 01-00212-00070 | 0.7         | 1.4                     | 9°                         | 3                    | 35                       |
| ■ 01-00212-00080 | 0.8         | 1.6                     | 9°                         | 3                    | 35                       |
| ■ 01-00212-00090 | 0.9         | 1.8                     | 9°                         | 3                    | 35                       |
| ■ 01-00212-00100 | 1           | 2                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00110 | 1.1         | 2                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00120 | 1.2         | 2.5                     | 9°                         | 4                    | 45                       |
| ■ 01-00212-00130 | 1.3         | 2.5                     | 9°                         | 4                    | 45                       |
| ■ 01-00212-00140 | 1.4         | 3                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00150 | 1.5         | 3                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00160 | 1.6         | 3                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00170 | 1.7         | 4                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00180 | 1.8         | 4                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00190 | 1.9         | 4                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00200 | 2           | 4                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00250 | 2.5         | 5                       | 9°                         | 4                    | 45                       |
| ■ 01-00212-00300 | 3           | 6                       | 9°                         | 6                    | 45                       |
| ■ 01-00212-00350 | 3.5         | 7                       | 9°                         | 6                    | 45                       |
| ■ 01-00212-00400 | 4           | 8                       | 9°                         | 6                    | 45                       |

| Unit : mm          |             |                         |                            |                      |                          |
|--------------------|-------------|-------------------------|----------------------------|----------------------|--------------------------|
| Code No.           | Dia.<br>(D) | Length of<br>Cut<br>(ℓ) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
| ■ 01-00212-00450   | 4.5         | 9                       | 9°                         | 6                    | 45                       |
| ■ 01-00212-00500   | 5           | 10                      | 9°                         | 6                    | 50                       |
| ■ 01-00212-00550   | 5.5         | 11                      | 9°                         | 6                    | 50                       |
| ■ 01-00212-00600   | 6           | 12                      | —                          | 6                    | 55                       |
| ▲ ■ 01-00212-00650 | 6.5         | 13                      | —                          | 6                    | 55                       |
| ▲ ■ 01-00212-00700 | 7           | 14                      | 9°                         | 8                    | 60                       |
| ▲ ■ 01-00212-00750 | 7.5         | 15                      | 9°                         | 8                    | 60                       |
| ▲ ■ 01-00212-00800 | 8           | 16                      | —                          | 8                    | 60                       |
| ▲ ■ 01-00212-00850 | 8.5         | 17                      | —                          | 8                    | 60                       |
| ▲ ■ 01-00212-00900 | 9           | 18                      | 9°                         | 10                   | 65                       |
| ▲ ■ 01-00212-00950 | 9.5         | 19                      | 9°                         | 10                   | 65                       |
| ▲ ■ 01-00212-01000 | 10          | 20                      | —                          | 10                   | 70                       |
| ▲ ■ 01-00212-01100 | 11          | 22                      | 9°                         | 12                   | 75                       |
| ▲ ■ 01-00212-01200 | 12          | 24                      | —                          | 12                   | 75                       |
| ▲ ■ 01-00212-01400 | 14          | 28                      | —                          | 12                   | 85                       |
| ▲ ■ 01-00212-01500 | 15          | 30                      | 9°                         | 16                   | 100                      |
| ▲ ■ 01-00212-01600 | 16          | 32                      | —                          | 16                   | 100                      |
| ▲ ■ 01-00212-01800 | 18          | 36                      | 9°                         | 20                   | 110                      |
| ▲ ■ 01-00212-02000 | 20          | 40                      | —                          | 20                   | 115                      |

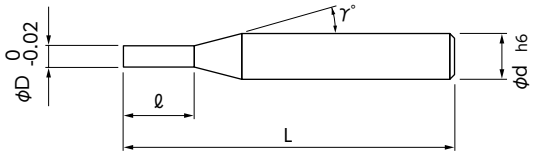
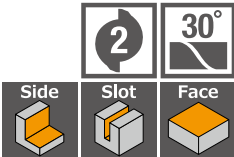
How to Order

When you order, indicate NC-2 (D). ※(γ) is reference value.

| Work Material             | Carbon Steels<br>S50C                                                                                                                                                      |                 |          | Alloy Steels<br>SCM・SKD・SUS |                 |          | Prehardened Steels<br>HPM・NAK |                 |          | Aluminium Alloy   |                 |          | Copper            |                 |          |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|-------------------------------|-----------------|----------|-------------------|-----------------|----------|-------------------|-----------------|----------|
| Cutting Speed             | 40~50m/min                                                                                                                                                                 |                 |          | 35~45m/min                  |                 |          | 25~35m/min                    |                 |          | 60~100m/min       |                 |          | 40~80m/min        |                 |          |
| Dia.                      | Spindle<br>Speed                                                                                                                                                           | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed              | Feed            |          | Spindle<br>Speed  | Feed            |          | Spindle<br>Speed  | Feed            |          |
|                           | min <sup>-1</sup>                                                                                                                                                          | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>             | mm/min          |          | min <sup>-1</sup> | mm/min          |          | min <sup>-1</sup> | mm/min          |          |
|                           |                                                                                                                                                                            | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                               | Side<br>Milling | Slotting |                   | Side<br>Milling | Slotting |                   | Side<br>Milling | Slotting |
| 0.5                       | 28,700                                                                                                                                                                     | 130             | 60       | 25,500                      | 100             | 50       | 19,100                        | 90              | 45       | 50,000            | 250             | 100      | 38,200            | 180             | 80       |
| 0.8                       | 17,900                                                                                                                                                                     | 130             | 60       | 15,900                      | 100             | 50       | 11,900                        | 90              | 45       | 50,000            | 250             | 100      | 23,900            | 180             | 80       |
| 1                         | 14,300                                                                                                                                                                     | 150             | 60       | 12,700                      | 100             | 50       | 9,600                         | 90              | 45       | 25,500            | 300             | 120      | 19,100            | 220             | 100      |
| 1.5                       | 9,600                                                                                                                                                                      | 150             | 60       | 8,500                       | 100             | 50       | 6,400                         | 90              | 45       | 17,000            | 300             | 120      | 12,700            | 220             | 100      |
| 2                         | 7,200                                                                                                                                                                      | 150             | 60       | 6,400                       | 100             | 50       | 4,800                         | 90              | 45       | 12,700            | 300             | 120      | 9,600             | 220             | 100      |
| 3                         | 4,800                                                                                                                                                                      | 180             | 70       | 4,200                       | 130             | 55       | 3,200                         | 100             | 50       | 8,500             | 350             | 150      | 6,400             | 250             | 110      |
| 4                         | 3,600                                                                                                                                                                      | 180             | 70       | 3,200                       | 130             | 55       | 2,400                         | 100             | 50       | 6,400             | 350             | 150      | 4,800             | 250             | 110      |
| 5                         | 2,900                                                                                                                                                                      | 200             | 80       | 2,500                       | 150             | 60       | 1,900                         | 120             | 55       | 5,100             | 400             | 180      | 3,800             | 300             | 130      |
| 6                         | 2,400                                                                                                                                                                      | 200             | 80       | 2,100                       | 150             | 60       | 1,600                         | 120             | 55       | 4,200             | 400             | 180      | 3,200             | 300             | 130      |
| 7                         | 2,000                                                                                                                                                                      | 200             | 80       | 1,800                       | 150             | 60       | 1,400                         | 120             | 55       | 3,600             | 400             | 180      | 2,700             | 300             | 130      |
| 8                         | 1,800                                                                                                                                                                      | 200             | 80       | 1,600                       | 150             | 60       | 1,200                         | 120             | 55       | 3,200             | 400             | 180      | 2,400             | 300             | 130      |
| 9                         | 1,600                                                                                                                                                                      | 200             | 80       | 1,400                       | 150             | 60       | 1,100                         | 120             | 55       | 2,800             | 400             | 180      | 2,100             | 300             | 130      |
| 10                        | 1,400                                                                                                                                                                      | 200             | 80       | 1,300                       | 150             | 60       | 1,000                         | 120             | 55       | 2,500             | 400             | 180      | 1,900             | 300             | 130      |
| 11                        | 1,300                                                                                                                                                                      | 200             | 80       | 1,200                       | 150             | 60       | 870                           | 120             | 55       | 2,300             | 400             | 180      | 1,700             | 300             | 130      |
| 12                        | 1,200                                                                                                                                                                      | 200             | 80       | 1,100                       | 150             | 60       | 800                           | 120             | 55       | 2,100             | 400             | 180      | 1,600             | 300             | 130      |
| 14                        | 1,020                                                                                                                                                                      | 200             | 80       | 910                         | 150             | 60       | 680                           | 120             | 55       | 1,800             | 400             | 180      | 1,400             | 300             | 130      |
| 15                        | 960                                                                                                                                                                        | 200             | 80       | 850                         | 150             | 60       | 640                           | 120             | 55       | 1,700             | 400             | 180      | 1,300             | 300             | 130      |
| 16                        | 900                                                                                                                                                                        | 200             | 80       | 800                         | 150             | 60       | 600                           | 120             | 55       | 1,600             | 400             | 180      | 1,200             | 300             | 130      |
| 18                        | 800                                                                                                                                                                        | 200             | 80       | 710                         | 150             | 60       | 530                           | 120             | 55       | 1,400             | 400             | 180      | 1,100             | 300             | 130      |
| 20                        | 720                                                                                                                                                                        | 200             | 80       | 640                         | 150             | 60       | 480                           | 120             | 55       | 1,300             | 400             | 180      | 1,000             | 300             | 130      |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling</div> <div>Slotting</div> <div><math>a_p</math><br/><math>\phi</math> 0.5~0.9=0.25D<br/><math>\phi</math> 1~2.5=0.5D<br/><math>\phi</math> 3~20=1D</div> |                 |          |                             |                 |          |                               |                 |          |                   |                 |          |                   |                 |          |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.                                                                                           |                 |          |                             |                 |          |                               |                 |          |                   |                 |          |                   |                 |          |

CHAMPION SOLID 2-Flute Medium End Mill

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels · Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                            |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                          | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

| Code No.         | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|-------------------|----------------------|----------------|--------------------|
| ■ 01-00232-00050 | 0.5      | 1.5               | 9°                   | 3              | 35                 |
| ■ 01-00232-00060 | 0.6      | 1.8               | 9°                   | 3              | 35                 |
| ■ 01-00232-00070 | 0.7      | 2.1               | 9°                   | 3              | 35                 |
| ■ 01-00232-00080 | 0.8      | 2.4               | 9°                   | 3              | 35                 |
| ■ 01-00232-00090 | 0.9      | 2.7               | 9°                   | 3              | 35                 |
| ■ 01-00232-00100 | 1        | 3                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00110 | 1.1      | 3.5               | 9°                   | 4              | 45                 |
| ■ 01-00232-00120 | 1.2      | 3.5               | 9°                   | 4              | 45                 |
| ■ 01-00232-00130 | 1.3      | 4                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00140 | 1.4      | 4.5               | 9°                   | 4              | 45                 |
| ■ 01-00232-00150 | 1.5      | 4.5               | 9°                   | 4              | 45                 |
| ■ 01-00232-00160 | 1.6      | 5                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00170 | 1.7      | 5                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00180 | 1.8      | 5.5               | 9°                   | 4              | 45                 |
| ■ 01-00232-00190 | 1.9      | 6                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00200 | 2        | 6                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00250 | 2.5      | 8                 | 9°                   | 4              | 45                 |
| ■ 01-00232-00300 | 3        | 10                | 9°                   | 6              | 45                 |
| ■ 01-00232-00350 | 3.5      | 11                | 9°                   | 6              | 50                 |
| ■ 01-00232-00400 | 4        | 12                | 9°                   | 6              | 50                 |

| Unit : mm          |          |                   |                      |                |                    |
|--------------------|----------|-------------------|----------------------|----------------|--------------------|
| Code No.           | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
| ■ 01-00232-00450   | 4.5      | 14                | 9°                   | 6              | 55                 |
| ■ 01-00232-00500   | 5        | 15                | 9°                   | 6              | 55                 |
| ■ 01-00232-00550   | 5.5      | 17                | 9°                   | 6              | 55                 |
| ■ 01-00232-00600   | 6        | 18                | —                    | 6              | 60                 |
| ▲ ■ 01-00232-00650 | 6.5      | 20                | —                    | 6              | 65                 |
| ▲ ■ 01-00232-00700 | 7        | 21                | 9°                   | 8              | 65                 |
| ▲ ■ 01-00232-00750 | 7.5      | 23                | 9°                   | 8              | 70                 |
| ▲ ■ 01-00232-00800 | 8        | 24                | —                    | 8              | 70                 |
| ▲ ■ 01-00232-00850 | 8.5      | 25                | —                    | 8              | 70                 |
| ▲ ■ 01-00232-00900 | 9        | 27                | 9°                   | 10             | 75                 |
| ▲ ■ 01-00232-00950 | 9.5      | 28                | 9°                   | 10             | 75                 |
| ▲ ■ 01-00232-01000 | 10       | 30                | —                    | 10             | 80                 |
| ▲ ■ 01-00232-01100 | 11       | 33                | 9°                   | 12             | 80                 |
| ▲ ■ 01-00232-01200 | 12       | 36                | —                    | 12             | 85                 |
| ▲ ■ 01-00232-01400 | 14       | 42                | —                    | 12             | 100                |
| ▲ ■ 01-00232-01500 | 15       | 45                | 9°                   | 16             | 110                |
| ▲ ■ 01-00232-01600 | 16       | 50                | —                    | 16             | 110                |
| ▲ ■ 01-00232-01800 | 18       | 55                | 9°                   | 20             | 130                |
| ▲ ■ 01-00232-02000 | 20       | 60                | —                    | 20             | 135                |

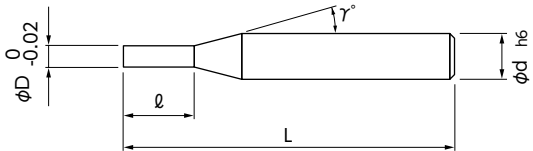
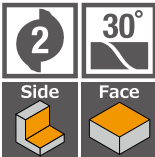
How to Order

When you order, indicate NCM-2 (D). ※(γ) is reference value.

| Work Material             | Carbon Steels S50C                                                                                                                                                                                       |              |          | Alloy Steels SCM · SKD · SUS |              |          | Prehardened Steels HPM · NAK |              |          | Aluminium Alloy   |              |          | Copper            |              |          |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|------------------------------|--------------|----------|------------------------------|--------------|----------|-------------------|--------------|----------|-------------------|--------------|----------|
| Cutting Speed             | 40~50m/min                                                                                                                                                                                               |              |          | 35~45m/min                   |              |          | 25~35m/min                   |              |          | 60~100m/min       |              |          | 40~80m/min        |              |          |
| Dia.                      | Spindle Speed                                                                                                                                                                                            | Feed         |          | Spindle Speed                | Feed         |          | Spindle Speed                | Feed         |          | Spindle Speed     | Feed         |          | Spindle Speed     | Feed         |          |
|                           | min <sup>-1</sup>                                                                                                                                                                                        | mm/min       |          | min <sup>-1</sup>            | mm/min       |          | min <sup>-1</sup>            | mm/min       |          | min <sup>-1</sup> | mm/min       |          | min <sup>-1</sup> | mm/min       |          |
|                           |                                                                                                                                                                                                          | Side Milling | Slotting |                              | Side Milling | Slotting |                              | Side Milling | Slotting |                   | Side Milling | Slotting |                   | Side Milling | Slotting |
| 0.5                       | 28,700                                                                                                                                                                                                   | 130          | 50       | 25,500                       | 90           | 40       | 19,100                       | 80           | 35       | 50,000            | 200          | 80       | 38,200            | 150          | 60       |
| 0.8                       | 17,900                                                                                                                                                                                                   | 130          | 50       | 15,900                       | 90           | 40       | 11,900                       | 80           | 35       | 50,000            | 200          | 80       | 23,900            | 150          | 60       |
| 1                         | 14,300                                                                                                                                                                                                   | 130          | 50       | 12,700                       | 90           | 40       | 9,600                        | 80           | 35       | 25,500            | 250          | 100      | 19,100            | 180          | 80       |
| 1.5                       | 9,600                                                                                                                                                                                                    | 130          | 50       | 8,500                        | 90           | 40       | 6,400                        | 80           | 35       | 17,000            | 250          | 100      | 12,700            | 180          | 80       |
| 2                         | 7,200                                                                                                                                                                                                    | 130          | 50       | 6,400                        | 90           | 40       | 4,800                        | 80           | 35       | 12,700            | 250          | 100      | 9,600             | 180          | 80       |
| 3                         | 4,800                                                                                                                                                                                                    | 150          | 60       | 4,200                        | 120          | 50       | 3,200                        | 90           | 40       | 8,500             | 250          | 100      | 6,400             | 180          | 80       |
| 4                         | 3,600                                                                                                                                                                                                    | 150          | 60       | 3,200                        | 120          | 50       | 2,400                        | 90           | 40       | 6,400             | 300          | 130      | 4,800             | 220          | 100      |
| 5                         | 2,900                                                                                                                                                                                                    | 170          | 70       | 2,500                        | 140          | 55       | 1,900                        | 110          | 45       | 5,100             | 300          | 130      | 3,800             | 220          | 100      |
| 6                         | 2,400                                                                                                                                                                                                    | 170          | 70       | 2,100                        | 140          | 55       | 1,600                        | 110          | 45       | 4,200             | 350          | 150      | 3,200             | 250          | 120      |
| 7                         | 2,000                                                                                                                                                                                                    | 170          | 70       | 1,800                        | 140          | 55       | 1,400                        | 110          | 45       | 3,600             | 350          | 150      | 2,700             | 250          | 120      |
| 8                         | 1,800                                                                                                                                                                                                    | 170          | 70       | 1,600                        | 140          | 55       | 1,200                        | 110          | 45       | 3,200             | 350          | 150      | 2,400             | 250          | 120      |
| 9                         | 1,600                                                                                                                                                                                                    | 170          | 70       | 1,400                        | 140          | 55       | 1,100                        | 110          | 45       | 2,800             | 350          | 150      | 2,100             | 250          | 120      |
| 10                        | 1,400                                                                                                                                                                                                    | 170          | 70       | 1,300                        | 140          | 55       | 1,000                        | 110          | 45       | 2,500             | 350          | 150      | 1,900             | 250          | 120      |
| 11                        | 1,300                                                                                                                                                                                                    | 170          | 70       | 1,200                        | 140          | 55       | 900                          | 110          | 45       | 2,300             | 350          | 150      | 1,700             | 250          | 120      |
| 12                        | 1,200                                                                                                                                                                                                    | 170          | 70       | 1,100                        | 140          | 55       | 800                          | 110          | 45       | 2,100             | 350          | 150      | 1,600             | 250          | 120      |
| 14                        | 1,020                                                                                                                                                                                                    | 170          | 70       | 910                          | 140          | 55       | 680                          | 110          | 45       | 1,800             | 350          | 150      | 1,400             | 250          | 120      |
| 15                        | 960                                                                                                                                                                                                      | 170          | 70       | 850                          | 140          | 55       | 640                          | 110          | 45       | 1,700             | 350          | 150      | 1,300             | 250          | 120      |
| 16                        | 900                                                                                                                                                                                                      | 170          | 70       | 800                          | 140          | 55       | 600                          | 110          | 45       | 1,600             | 350          | 150      | 1,200             | 250          | 120      |
| 18                        | 800                                                                                                                                                                                                      | 170          | 70       | 710                          | 140          | 55       | 530                          | 110          | 45       | 1,400             | 350          | 150      | 1,100             | 250          | 120      |
| 20                        | 720                                                                                                                                                                                                      | 170          | 70       | 640                          | 140          | 55       | 480                          | 110          | 45       | 1,300             | 350          | 150      | 1,000             | 250          | 120      |
| Depth of Cut<br>(D: Dia.) | <div><div>Side Milling</div><div>Slotting</div><div><math>a_p</math><br/><math>\phi 0.5 \sim 0.9 = 0.25D</math><br/><math>\phi 1 \sim 2.5 = 0.5D</math><br/><math>\phi 3 \sim 20 = 1D</math></div></div> |              |          |                              |              |          |                              |              |          |                   |              |          |                   |              |          |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.                                                                                                                         |              |          |                              |              |          |                              |              |          |                   |              |          |                   |              |          |

CHAMPION SOLID 2-Flute Long End Mill

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| ■ 01-00222-00100   | 1           | 4                    | 9°                               | 4                 | 45                    |
| ■ 01-00222-00150   | 1.5         | 6                    | 9°                               | 4                 | 45                    |
| ■ 01-00222-00200   | 2           | 10                   | 9°                               | 4                 | 50                    |
| ■ 01-00222-00250   | 2.5         | 12                   | 9°                               | 4                 | 50                    |
| ■ 01-00222-00300   | 3           | 18                   | 9°                               | 6                 | 60                    |
| ■ 01-00222-00400   | 4           | 22                   | 9°                               | 6                 | 60                    |
| ■ 01-00222-00500   | 5           | 25                   | 9°                               | 6                 | 65                    |
| ■ 01-00222-00600   | 6           | 25                   | —                                | 6                 | 65                    |
| ▲ ■ 01-00222-00800 | 8           | 35                   | —                                | 8                 | 80                    |
| ▲ ■ 01-00222-01000 | 10          | 42                   | —                                | 10                | 100                   |
| ▲ ■ 01-00222-01200 | 12          | 45                   | —                                | 12                | 100                   |

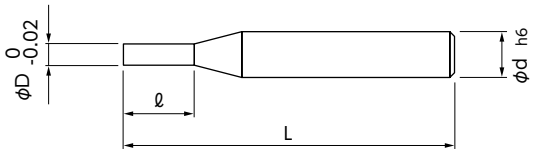
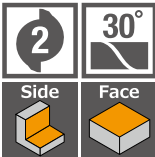
How to Order

When you order, indicate NCL-2 (D). ※( $\gamma$ ) is reference value.

| Work Material             | Carbon Steels<br>S50C                                                                                                                       |        | Alloy Steels<br>SCM•SKD•SUS |        | Prehardened Steels<br>HPM•NAK |        | Aluminium Alloy   |        | Copper            |        |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|-------------------|--------|-------------------|--------|
| Cutting Speed             | 20~30m/min                                                                                                                                  |        | 15~25m/min                  |        | 15~20m/min                    |        | 50~70m/min        |        | 40~60m/min        |        |
| Dia.                      | Spindle Speed                                                                                                                               | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   | Spindle Speed     | Feed   | Spindle Speed     | Feed   |
|                           | min <sup>-1</sup>                                                                                                                           | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min | min <sup>-1</sup> | mm/min | min <sup>-1</sup> | mm/min |
| 1                         | 8,000                                                                                                                                       | 100    | 6,400                       | 85     | 5,600                         | 60     | 19,100            | 200    | 15,900            | 150    |
| 1.5                       | 5,300                                                                                                                                       | 100    | 4,200                       | 85     | 3,700                         | 60     | 12,700            | 200    | 10,600            | 150    |
| 2                         | 4,000                                                                                                                                       | 100    | 3,200                       | 85     | 2,800                         | 60     | 9,600             | 200    | 8,000             | 150    |
| 2.5                       | 3,200                                                                                                                                       | 100    | 2,500                       | 85     | 2,200                         | 60     | 7,600             | 200    | 6,400             | 170    |
| 3                         | 2,700                                                                                                                                       | 110    | 2,100                       | 90     | 1,900                         | 65     | 6,400             | 220    | 5,300             | 170    |
| 4                         | 2,000                                                                                                                                       | 110    | 1,600                       | 90     | 1,400                         | 65     | 4,800             | 220    | 4,000             | 170    |
| 5                         | 1,600                                                                                                                                       | 120    | 1,300                       | 95     | 1,100                         | 70     | 3,800             | 250    | 3,200             | 200    |
| 6                         | 1,300                                                                                                                                       | 120    | 1,100                       | 95     | 930                           | 70     | 3,200             | 250    | 2,700             | 200    |
| 8                         | 1,000                                                                                                                                       | 120    | 800                         | 95     | 700                           | 70     | 2,400             | 250    | 2,000             | 200    |
| 10                        | 800                                                                                                                                         | 120    | 640                         | 95     | 560                           | 70     | 1,900             | 250    | 1,600             | 200    |
| 12                        | 660                                                                                                                                         | 120    | 530                         | 95     | 460                           | 70     | 1,600             | 250    | 1,300             | 200    |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling</div> <div></div> <div><math>a_p</math><br/><math>\phi 1 \sim 10 = 4D</math><br/><math>\phi 12 = 45\text{mm}</math></div> |        |                             |        |                               |        |                   |        |                   |        |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.                                                            |        |                             |        |                               |        |                   |        |                   |        |



CHAMPION SOLID 2-Flute Long Shank End Mill



● ■ : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.         | Dia.<br>(D) | Length of Cut<br>(l) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|------------------|-------------|----------------------|-------------------|-----------------------|
| ■ 01-00242-00100 | 1           | 2                    | 4                 | 100                   |
| ■ 01-00242-00150 | 1.5         | 3                    | 4                 | 100                   |
| ■ 01-00242-00200 | 2           | 4                    | 4                 | 100                   |
| ■ 01-00242-00250 | 2.5         | 5                    | 4                 | 100                   |
| ■ 01-00242-00300 | 3           | 6                    | 6                 | 120                   |
| ■ 01-00242-00400 | 4           | 8                    | 6                 | 120                   |
| ■ 01-00242-00500 | 5           | 10                   | 6                 | 130                   |
| ■ 01-00242-00600 | 6           | 12                   | 6                 | 130                   |
| ■ 01-00242-00700 | 7           | 14                   | 8                 | 140                   |
| ■ 01-00242-00800 | 8           | 16                   | 8                 | 140                   |
| ■ 01-00242-00900 | 9           | 18                   | 10                | 150                   |
| ■ 01-00242-01000 | 10          | 20                   | 10                | 150                   |
| ■ 01-00242-01100 | 11          | 22                   | 12                | 170                   |
| ■ 01-00242-01200 | 12          | 24                   | 12                | 170                   |

How to Order

When you order, indicate NC-LS-2 (D).

※(  $\gamma$  ) is reference value.



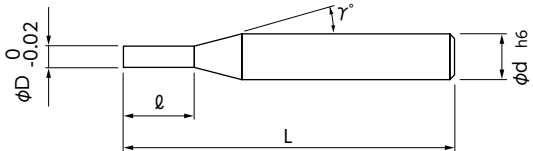
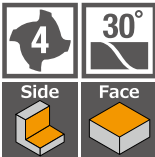
Square



Square

CHAMPION SOLID 4-Flute End Mill

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 01-00244-00100 | 1           | 2                       | 9°                                  | 4                    | 45                       |
| 01-00244-00110 | 1.1         | 2.2                     | 9°                                  | 4                    | 45                       |
| 01-00244-00120 | 1.2         | 2.4                     | 9°                                  | 4                    | 45                       |
| 01-00244-00130 | 1.3         | 2.6                     | 9°                                  | 4                    | 45                       |
| 01-00244-00140 | 1.4         | 2.8                     | 9°                                  | 4                    | 45                       |
| 01-00244-00150 | 1.5         | 3                       | 9°                                  | 4                    | 45                       |
| 01-00244-00160 | 1.6         | 3.2                     | 9°                                  | 4                    | 45                       |
| 01-00244-00170 | 1.7         | 3.4                     | 9°                                  | 4                    | 45                       |
| 01-00244-00180 | 1.8         | 3.6                     | 9°                                  | 4                    | 45                       |
| 01-00244-00190 | 1.9         | 3.8                     | 9°                                  | 4                    | 45                       |
| 01-00244-00200 | 2           | 4                       | 9°                                  | 4                    | 45                       |
| 01-00244-00210 | 2.1         | 4.2                     | 9°                                  | 4                    | 45                       |
| 01-00244-00220 | 2.2         | 4.4                     | 9°                                  | 4                    | 45                       |
| 01-00244-00230 | 2.3         | 4.6                     | 9°                                  | 4                    | 45                       |
| 01-00244-00240 | 2.4         | 4.8                     | 9°                                  | 4                    | 45                       |
| 01-00244-00250 | 2.5         | 5                       | 9°                                  | 4                    | 45                       |
| 01-00244-00260 | 2.6         | 5.2                     | 9°                                  | 6                    | 45                       |
| 01-00244-00270 | 2.7         | 5.4                     | 9°                                  | 6                    | 45                       |
| 01-00244-00280 | 2.8         | 5.6                     | 9°                                  | 6                    | 45                       |
| 01-00244-00290 | 2.9         | 5.8                     | 9°                                  | 6                    | 45                       |
| 01-00244-00300 | 3           | 6                       | 9°                                  | 6                    | 45                       |
| 01-00244-00310 | 3.1         | 6.2                     | 9°                                  | 6                    | 45                       |
| 01-00244-00320 | 3.2         | 6.4                     | 9°                                  | 6                    | 45                       |
| 01-00244-00330 | 3.3         | 6.6                     | 9°                                  | 6                    | 45                       |
| 01-00244-00340 | 3.4         | 6.8                     | 9°                                  | 6                    | 45                       |
| 01-00244-00350 | 3.5         | 7                       | 9°                                  | 6                    | 45                       |
| 01-00244-00360 | 3.6         | 7.2                     | 9°                                  | 6                    | 45                       |
| 01-00244-00370 | 3.7         | 7.4                     | 9°                                  | 6                    | 45                       |
| 01-00244-00380 | 3.8         | 7.6                     | 9°                                  | 6                    | 45                       |
| 01-00244-00390 | 3.9         | 7.8                     | 9°                                  | 6                    | 45                       |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 01-00244-00400 | 4           | 8                       | 9°                                  | 6                    | 45                       |
| 01-00244-00410 | 4.1         | 8.2                     | 9°                                  | 6                    | 45                       |
| 01-00244-00420 | 4.2         | 8.4                     | 9°                                  | 6                    | 45                       |
| 01-00244-00430 | 4.3         | 8.6                     | 9°                                  | 6                    | 45                       |
| 01-00244-00440 | 4.4         | 8.8                     | 9°                                  | 6                    | 45                       |
| 01-00244-00450 | 4.5         | 9                       | 9°                                  | 6                    | 45                       |
| 01-00244-00460 | 4.6         | 9.2                     | 9°                                  | 6                    | 50                       |
| 01-00244-00470 | 4.7         | 9.4                     | 9°                                  | 6                    | 50                       |
| 01-00244-00480 | 4.8         | 9.6                     | 9°                                  | 6                    | 50                       |
| 01-00244-00490 | 4.9         | 9.8                     | 9°                                  | 6                    | 50                       |
| 01-00244-00500 | 5           | 10                      | 9°                                  | 6                    | 50                       |
| 01-00244-00510 | 5.1         | 10.2                    | 9°                                  | 6                    | 50                       |
| 01-00244-00520 | 5.2         | 10.4                    | 9°                                  | 6                    | 50                       |
| 01-00244-00530 | 5.3         | 10.6                    | 9°                                  | 6                    | 50                       |
| 01-00244-00540 | 5.4         | 10.8                    | 9°                                  | 6                    | 50                       |
| 01-00244-00550 | 5.5         | 11                      | 9°                                  | 6                    | 50                       |
| 01-00244-00560 | 5.6         | 11.2                    | 9°                                  | 6                    | 55                       |
| 01-00244-00570 | 5.7         | 11.4                    | 9°                                  | 6                    | 55                       |
| 01-00244-00580 | 5.8         | 11.6                    | 9°                                  | 6                    | 55                       |
| 01-00244-00590 | 5.9         | 11.8                    | 9°                                  | 6                    | 55                       |
| 01-00244-00600 | 6           | 12                      | —                                   | 6                    | 55                       |
| 01-00244-00610 | 6.1         | 12.2                    | —                                   | 6                    | 55                       |
| 01-00244-00620 | 6.2         | 12.4                    | —                                   | 6                    | 55                       |
| 01-00244-00630 | 6.3         | 12.6                    | —                                   | 6                    | 55                       |
| 01-00244-00640 | 6.4         | 12.8                    | —                                   | 6                    | 55                       |
| 01-00244-00650 | 6.5         | 13                      | —                                   | 6                    | 55                       |
| 01-00244-00660 | 6.6         | 13.2                    | 9°                                  | 8                    | 60                       |
| 01-00244-00670 | 6.7         | 13.4                    | 9°                                  | 8                    | 60                       |
| 01-00244-00680 | 6.8         | 13.6                    | 9°                                  | 8                    | 60                       |
| 01-00244-00690 | 6.9         | 13.8                    | 9°                                  | 8                    | 60                       |

Unit : mm

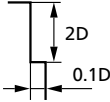
| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 01-00244-00700 | 7           | 14                      | 9°                                  | 8                    | 60                       |
| 01-00244-00710 | 7.1         | 14.2                    | 9°                                  | 8                    | 60                       |
| 01-00244-00720 | 7.2         | 14.4                    | 9°                                  | 8                    | 60                       |
| 01-00244-00730 | 7.3         | 14.6                    | 9°                                  | 8                    | 60                       |
| 01-00244-00740 | 7.4         | 14.8                    | 9°                                  | 8                    | 60                       |
| 01-00244-00750 | 7.5         | 15                      | 9°                                  | 8                    | 60                       |
| 01-00244-00760 | 7.6         | 15.2                    | 9°                                  | 8                    | 60                       |
| 01-00244-00770 | 7.7         | 15.4                    | 9°                                  | 8                    | 60                       |
| 01-00244-00780 | 7.8         | 15.6                    | 9°                                  | 8                    | 60                       |
| 01-00244-00790 | 7.9         | 15.8                    | 9°                                  | 8                    | 60                       |
| 01-00244-00800 | 8           | 16                      | —                                   | 8                    | 60                       |
| 01-00244-00810 | 8.1         | 16.2                    | —                                   | 8                    | 60                       |
| 01-00244-00820 | 8.2         | 16.4                    | —                                   | 8                    | 60                       |
| 01-00244-00830 | 8.3         | 16.6                    | —                                   | 8                    | 60                       |
| 01-00244-00840 | 8.4         | 16.8                    | —                                   | 8                    | 60                       |
| 01-00244-00850 | 8.5         | 17                      | —                                   | 8                    | 60                       |
| 01-00244-00860 | 8.6         | 17.2                    | 9°                                  | 10                   | 65                       |
| 01-00244-00870 | 8.7         | 17.4                    | 9°                                  | 10                   | 65                       |
| 01-00244-00880 | 8.8         | 17.6                    | 9°                                  | 10                   | 65                       |
| 01-00244-00890 | 8.9         | 17.8                    | 9°                                  | 10                   | 65                       |
| 01-00244-00900 | 9           | 18                      | 9°                                  | 10                   | 65                       |
| 01-00244-00910 | 9.1         | 18.2                    | 9°                                  | 10                   | 65                       |
| 01-00244-00920 | 9.2         | 18.4                    | 9°                                  | 10                   | 65                       |
| 01-00244-00930 | 9.3         | 18.6                    | 9°                                  | 10                   | 65                       |
| 01-00244-00940 | 9.4         | 18.8                    | 9°                                  | 10                   | 65                       |
| 01-00244-00950 | 9.5         | 19                      | 9°                                  | 10                   | 65                       |
| 01-00244-00960 | 9.6         | 19.2                    | 9°                                  | 10                   | 70                       |
| 01-00244-00970 | 9.7         | 19.4                    | 9°                                  | 10                   | 70                       |
| 01-00244-00980 | 9.8         | 19.6                    | 9°                                  | 10                   | 70                       |
| 01-00244-00990 | 9.9         | 19.8                    | 9°                                  | 10                   | 70                       |

| Code No.       | Dia.<br>(D) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|----------------|-------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| 01-00244-01000 | 10          | 20                      | —                                   | 10                   | 70                       |
| 01-00244-01010 | 10.1        | 20.2                    | 9°                                  | 12                   | 75                       |
| 01-00244-01020 | 10.2        | 20.4                    | 9°                                  | 12                   | 75                       |
| 01-00244-01030 | 10.3        | 20.6                    | 9°                                  | 12                   | 75                       |
| 01-00244-01040 | 10.4        | 20.8                    | 9°                                  | 12                   | 75                       |
| 01-00244-01050 | 10.5        | 21                      | 9°                                  | 12                   | 75                       |
| 01-00244-01060 | 10.6        | 21.2                    | 9°                                  | 12                   | 75                       |
| 01-00244-01070 | 10.7        | 21.4                    | 9°                                  | 12                   | 75                       |
| 01-00244-01080 | 10.8        | 21.6                    | 9°                                  | 12                   | 75                       |
| 01-00244-01090 | 10.9        | 21.8                    | 9°                                  | 12                   | 75                       |
| 01-00244-01100 | 11          | 22                      | 9°                                  | 12                   | 75                       |
| 01-00244-01110 | 11.1        | 22.2                    | 9°                                  | 12                   | 75                       |
| 01-00244-01120 | 11.2        | 22.4                    | 9°                                  | 12                   | 75                       |
| 01-00244-01130 | 11.3        | 22.6                    | 9°                                  | 12                   | 75                       |
| 01-00244-01140 | 11.4        | 22.8                    | 9°                                  | 12                   | 75                       |
| 01-00244-01150 | 11.5        | 23                      | 9°                                  | 12                   | 75                       |
| 01-00244-01160 | 11.6        | 23.2                    | 9°                                  | 12                   | 75                       |
| 01-00244-01170 | 11.7        | 23.4                    | 9°                                  | 12                   | 75                       |
| 01-00244-01180 | 11.8        | 23.6                    | 9°                                  | 12                   | 75                       |
| 01-00244-01190 | 11.9        | 23.8                    | 9°                                  | 12                   | 75                       |
| 01-00244-01200 | 12          | 24                      | —                                   | 12                   | 75                       |
| 01-00244-01400 | 14          | 28                      | —                                   | 12                   | 85                       |
| 01-00244-01500 | 15          | 30                      | 9°                                  | 16                   | 100                      |
| 01-00244-01600 | 16          | 32                      | —                                   | 16                   | 100                      |
| 01-00244-01800 | 18          | 36                      | 9°                                  | 20                   | 110                      |
| 01-00244-02000 | 20          | 40                      | —                                   | 20                   | 115                      |

How to Order

When you order, indicate NC-4 (D). ※( $\gamma$ ) is reference value.

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                            |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed                 | 40～50m/min                                                                                                                       |        | 35～45m/min                  |        | 25～35m/min                    |        |
| Dia.                          | Spindle Speed                                                                                                                    | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                               | min <sup>-1</sup>                                                                                                                | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 1                             | 14,300                                                                                                                           | 250    | 12,700                      | 220    | 9,600                         | 190    |
| 2                             | 7,200                                                                                                                            | 250    | 6,400                       | 220    | 4,800                         | 190    |
| 3                             | 4,800                                                                                                                            | 270    | 4,200                       | 240    | 3,200                         | 210    |
| 4                             | 3,600                                                                                                                            | 270    | 3,200                       | 240    | 2,400                         | 210    |
| 5                             | 2,900                                                                                                                            | 300    | 2,500                       | 260    | 1,900                         | 230    |
| 6                             | 2,400                                                                                                                            | 300    | 2,100                       | 260    | 1,600                         | 230    |
| 7                             | 2,000                                                                                                                            | 300    | 1,800                       | 260    | 1,400                         | 230    |
| 8                             | 1,800                                                                                                                            | 300    | 1,600                       | 260    | 1,200                         | 230    |
| 9                             | 1,600                                                                                                                            | 300    | 1,400                       | 260    | 1,100                         | 230    |
| 10                            | 1,400                                                                                                                            | 300    | 1,300                       | 260    | 1,000                         | 230    |
| 11                            | 1,300                                                                                                                            | 300    | 1,200                       | 260    | 870                           | 230    |
| 12                            | 1,200                                                                                                                            | 300    | 1,100                       | 260    | 800                           | 230    |
| 14                            | 1,020                                                                                                                            | 300    | 910                         | 260    | 680                           | 230    |
| 15                            | 960                                                                                                                              | 300    | 850                         | 260    | 640                           | 230    |
| 16                            | 900                                                                                                                              | 300    | 800                         | 260    | 600                           | 230    |
| 18                            | 800                                                                                                                              | 300    | 710                         | 260    | 530                           | 230    |
| 20                            | 720                                                                                                                              | 300    | 640                         | 260    | 480                           | 230    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div>                       |        |                             |        |                               |        |
| Notes                         | ※ 1 Use cutting fluid.<br>※ 2 It is available only for side milling.<br>※ 3 Adjust both spindle speed and feed at the same rate. |        |                             |        |                               |        |



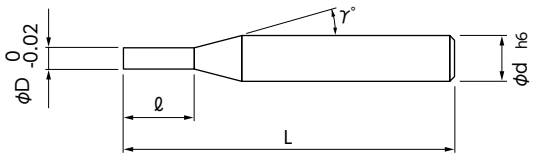
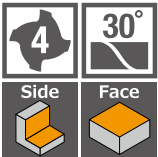
Square



Square

CHAMPION SOLID 4-Flute Medium End Mill

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.  
● ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia. (D) | Length of Cut (L) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|----------|-------------------|----------------------|----------------|--------------------|
| ■ 01-00234-00100   | 1        | 3                 | 9°                   | 4              | 45                 |
| ■ 01-00234-00150   | 1.5      | 4.5               | 9°                   | 4              | 45                 |
| ■ 01-00234-00200   | 2        | 6                 | 9°                   | 4              | 45                 |
| ■ 01-00234-00250   | 2.5      | 8                 | 9°                   | 4              | 45                 |
| ■ 01-00234-00300   | 3        | 10                | 9°                   | 6              | 45                 |
| ■ 01-00234-00350   | 3.5      | 11                | 9°                   | 6              | 50                 |
| ■ 01-00234-00400   | 4        | 12                | 9°                   | 6              | 50                 |
| ■ 01-00234-00450   | 4.5      | 14                | 9°                   | 6              | 55                 |
| ■ 01-00234-00500   | 5        | 15                | 9°                   | 6              | 55                 |
| ■ 01-00234-00550   | 5.5      | 17                | 9°                   | 6              | 55                 |
| ■ 01-00234-00600   | 6        | 18                | —                    | 6              | 60                 |
| ▲ ■ 01-00234-00650 | 6.5      | 20                | —                    | 6              | 65                 |
| ▲ ■ 01-00234-00700 | 7        | 21                | 9°                   | 8              | 65                 |
| ▲ ■ 01-00234-00750 | 7.5      | 23                | 9°                   | 8              | 70                 |
| ▲ ■ 01-00234-00800 | 8        | 24                | —                    | 8              | 70                 |
| ▲ ■ 01-00234-00850 | 8.5      | 25                | —                    | 8              | 70                 |
| ▲ ■ 01-00234-00900 | 9        | 27                | 9°                   | 10             | 75                 |
| ▲ ■ 01-00234-00950 | 9.5      | 28                | 9°                   | 10             | 75                 |
| ▲ ■ 01-00234-01000 | 10       | 30                | —                    | 10             | 80                 |
| ▲ ■ 01-00234-01100 | 11       | 33                | 9°                   | 12             | 80                 |
| ▲ ■ 01-00234-01200 | 12       | 36                | —                    | 12             | 85                 |
| ▲ ■ 01-00234-01400 | 14       | 42                | —                    | 12             | 100                |
| ▲ ■ 01-00234-01500 | 15       | 45                | 9°                   | 16             | 110                |
| ▲ ■ 01-00234-01600 | 16       | 50                | —                    | 16             | 110                |
| ▲ ■ 01-00234-01800 | 18       | 55                | 9°                   | 20             | 130                |
| ▲ ■ 01-00234-02000 | 20       | 60                | —                    | 20             | 135                |

How to Order

When you order, indicate NCM-4 (D). ※ (γ) is reference value.

| Work Material             | Carbon Steels<br>S50C                                                                                                         |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed             | 40~50m/min                                                                                                                    |        | 35~45m/min                  |        | 25~35m/min                    |        |
| Dia.                      | Spindle Speed                                                                                                                 | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                           | min <sup>-1</sup>                                                                                                             | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 1                         | 14,300                                                                                                                        | 180    | 12,700                      | 160    | 9,600                         | 140    |
| 2                         | 7,200                                                                                                                         | 180    | 6,400                       | 160    | 4,800                         | 140    |
| 3                         | 4,800                                                                                                                         | 190    | 4,200                       | 170    | 3,200                         | 150    |
| 4                         | 3,600                                                                                                                         | 190    | 3,200                       | 170    | 2,400                         | 150    |
| 5                         | 2,900                                                                                                                         | 210    | 2,500                       | 190    | 1,900                         | 170    |
| 6                         | 2,400                                                                                                                         | 210    | 2,100                       | 190    | 1,600                         | 170    |
| 7                         | 2,000                                                                                                                         | 210    | 1,800                       | 190    | 1,400                         | 170    |
| 8                         | 1,800                                                                                                                         | 210    | 1,600                       | 190    | 1,200                         | 170    |
| 9                         | 1,600                                                                                                                         | 210    | 1,400                       | 190    | 1,100                         | 170    |
| 10                        | 1,400                                                                                                                         | 210    | 1,300                       | 190    | 1,000                         | 170    |
| 11                        | 1,300                                                                                                                         | 210    | 1,200                       | 190    | 870                           | 170    |
| 12                        | 1,200                                                                                                                         | 210    | 1,100                       | 190    | 800                           | 170    |
| 14                        | 1,020                                                                                                                         | 210    | 910                         | 190    | 680                           | 170    |
| 15                        | 960                                                                                                                           | 210    | 850                         | 190    | 640                           | 170    |
| 16                        | 900                                                                                                                           | 210    | 800                         | 190    | 600                           | 170    |
| 18                        | 800                                                                                                                           | 210    | 710                         | 190    | 530                           | 170    |
| 20                        | 720                                                                                                                           | 210    | 640                         | 190    | 480                           | 170    |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling</div>                                                                                                       |        |                             |        |                               |        |
| Notes                     | ※1 Use cutting fluid.<br>※2 It is available only for side milling.<br>※3 Adjust both spindle speed and feed at the same rate. |        |                             |        |                               |        |



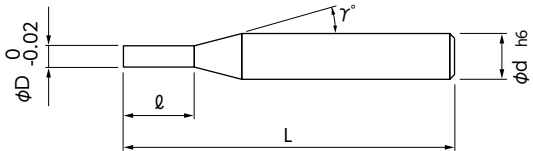
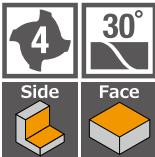
Square



Square

CHAMPION SOLID 4-Flute Long End Mill

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.  
● ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| ■ 01-00224-00200   | 2           | 10                   | 9°                      | 4                 | 50                    |
| ■ 01-00224-00300   | 3           | 18                   | 9°                      | 6                 | 60                    |
| ■ 01-00224-00400   | 4           | 22                   | 9°                      | 6                 | 60                    |
| ■ 01-00224-00500   | 5           | 25                   | 9°                      | 6                 | 65                    |
| ■ 01-00224-00600   | 6           | 25                   | —                       | 6                 | 65                    |
| ▲ ■ 01-00224-00800 | 8           | 35                   | —                       | 8                 | 80                    |
| ▲ ■ 01-00224-01000 | 10          | 42                   | —                       | 10                | 100                   |
| ▲ ■ 01-00224-01200 | 12          | 45                   | —                       | 12                | 100                   |

How to Order

When you order, indicate NCL-4 (D). ※ (γ) is reference value.

| Work Material                  | Carbon Steels<br>S50C                                                                                                                       |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed                  | 20~25m/min                                                                                                                                  |        | 15~20m/min                  |        | 10~15m/min                    |        |
| Dia.                           | Spindle Speed                                                                                                                               | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                                | min <sup>-1</sup>                                                                                                                           | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 2                              | 3,200                                                                                                                                       | 120    | 2,800                       | 100    | 2,400                         | 90     |
| 3                              | 2,100                                                                                                                                       | 130    | 1,900                       | 110    | 1,600                         | 100    |
| 4                              | 1,600                                                                                                                                       | 130    | 1,400                       | 110    | 1,200                         | 100    |
| 5                              | 1,300                                                                                                                                       | 140    | 1,100                       | 120    | 1,000                         | 110    |
| 6                              | 1,100                                                                                                                                       | 140    | 930                         | 120    | 800                           | 110    |
| 8                              | 800                                                                                                                                         | 140    | 700                         | 120    | 600                           | 110    |
| 10                             | 640                                                                                                                                         | 140    | 560                         | 120    | 480                           | 110    |
| 12                             | 530                                                                                                                                         | 140    | 460                         | 120    | 400                           | 110    |
| Depth of Cut<br><br>(D : Dia.) | <div>Side Milling</div> <div></div> <div><math>a_p</math><br/><math>\phi 2 \sim 10 = 4D</math><br/><math>\phi 12 = 45\text{mm}</math></div> |        |                             |        |                               |        |
| Notes                          | ※1 Use cutting fluid.<br>※2 It is available only for side milling.<br>※3 Adjust both spindle speed and feed at the same rate.               |        |                             |        |                               |        |

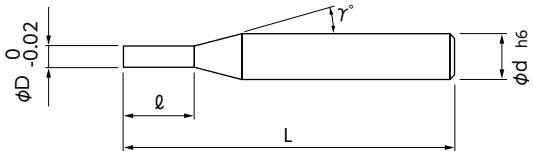
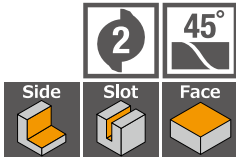


Square



Square





● ■ : Semi-standard Products, please inquire for price and delivery.  
● ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|----------|-------------------|----------------------|----------------|--------------------|
| ■ 01-00112-00100   | 1        | 2.5               | 9°                   | 4              | 45                 |
| ■ 01-00112-00150   | 1.5      | 3                 | 9°                   | 4              | 45                 |
| ■ 01-00112-00200   | 2        | 6                 | 9°                   | 4              | 45                 |
| ■ 01-00112-00250   | 2.5      | 8                 | 9°                   | 4              | 45                 |
| ■ 01-00112-00300   | 3        | 8                 | 9°                   | 6              | 45                 |
| ■ 01-00112-00350   | 3.5      | 9                 | 9°                   | 6              | 45                 |
| ■ 01-00112-00400   | 4        | 10                | 9°                   | 6              | 45                 |
| ■ 01-00112-00450   | 4.5      | 13                | 9°                   | 6              | 50                 |
| ■ 01-00112-00500   | 5        | 13                | 9°                   | 6              | 50                 |
| ■ 01-00112-00550   | 5.5      | 13                | 9°                   | 6              | 50                 |
| ■ 01-00112-00600   | 6        | 13                | —                    | 6              | 50                 |
| ■ 01-00112-00650   | 6.5      | 18                | 9°                   | 8              | 60                 |
| ■ 01-00112-00700   | 7        | 18                | 9°                   | 8              | 60                 |
| ■ 01-00112-00750   | 7.5      | 18                | 9°                   | 8              | 60                 |
| ■ 01-00112-00800   | 8        | 18                | —                    | 8              | 60                 |
| ■ 01-00112-00850   | 8.5      | 20                | 9°                   | 10             | 65                 |
| ■ 01-00112-00900   | 9        | 20                | 9°                   | 10             | 65                 |
| ■ 01-00112-00950   | 9.5      | 20                | 9°                   | 10             | 65                 |
| ■ 01-00112-01000   | 10       | 20                | —                    | 10             | 65                 |
| ■ 01-00112-01100   | 11       | 23                | 9°                   | 12             | 70                 |
| ■ 01-00112-01200   | 12       | 23                | —                    | 12             | 70                 |
| ▲ ■ 01-00112-01400 | 14       | 30                | 9°                   | 16             | 85                 |
| ▲ ■ 01-00112-01500 | 15       | 35                | 9°                   | 16             | 90                 |
| ▲ ■ 01-00112-01600 | 16       | 35                | —                    | 16             | 90                 |
| ▲ ■ 01-00112-01800 | 18       | 40                | 9°                   | 20             | 100                |
| ▲ ■ 01-00112-02000 | 20       | 45                | —                    | 20             | 110                |

How to Order

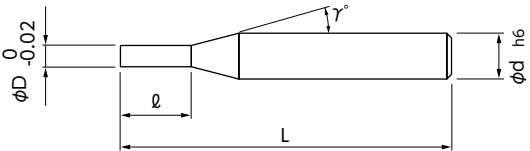
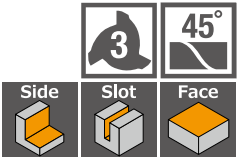
When you order, indicate NE-2 (D).

※(γ) is reference value.

| Work Material             | Carbon Steels<br>S50C                                                                                                                                |              |          | Alloy Steels<br>SCM・SKD・SUS |              |          | Prehardened Steels<br>HPM・NAK |              |          | Aluminium Alloy   |              |          | Copper            |              |          |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------|--------------|----------|-------------------------------|--------------|----------|-------------------|--------------|----------|-------------------|--------------|----------|
| Cutting Speed             | 40~50m/min                                                                                                                                           |              |          | 35~45m/min                  |              |          | 25~35m/min                    |              |          | 60~100m/min       |              |          | 40~80m/min        |              |          |
| Dia.                      | Spindle Speed                                                                                                                                        | Feed         |          | Spindle Speed               | Feed         |          | Spindle Speed                 | Feed         |          | Spindle Speed     | Feed         |          | Spindle Speed     | Feed         |          |
|                           | min <sup>-1</sup>                                                                                                                                    | mm/min       |          | min <sup>-1</sup>           | mm/min       |          | min <sup>-1</sup>             | mm/min       |          | min <sup>-1</sup> | mm/min       |          | min <sup>-1</sup> | mm/min       |          |
|                           |                                                                                                                                                      | Side Milling | Slotting |                             | Side Milling | Slotting |                               | Side Milling | Slotting |                   | Side Milling | Slotting |                   | Side Milling | Slotting |
| 1                         | 14,300                                                                                                                                               | 200          | 80       | 12,700                      | 150          | 60       | 9,600                         | 110          | 40       | 25,500            | 400          | 150      | 19,100            | 250          | 130      |
| 1.5                       | 9,600                                                                                                                                                | 200          | 80       | 8,500                       | 150          | 60       | 6,400                         | 110          | 40       | 17,000            | 400          | 150      | 12,700            | 250          | 130      |
| 2                         | 7,200                                                                                                                                                | 200          | 80       | 6,400                       | 150          | 60       | 4,800                         | 110          | 40       | 12,700            | 400          | 150      | 9,600             | 250          | 130      |
| 2.5                       | 5,700                                                                                                                                                | 200          | 80       | 5,100                       | 150          | 60       | 3,800                         | 110          | 40       | 10,200            | 400          | 150      | 7,600             | 250          | 130      |
| 3                         | 4,800                                                                                                                                                | 230          | 90       | 4,200                       | 180          | 70       | 3,200                         | 130          | 50       | 8,500             | 450          | 180      | 6,400             | 300          | 160      |
| 4                         | 3,600                                                                                                                                                | 230          | 90       | 3,200                       | 180          | 70       | 2,400                         | 130          | 50       | 6,400             | 450          | 180      | 4,800             | 300          | 160      |
| 5                         | 2,900                                                                                                                                                | 250          | 100      | 2,500                       | 200          | 80       | 1,900                         | 150          | 60       | 5,100             | 500          | 220      | 3,800             | 350          | 180      |
| 6                         | 2,400                                                                                                                                                | 250          | 100      | 2,100                       | 200          | 80       | 1,600                         | 150          | 60       | 4,200             | 500          | 220      | 3,200             | 350          | 180      |
| 7                         | 2,000                                                                                                                                                | 250          | 100      | 1,800                       | 200          | 80       | 1,400                         | 150          | 60       | 3,600             | 500          | 220      | 2,700             | 350          | 180      |
| 8                         | 1,800                                                                                                                                                | 250          | 100      | 1,600                       | 200          | 80       | 1,200                         | 150          | 60       | 3,200             | 500          | 220      | 2,400             | 350          | 180      |
| 9                         | 1,600                                                                                                                                                | 250          | 100      | 1,400                       | 200          | 80       | 1,100                         | 150          | 60       | 2,800             | 500          | 220      | 2,100             | 350          | 180      |
| 10                        | 1,400                                                                                                                                                | 250          | 100      | 1,300                       | 200          | 80       | 1,000                         | 150          | 60       | 2,500             | 500          | 220      | 1,900             | 350          | 180      |
| 11                        | 1,300                                                                                                                                                | 250          | 100      | 1,200                       | 200          | 80       | 870                           | 150          | 60       | 2,300             | 500          | 220      | 1,700             | 350          | 180      |
| 12                        | 1,200                                                                                                                                                | 250          | 100      | 1,100                       | 200          | 80       | 800                           | 150          | 60       | 2,100             | 500          | 220      | 1,600             | 350          | 180      |
| 14                        | 1,020                                                                                                                                                | 250          | 100      | 910                         | 200          | 80       | 680                           | 150          | 60       | 1,800             | 500          | 220      | 1,400             | 350          | 180      |
| 15                        | 960                                                                                                                                                  | 250          | 100      | 850                         | 200          | 80       | 640                           | 150          | 60       | 1,700             | 500          | 220      | 1,300             | 350          | 180      |
| 16                        | 900                                                                                                                                                  | 250          | 100      | 800                         | 200          | 80       | 600                           | 150          | 60       | 1,600             | 500          | 220      | 1,200             | 350          | 180      |
| 18                        | 800                                                                                                                                                  | 250          | 100      | 710                         | 200          | 80       | 530                           | 150          | 60       | 1,400             | 500          | 220      | 1,100             | 350          | 180      |
| 20                        | 720                                                                                                                                                  | 250          | 100      | 640                         | 200          | 80       | 480                           | 150          | 60       | 1,300             | 500          | 220      | 1,000             | 350          | 180      |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling</div> <div>Slotting</div> <div><math>a_p</math><br/><math>\phi 1 \sim 2.5 = 0.5D</math><br/><math>\phi 3 \sim 20 = 1D</math></div> |              |          |                             |              |          |                               |              |          |                   |              |          |                   |              |          |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Use high rigid holder.                                        |              |          |                             |              |          |                               |              |          |                   |              |          |                   |              |          |

POWER SOLID 3-Flute End Mill

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| ■ 01-00113-00300   | 3           | 8                    | 9°                               | 6                 | 45                    |
| ■ 01-00113-00350   | 3.5         | 10                   | 9°                               | 6                 | 45                    |
| ■ 01-00113-00400   | 4           | 10                   | 9°                               | 6                 | 45                    |
| ■ 01-00113-00450   | 4.5         | 13                   | 9°                               | 6                 | 50                    |
| ■ 01-00113-00500   | 5           | 13                   | 9°                               | 6                 | 50                    |
| ■ 01-00113-00550   | 5.5         | 13                   | 9°                               | 6                 | 50                    |
| ■ 01-00113-00600   | 6           | 13                   | —                                | 6                 | 50                    |
| ■ 01-00113-00650   | 6.5         | 18                   | 9°                               | 8                 | 60                    |
| ■ 01-00113-00700   | 7           | 18                   | 9°                               | 8                 | 60                    |
| ■ 01-00113-00750   | 7.5         | 18                   | 9°                               | 8                 | 60                    |
| ■ 01-00113-00800   | 8           | 18                   | —                                | 8                 | 60                    |
| ■ 01-00113-00850   | 8.5         | 20                   | 9°                               | 10                | 65                    |
| ■ 01-00113-00900   | 9           | 20                   | 9°                               | 10                | 65                    |
| ■ 01-00113-00950   | 9.5         | 20                   | 9°                               | 10                | 65                    |
| ■ 01-00113-01000   | 10          | 20                   | —                                | 10                | 65                    |
| ■ 01-00113-01100   | 11          | 23                   | 9°                               | 12                | 70                    |
| ■ 01-00113-01200   | 12          | 23                   | —                                | 12                | 70                    |
| ■ 01-00113-01300   | 13          | 30                   | 9°                               | 16                | 85                    |
| ▲ ■ 01-00113-01400 | 14          | 30                   | 9°                               | 16                | 85                    |
| ▲ ■ 01-00113-01500 | 15          | 35                   | 9°                               | 16                | 90                    |
| ▲ ■ 01-00113-01600 | 16          | 35                   | —                                | 16                | 90                    |
| ▲ ■ 01-00113-01800 | 18          | 40                   | 9°                               | 20                | 100                   |
| ▲ ■ 01-00113-02000 | 20          | 45                   | —                                | 20                | 110                   |

How to Order

When you order, indicate NE-3 (D). ※( $\gamma$ ) is reference value.

| Work Material             | Carbon Steels<br>S50C                                                                                         |              |          | Alloy Steels<br>SCM·SKD·SUS |              |          | Prehardened Steels<br>HPM·NAK |              |          | Aluminium Alloy   |              |          | Copper            |              |          |
|---------------------------|---------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------|--------------|----------|-------------------------------|--------------|----------|-------------------|--------------|----------|-------------------|--------------|----------|
| Cutting Speed             | 40~50m/min                                                                                                    |              |          | 35~45m/min                  |              |          | 25~35m/min                    |              |          | 60~100m/min       |              |          | 40~80m/min        |              |          |
| Dia.                      | Spindle Speed                                                                                                 | Feed         |          | Spindle Speed               | Feed         |          | Spindle Speed                 | Feed         |          | Spindle Speed     | Feed         |          | Spindle Speed     | Feed         |          |
|                           | min <sup>-1</sup>                                                                                             | mm/min       |          | min <sup>-1</sup>           | mm/min       |          | min <sup>-1</sup>             | mm/min       |          | min <sup>-1</sup> | mm/min       |          | min <sup>-1</sup> | mm/min       |          |
|                           |                                                                                                               | Side Milling | Slotting |                             | Side Milling | Slotting |                               | Side Milling | Slotting |                   | Side Milling | Slotting |                   | Side Milling | Slotting |
| 6                         | 2,400                                                                                                         | 330          | 110      | 2,100                       | 260          | 90       | 1,600                         | 200          | 70       | 4,200             | 600          | 250      | 3,200             | 450          | 200      |
| 8                         | 1,800                                                                                                         | 330          | 110      | 1,600                       | 260          | 90       | 1,200                         | 200          | 70       | 3,200             | 600          | 250      | 2,400             | 450          | 200      |
| 10                        | 1,400                                                                                                         | 330          | 110      | 1,300                       | 260          | 90       | 1,000                         | 200          | 70       | 2,500             | 600          | 250      | 1,900             | 450          | 200      |
| 12                        | 1,200                                                                                                         | 330          | 110      | 1,100                       | 260          | 90       | 800                           | 200          | 70       | 2,100             | 600          | 250      | 1,600             | 450          | 200      |
| 14                        | 1,020                                                                                                         | 330          | 110      | 910                         | 260          | 90       | 680                           | 200          | 70       | 1,800             | 600          | 250      | 1,400             | 450          | 200      |
| 15                        | 960                                                                                                           | 330          | 110      | 850                         | 260          | 90       | 640                           | 200          | 70       | 1,700             | 600          | 250      | 1,300             | 450          | 200      |
| 16                        | 900                                                                                                           | 330          | 110      | 800                         | 260          | 90       | 600                           | 200          | 70       | 1,600             | 600          | 250      | 1,200             | 450          | 200      |
| 18                        | 800                                                                                                           | 330          | 110      | 710                         | 260          | 90       | 530                           | 200          | 70       | 1,400             | 600          | 250      | 1,100             | 450          | 200      |
| 20                        | 720                                                                                                           | 330          | 110      | 640                         | 260          | 90       | 480                           | 200          | 70       | 1,300             | 600          | 250      | 1,000             | 450          | 200      |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling: 2D (vertical), 0.1D (horizontal)</div> <div>Slotting: D (horizontal), 1D (vertical)</div>  |              |          |                             |              |          |                               |              |          |                   |              |          |                   |              |          |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Use high rigid holder. |              |          |                             |              |          |                               |              |          |                   |              |          |                   |              |          |

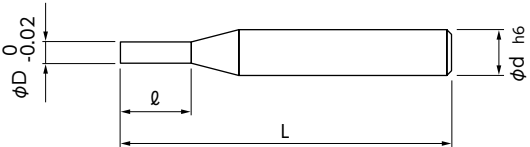


Square



Square

POWER SOLID 3-Flute Long End Mill



● ■ : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.         | Dia.<br>(D) | Length of Cut<br>(ℓ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|------------------|-------------|----------------------|-------------------|-----------------------|
| ■ 01-00116-00600 | 6           | 25                   | 6                 | 75                    |
| ■ 01-00116-00800 | 8           | 35                   | 8                 | 90                    |
| ■ 01-00116-01000 | 10          | 45                   | 10                | 110                   |
| ■ 01-00116-01200 | 12          | 55                   | 12                | 120                   |
| ■ 01-00116-01400 | 14          | 65                   | 16                | 140                   |
| ■ 01-00116-01600 | 16          | 65                   | 16                | 140                   |
| ■ 01-00116-01800 | 18          | 75                   | 20                | 155                   |
| ■ 01-00116-02000 | 20          | 85                   | 20                | 165                   |

How to Order

When you order, indicate NEL-3 (D).



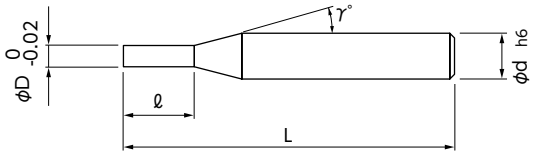
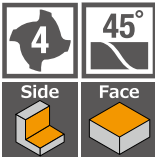
Square



Square

POWER SOLID 4-Flute End Mill

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(L) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| ■ 01-00114-00300   | 3           | 8                    | 9°                               | 6                 | 45                    |
| ■ 01-00114-00400   | 4           | 10                   | 9°                               | 6                 | 45                    |
| ■ 01-00114-00450   | 4.5         | 13                   | 9°                               | 6                 | 50                    |
| ■ 01-00114-00500   | 5           | 13                   | 9°                               | 6                 | 50                    |
| ■ 01-00114-00600   | 6           | 13                   | —                                | 6                 | 50                    |
| ■ 01-00114-00700   | 7           | 18                   | 9°                               | 8                 | 60                    |
| ▲ ■ 01-00114-00800 | 8           | 18                   | —                                | 8                 | 60                    |
| ▲ ■ 01-00114-01000 | 10          | 20                   | —                                | 10                | 65                    |
| ▲ ■ 01-00114-01200 | 12          | 23                   | —                                | 12                | 70                    |
| ▲ ■ 01-00114-01400 | 14          | 30                   | 9°                               | 16                | 85                    |
| ▲ ■ 01-00114-01500 | 15          | 35                   | 9°                               | 16                | 90                    |
| ▲ ■ 01-00114-01600 | 16          | 35                   | —                                | 16                | 90                    |
| ▲ ■ 01-00114-01800 | 18          | 40                   | 9°                               | 20                | 100                   |
| ▲ ■ 01-00114-02000 | 20          | 45                   | —                                | 20                | 110                   |

How to Order

When you order, indicate NE-4 (D). ※ ( $\gamma$ ) is reference value.

| Work Material                 | Carbon Steels<br>S50C                                                                                                                                      |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed                 | 40~50m/min                                                                                                                                                 |        | 35~45m/min                  |        | 25~35m/min                    |        |
| Dia.                          | Spindle Speed                                                                                                                                              | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                               | min <sup>-1</sup>                                                                                                                                          | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 3                             | 4,800                                                                                                                                                      | 340    | 4,200                       | 270    | 3,200                         | 250    |
| 4                             | 3,600                                                                                                                                                      | 340    | 3,200                       | 270    | 2,400                         | 250    |
| 5                             | 2,900                                                                                                                                                      | 370    | 2,500                       | 300    | 1,900                         | 280    |
| 6                             | 2,400                                                                                                                                                      | 370    | 2,100                       | 300    | 1,600                         | 280    |
| 8                             | 1,800                                                                                                                                                      | 370    | 1,600                       | 300    | 1,200                         | 280    |
| 10                            | 1,400                                                                                                                                                      | 370    | 1,300                       | 300    | 1,000                         | 280    |
| 12                            | 1,200                                                                                                                                                      | 370    | 1,100                       | 300    | 800                           | 280    |
| 14                            | 1,020                                                                                                                                                      | 370    | 910                         | 300    | 680                           | 280    |
| 15                            | 960                                                                                                                                                        | 370    | 850                         | 300    | 640                           | 280    |
| 16                            | 900                                                                                                                                                        | 370    | 800                         | 300    | 600                           | 280    |
| 18                            | 800                                                                                                                                                        | 370    | 710                         | 300    | 530                           | 280    |
| 20                            | 720                                                                                                                                                        | 370    | 640                         | 300    | 480                           | 280    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div>                                                                                                                                    |        |                             |        |                               |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 It is available only for side cutting.<br>※3 Adjust both spindle speed and feed at the same rate.<br>※4 Use high rigid holder. |        |                             |        |                               |        |

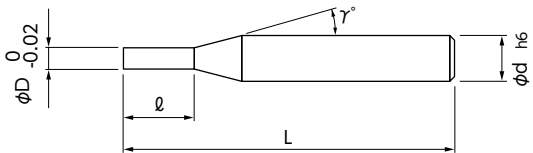
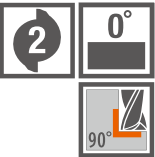


Square



Square

Straight End Mill for Reforming



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         |                  |                |                 |        |       |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(l) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| ■ 01-00812-00100   | 1           | 2                    | 9°                               | 4                 | 45                    |
| ■ 01-00812-00150   | 1.5         | 3                    | 9°                               | 4                 | 45                    |
| ■ 01-00812-00200   | 2           | 4                    | 9°                               | 4                 | 45                    |
| ■ 01-00812-00250   | 2.5         | 5                    | 9°                               | 4                 | 45                    |
| ■ 01-00812-00300   | 3           | 6                    | 9°                               | 6                 | 45                    |
| ■ 01-00812-00400   | 4           | 8                    | 9°                               | 6                 | 45                    |
| ■ 01-00812-00500   | 5           | 10                   | 9°                               | 6                 | 50                    |
| ■ 01-00812-00600   | 6           | 12                   | —                                | 6                 | 55                    |
| ▲ ■ 01-00812-00700 | 7           | 14                   | 9°                               | 8                 | 60                    |
| ▲ ■ 01-00812-00800 | 8           | 16                   | —                                | 8                 | 60                    |
| ▲ ■ 01-00812-00900 | 9           | 18                   | 9°                               | 10                | 65                    |
| ▲ ■ 01-00812-01000 | 10          | 20                   | —                                | 10                | 70                    |
| ▲ ■ 01-00812-01100 | 11          | 22                   | 9°                               | 12                | 75                    |
| ▲ ■ 01-00812-01200 | 12          | 24                   | —                                | 12                | 75                    |

How to Order

When you order, indicate NSL-2 (D). ※( $\gamma$ ) is reference value.



Square

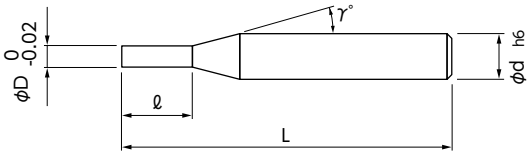
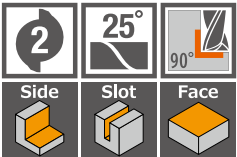


Square



2-Flute End Mill for Nonferrous

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| ■ 07-00036-00050   | 0.5         | 1                    | 12°                     | 4                 | 45                    |
| ■ 07-00036-00080   | 0.8         | 1.6                  | 12°                     | 4                 | 45                    |
| ■ 07-00036-00100   | 1           | 2                    | 9°                      | 4                 | 45                    |
| ■ 07-00036-00150   | 1.5         | 3                    | 9°                      | 4                 | 45                    |
| ■ 07-00036-00200   | 2           | 4                    | 9°                      | 4                 | 45                    |
| ■ 07-00036-00250   | 2.5         | 5                    | 9°                      | 4                 | 45                    |
| ■ 07-00036-00300   | 3           | 6                    | 9°                      | 6                 | 50                    |
| ■ 07-00036-00400   | 4           | 8                    | 9°                      | 6                 | 50                    |
| ■ 07-00036-00500   | 5           | 10                   | 9°                      | 6                 | 60                    |
| ■ 07-00036-00600   | 6           | 12                   | —                       | 6                 | 60                    |
| ▲ ■ 07-00036-00800 | 8           | 16                   | —                       | 8                 | 70                    |
| ▲ ■ 07-00036-01000 | 10          | 20                   | —                       | 10                | 80                    |
| ▲ ■ 07-00036-01200 | 12          | 24                   | —                       | 12                | 80                    |
| ▲ ■ 07-00036-01600 | 16          | 32                   | —                       | 16                | 100                   |
| ▲ ■ 07-00036-02000 | 20          | 40                   | —                       | 20                | 120                   |

How to Order

When you order, indicate DX (D). ※(γ) is reference value.

| Work Material              | Copper                                                                                                               |        | Aluminium Alloy   |        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed              | 60m/min                                                                                                              |        | 80~150m/min       |        |
| Dia.                       | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                            | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 0.5                        | 38,000                                                                                                               | 150    | 50,000            | 520    |
| 0.8                        | 24,000                                                                                                               | 150    | 50,000            | 520    |
| 1                          | 19,000                                                                                                               | 150    | 48,000            | 800    |
| 1.5                        | 13,000                                                                                                               | 150    | 32,000            | 1,000  |
| 2                          | 9,600                                                                                                                | 150    | 24,000            | 1,000  |
| 2.5                        | 7,700                                                                                                                | 200    | 19,000            | 1,000  |
| 3                          | 6,400                                                                                                                | 200    | 16,000            | 1,000  |
| 4                          | 4,800                                                                                                                | 200    | 12,000            | 1,000  |
| 5                          | 3,800                                                                                                                | 200    | 9,600             | 1,000  |
| 6                          | 3,200                                                                                                                | 200    | 8,000             | 1,000  |
| 8                          | 2,400                                                                                                                | 200    | 6,000             | 1,000  |
| 10                         | 1,900                                                                                                                | 200    | 4,800             | 1,000  |
| 12                         | 1,600                                                                                                                | 200    | 4,000             | 1,000  |
| 16                         | 1,200                                                                                                                | 200    | 3,000             | 1,000  |
| 20                         | 960                                                                                                                  | 200    | 2,400             | 1,000  |
| Depth of Cut<br>(D : Dia.) | <div>Side Milling</div>                                                                                              |        |                   |        |
| Notes                      | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |



Square

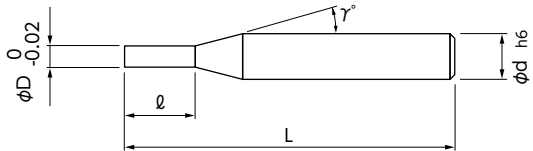
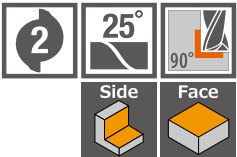


Square



2-Flute Medium End Mill for Nonferrous

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

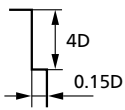
▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|-------------------------|-------------------|-----------------------|
| ■ 07-00040-00300   | 3           | 12                   | 9°                      | 6                 | 60                    |
| ■ 07-00040-00400   | 4           | 16                   | 9°                      | 6                 | 60                    |
| ■ 07-00040-00500   | 5           | 20                   | 9°                      | 6                 | 70                    |
| ■ 07-00040-00600   | 6           | 24                   | —                       | 6                 | 70                    |
| ▲ ■ 07-00040-00800 | 8           | 32                   | —                       | 8                 | 90                    |
| ▲ ■ 07-00040-01000 | 10          | 40                   | —                       | 10                | 100                   |
| ▲ ■ 07-00040-01200 | 12          | 48                   | —                       | 12                | 110                   |
| ▲ ■ 07-00040-01600 | 16          | 64                   | —                       | 16                | 140                   |
| ▲ ■ 07-00040-02000 | 20          | 80                   | —                       | 20                | 160                   |

How to Order

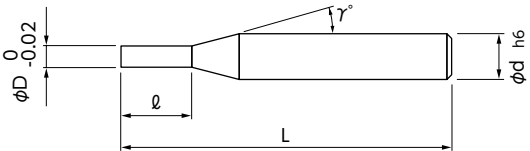
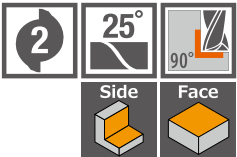
When you order, indicate DXM (D). ※(γ) is reference value.

| Work Material                 | Copper                                                                                                               |        | Aluminium Alloy   |        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed                 | 40m/min                                                                                                              |        | 50~100m/min       |        |
| Dia.                          | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 3                             | 4,300                                                                                                                | 130    | 10,000            | 660    |
| 4                             | 3,200                                                                                                                | 130    | 8,000             | 660    |
| 5                             | 2,600                                                                                                                | 130    | 6,400             | 660    |
| 6                             | 2,100                                                                                                                | 130    | 5,300             | 660    |
| 8                             | 1,600                                                                                                                | 130    | 4,000             | 660    |
| 10                            | 1,300                                                                                                                | 130    | 3,200             | 660    |
| 12                            | 1,000                                                                                                                | 130    | 2,600             | 660    |
| 16                            | 800                                                                                                                  | 130    | 2,000             | 660    |
| 20                            | 640                                                                                                                  | 130    | 1,200             | 660    |
| Depth of Cut<br><br>(D: Dia.) | <div>Side Milling</div>          |        |                   |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |



2-Flute Long End Mill for Nonferrous

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>(ℓ) | Neck Taper Angle<br>( $\gamma$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|----------------------------------|-------------------|-----------------------|
| ■ 07-00045-00300   | 3           | 15                   | 9°                               | 6                 | 70                    |
| ■ 07-00045-00400   | 4           | 20                   | 9°                               | 6                 | 70                    |
| ■ 07-00045-00500   | 5           | 25                   | 9°                               | 6                 | 80                    |
| ■ 07-00045-00600   | 6           | 30                   | —                                | 6                 | 80                    |
| ▲ ■ 07-00045-00800 | 8           | 40                   | —                                | 8                 | 100                   |
| ▲ ■ 07-00045-01000 | 10          | 50                   | —                                | 10                | 110                   |
| ▲ ■ 07-00045-01200 | 12          | 60                   | —                                | 12                | 120                   |
| ▲ ■ 07-00045-01600 | 16          | 80                   | —                                | 16                | 160                   |
| ▲ ■ 07-00045-02000 | 20          | 100                  | —                                | 20                | 190                   |

How to Order

When you order, indicate DXL (D). ※ ( $\gamma$ ) is reference value.

| Work Material              | Copper                                                                                                               |        | Aluminium Alloy   |        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed              | 30m/min                                                                                                              |        | 40~80m/min        |        |
| Dia.                       | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                            | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 3                          | 3,200                                                                                                                | 100    | 8,000             | 500    |
| 4                          | 2,400                                                                                                                | 100    | 6,000             | 500    |
| 5                          | 1,900                                                                                                                | 100    | 4,800             | 500    |
| 6                          | 1,600                                                                                                                | 100    | 4,000             | 500    |
| 8                          | 1,200                                                                                                                | 100    | 3,000             | 500    |
| 10                         | 1,000                                                                                                                | 100    | 2,400             | 500    |
| 12                         | 800                                                                                                                  | 100    | 2,000             | 500    |
| 16                         | 600                                                                                                                  | 100    | 1,500             | 500    |
| 20                         | 500                                                                                                                  | 100    | 1,200             | 500    |
| Depth of Cut<br>(D : Dia.) | <div>Side Milling</div>                                                                                              |        |                   |        |
| Notes                      | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |



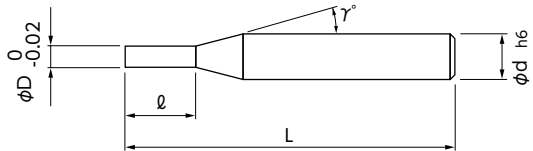
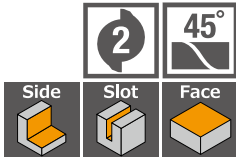
Square



Square

2-Flute End Mill for Aluminium

Recommended Milling Conditions



Work Material

| Carbon Steels | Alloy Steels · Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                            |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                            |                    |                 |         |                  |                | ○               | ○      | ○     |

▲ Discontinued Products

Unit : mm

| Code No.           | Dia. (D) | Length of Cut ( $\ell$ ) | Neck Taper Angle ( $\gamma$ ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|----------|--------------------------|-------------------------------|----------------|--------------------|
| ■ 01-00622-00310   | 3        | 10                       | 9°                            | 6              | 50                 |
| ■ 01-00622-00315   |          | 15                       | 9°                            | 6              | 55                 |
| ■ 01-00622-00320   |          | 20                       | 9°                            | 6              | 60                 |
| ■ 01-00622-00412   | 4        | 12                       | 9°                            | 6              | 50                 |
| ■ 01-00622-00416   |          | 16                       | 9°                            | 6              | 55                 |
| ■ 01-00622-00422   |          | 22                       | 9°                            | 6              | 60                 |
| ■ 01-00622-00514   | 5        | 14                       | 9°                            | 6              | 55                 |
| ■ 01-00622-00522   |          | 22                       | 9°                            | 6              | 60                 |
| ■ 01-00622-00528   |          | 28                       | 9°                            | 6              | 65                 |
| ■ 01-00622-00616   | 6        | 16                       | —                             | 6              | 55                 |
| ■ 01-00622-00622   |          | 22                       | —                             | 6              | 60                 |
| ■ 01-00622-00630   |          | 30                       | —                             | 6              | 70                 |
| ▲ ■ 01-00622-00822 | 8        | 22                       | —                             | 8              | 70                 |
| ▲ ■ 01-00622-00828 |          | 28                       | —                             | 8              | 75                 |
| ▲ ■ 01-00622-00836 |          | 36                       | —                             | 8              | 90                 |
| ▲ ■ 01-00622-01026 | 10       | 26                       | —                             | 10             | 75                 |
| ▲ ■ 01-00622-01036 |          | 36                       | —                             | 10             | 85                 |
| ▲ ■ 01-00622-01046 |          | 46                       | —                             | 10             | 95                 |
| ▲ ■ 01-00622-01228 | 12       | 28                       | —                             | 12             | 80                 |
| ▲ ■ 01-00622-01238 |          | 38                       | —                             | 12             | 90                 |
| ▲ ■ 01-00622-01248 |          | 48                       | —                             | 12             | 100                |
| ▲ ■ 01-00622-01640 | 16       | 40                       | —                             | 16             | 100                |
| ▲ ■ 01-00622-01665 |          | 65                       | —                             | 16             | 130                |
| ▲ ■ 01-00622-02045 | 20       | 45                       | —                             | 20             | 110                |
| ▲ ■ 01-00622-02080 |          | 80                       | —                             | 20             | 140                |
| ▲ ■ 01-00622-02550 | 25       | 50                       | —                             | 25             | 120                |

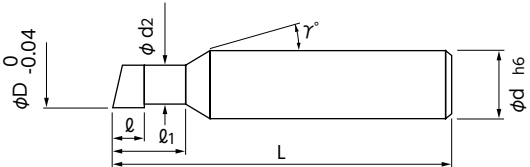
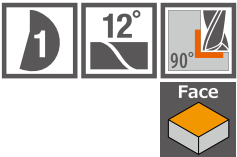
How to Order

When you order, indicate NEA-2 (D)×( $\ell$ ). ※( $\gamma$ ) is reference value.

| Work Material             |               | Aluminium Alloy                                                                                                                                                                 |                |          | Copper Alloy                       |                |          |
|---------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|------------------------------------|----------------|----------|
| Cutting Speed             |               | 60~150m/min                                                                                                                                                                     |                |          | 40~60m/min                         |                |          |
| Dia.                      | Length of Cut | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                              | Feed<br>mm/min |          | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |          |
|                           |               |                                                                                                                                                                                 | Side Milling   | Slotting |                                    | Side Milling   | Slotting |
|                           |               |                                                                                                                                                                                 |                |          |                                    |                |          |
| 3                         | 10            | 16,000                                                                                                                                                                          | 800            | 330      | 8,500                              | 250            | 100      |
|                           | 15            | 10,600                                                                                                                                                                          | 600            | 270      | 6,400                              | 250            | 100      |
|                           | 20            | 6,400                                                                                                                                                                           | 600            | 270      | 4,200                              | 250            | 100      |
| 4                         | 12            | 12,000                                                                                                                                                                          | 800            | 330      | 6,400                              | 250            | 100      |
|                           | 16            | 8,000                                                                                                                                                                           | 600            | 270      | 4,800                              | 250            | 100      |
|                           | 22            | 4,800                                                                                                                                                                           | 600            | 270      | 3,200                              | 250            | 100      |
| 5                         | 14            | 9,600                                                                                                                                                                           | 800            | 330      | 5,100                              | 300            | 130      |
|                           | 22            | 6,400                                                                                                                                                                           | 600            | 270      | 3,800                              | 300            | 130      |
|                           | 28            | 3,800                                                                                                                                                                           | 600            | 270      | 2,500                              | 300            | 130      |
| 6                         | 16            | 8,000                                                                                                                                                                           | 800            | 330      | 4,200                              | 300            | 130      |
|                           | 22            | 5,300                                                                                                                                                                           | 600            | 270      | 3,200                              | 300            | 130      |
|                           | 30            | 3,200                                                                                                                                                                           | 600            | 270      | 2,700                              | 300            | 130      |
| 8                         | 22            | 6,000                                                                                                                                                                           | 800            | 330      | 3,200                              | 300            | 130      |
|                           | 28            | 4,000                                                                                                                                                                           | 600            | 270      | 2,400                              | 300            | 130      |
|                           | 36            | 2,400                                                                                                                                                                           | 600            | 270      | 2,000                              | 300            | 130      |
| 10                        | 26            | 4,800                                                                                                                                                                           | 800            | 330      | 2,500                              | 300            | 130      |
|                           | 36            | 3,200                                                                                                                                                                           | 600            | 270      | 1,900                              | 300            | 130      |
|                           | 46            | 1,900                                                                                                                                                                           | 600            | 270      | 1,600                              | 300            | 130      |
| 12                        | 28            | 4,000                                                                                                                                                                           | 800            | 330      | 2,100                              | 300            | 130      |
|                           | 38            | 2,700                                                                                                                                                                           | 600            | 270      | 1,600                              | 300            | 130      |
|                           | 48            | 1,600                                                                                                                                                                           | 600            | 270      | 1,300                              | 300            | 130      |
| 16                        | 40            | 2,000                                                                                                                                                                           | 800            | 330      | 1,600                              | 300            | 130      |
|                           | 65            | 1,200                                                                                                                                                                           | 600            | 270      | 1,200                              | 300            | 130      |
| 20                        | 45            | 1,600                                                                                                                                                                           | 800            | 330      | 1,300                              | 300            | 130      |
|                           | 80            | 1,000                                                                                                                                                                           | 600            | 270      | 960                                | 300            | 130      |
| 25                        | 50            | 1,300                                                                                                                                                                           | 800            | 330      | 760                                | 300            | 130      |
| Depth of Cut<br>(D: Dia.) |               | <div>Side Milling</div> <div>Full Flute</div> <div>0.1D</div> <div>Slotting</div> <div>D</div> <div>a<sub>p</sub></div> <div>a<sub>p</sub><br/>φ 3、4=0.3D<br/>φ 5~25=0.5D</div> |                |          |                                    |                |          |
| Notes                     |               | ※1 Water soluble fluid is recommended.<br>※2 Adjust both spindle speed and feed at the same rate.                                                                               |                |          |                                    |                |          |

Surface End Mill for Nonferrous

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

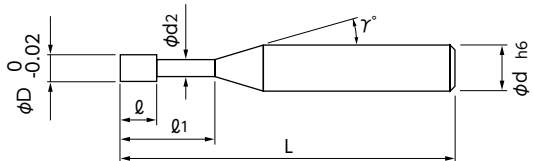
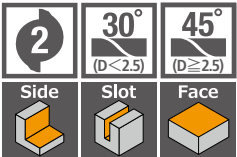
| Code No.           | Dia.<br>(D) | Length of Cut<br>(L) | Neck Dia.<br>(d2) | Under Neck Length<br>(L1) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|----------------------|-------------------|---------------------------|-------------------------|-------------------|-----------------------|
| ■ 07-00001-00100   | 1           | 0.5                  | 0.9               | 1                         | 12°                     | 6                 | 60                    |
| ■ 07-00001-00200   | 2           | 1                    | 1.8               | 2                         | 12°                     | 6                 | 60                    |
| ■ 07-00001-00300   | 3           | 1.5                  | 2.7               | 3                         | 12°                     | 6                 | 60                    |
| ■ 07-00001-00400   | 4           | 2                    | 3.6               | 4                         | 12°                     | 6                 | 60                    |
| ■ 07-00001-00500   | 5           | 2.5                  | 4.5               | 5                         | 12°                     | 6                 | 60                    |
| ■ 07-00001-00600   | 6           | 3                    | 5.4               | 6                         | —                       | 6                 | 60                    |
| ▲ ■ 07-00001-00800 | 8           | 4                    | 7.2               | 8                         | —                       | 8                 | 70                    |
| ▲ ■ 07-00001-01000 | 10          | 5                    | 9                 | 10                        | —                       | 10                | 80                    |
| ▲ ■ 07-00001-01200 | 12          | 6                    | 10.8              | 12                        | —                       | 12                | 80                    |
| ▲ ■ 07-00001-01600 | 16          | 8                    | 14.4              | 16                        | —                       | 16                | 100                   |
| ▲ ■ 07-00001-02000 | 20          | 10                   | 18                | 20                        | —                       | 20                | 120                   |

How to Order

When you order, indicate DSF (D). ※ ( γ ) is reference value.

| Work Material                 | Copper                                                                                                               |        | Aluminium Alloy   |        |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed                 | 80m/min                                                                                                              |        | 80~150m/min       |        |
| Dia.                          | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                               | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 1                             | 26,000                                                                                                               | 220    | 48,000            | 480    |
| 2                             | 13,000                                                                                                               | 220    | 24,000            | 480    |
| 3                             | 8,500                                                                                                                | 220    | 16,000            | 480    |
| 4                             | 6,400                                                                                                                | 220    | 12,000            | 480    |
| 5                             | 5,100                                                                                                                | 220    | 9,600             | 480    |
| 6                             | 4,200                                                                                                                | 220    | 8,000             | 480    |
| 8                             | 3,200                                                                                                                | 220    | 6,000             | 480    |
| 10                            | 2,600                                                                                                                | 220    | 4,800             | 480    |
| 12                            | 2,100                                                                                                                | 220    | 4,000             | 480    |
| 16                            | 1,600                                                                                                                | 220    | 3,000             | 480    |
| 20                            | 1,300                                                                                                                | 220    | 2,400             | 480    |
| Depth of Cut<br><br>(D: Dia.) | <div>Slotting</div> <div></div>                                                                                      |        |                   |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |





● Suitable for cutting in narrow and deep part by long neck end mill.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck Length<br>(L1) | Length of Cut<br>(L) | Neck Dia.<br>(d2) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|---------------------------|----------------------|-------------------|-------------------------|-------------------|-----------------------|
| 01-00412-00502 | 0.5         | 2                         | 0.7                  | 0.46              | 12°                     | 3                 | 35                    |
| 01-00412-00504 |             | 4                         | 0.7                  | 0.46              | 12°                     | 3                 | 35                    |
| 01-00412-00506 |             | 6                         | 0.7                  | 0.46              | 12°                     | 3                 | 35                    |
| 01-00412-00602 | 0.6         | 2                         | 0.9                  | 0.56              | 12°                     | 3                 | 35                    |
| 01-00412-00604 |             | 4                         | 0.9                  | 0.56              | 12°                     | 3                 | 35                    |
| 01-00412-00606 |             | 6                         | 0.9                  | 0.56              | 12°                     | 3                 | 35                    |
| 01-00412-00702 | 0.7         | 2                         | 1                    | 0.66              | 12°                     | 4                 | 45                    |
| 01-00412-00704 |             | 4                         | 1                    | 0.66              | 12°                     | 4                 | 45                    |
| 01-00412-00706 |             | 6                         | 1                    | 0.66              | 12°                     | 4                 | 45                    |
| 01-00412-00804 | 0.8         | 4                         | 1.2                  | 0.76              | 12°                     | 4                 | 45                    |
| 01-00412-00806 |             | 6                         | 1.2                  | 0.76              | 12°                     | 4                 | 45                    |
| 01-00412-00808 |             | 8                         | 1.2                  | 0.76              | 12°                     | 4                 | 45                    |
| 01-00412-00906 | 0.9         | 6                         | 1.35                 | 0.86              | 12°                     | 4                 | 45                    |
| 01-00412-00908 |             | 8                         | 1.35                 | 0.86              | 12°                     | 4                 | 45                    |
| 01-00412-00910 |             | 10                        | 1.35                 | 0.86              | 12°                     | 4                 | 45                    |
| 01-00412-01006 | 1           | 6                         | 1.5                  | 0.95              | 12°                     | 4                 | 45                    |
| 01-00412-01008 |             | 8                         | 1.5                  | 0.95              | 12°                     | 4                 | 45                    |
| 01-00412-01010 |             | 10                        | 1.5                  | 0.95              | 12°                     | 4                 | 45                    |
| 01-00412-01012 |             | 12                        | 1.5                  | 0.95              | 12°                     | 4                 | 45                    |
| 01-00412-01206 | 1.2         | 6                         | 1.8                  | 1.15              | 12°                     | 4                 | 45                    |
| 01-00412-01208 |             | 8                         | 1.8                  | 1.15              | 12°                     | 4                 | 45                    |
| 01-00412-01210 |             | 10                        | 1.8                  | 1.15              | 12°                     | 4                 | 45                    |
| 01-00412-01212 |             | 12                        | 1.8                  | 1.15              | 12°                     | 4                 | 45                    |
| 01-00412-01406 | 1.4         | 6                         | 2.1                  | 1.35              | 12°                     | 4                 | 45                    |
| 01-00412-01408 |             | 8                         | 2.1                  | 1.35              | 12°                     | 4                 | 45                    |
| 01-00412-01410 |             | 10                        | 2.1                  | 1.35              | 12°                     | 4                 | 45                    |
| 01-00412-01412 |             | 12                        | 2.1                  | 1.35              | 12°                     | 4                 | 45                    |
| 01-00412-01414 |             | 14                        | 2.1                  | 1.35              | 12°                     | 4                 | 50                    |
| 01-00412-01416 |             | 16                        | 2.1                  | 1.35              | 12°                     | 4                 | 50                    |
| 01-00412-01506 | 1.5         | 6                         | 2.3                  | 1.45              | 12°                     | 4                 | 45                    |

How to Order

When you order, indicate NHR-2 (D)×(L1). ※(γ) is reference value.

Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck Length<br>(L1) | Length of Cut<br>(L) | Neck Dia.<br>(d2) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|---------------------------|----------------------|-------------------|-------------------------|-------------------|-----------------------|
| 01-00412-01508 | 1.5         | 8                         | 2.3                  | 1.45              | 12°                     | 4                 | 45                    |
| 01-00412-01510 |             | 10                        | 2.3                  | 1.45              | 12°                     | 4                 | 45                    |
| 01-00412-01512 |             | 12                        | 2.3                  | 1.45              | 12°                     | 4                 | 45                    |
| 01-00412-01514 |             | 14                        | 2.3                  | 1.45              | 12°                     | 4                 | 50                    |
| 01-00412-01516 |             | 16                        | 2.3                  | 1.45              | 12°                     | 4                 | 50                    |
| 01-00412-01518 |             | 18                        | 2.3                  | 1.45              | 12°                     | 4                 | 55                    |
| 01-00412-01520 |             | 20                        | 2.3                  | 1.45              | 12°                     | 4                 | 55                    |
| 01-00412-01606 | 1.6         | 6                         | 2.4                  | 1.55              | 12°                     | 4                 | 45                    |
| 01-00412-01608 |             | 8                         | 2.4                  | 1.55              | 12°                     | 4                 | 45                    |
| 01-00412-01610 |             | 10                        | 2.4                  | 1.55              | 12°                     | 4                 | 45                    |
| 01-00412-01612 |             | 12                        | 2.4                  | 1.55              | 12°                     | 4                 | 45                    |
| 01-00412-01614 |             | 14                        | 2.4                  | 1.55              | 12°                     | 4                 | 50                    |
| 01-00412-01616 |             | 16                        | 2.4                  | 1.55              | 12°                     | 4                 | 50                    |
| 01-00412-01618 |             | 18                        | 2.4                  | 1.55              | 12°                     | 4                 | 55                    |
| 01-00412-01620 |             | 20                        | 2.4                  | 1.55              | 12°                     | 4                 | 55                    |
| 01-00412-01806 | 1.8         | 6                         | 2.7                  | 1.75              | 12°                     | 4                 | 45                    |
| 01-00412-01808 |             | 8                         | 2.7                  | 1.75              | 12°                     | 4                 | 45                    |
| 01-00412-01810 |             | 10                        | 2.7                  | 1.75              | 12°                     | 4                 | 45                    |
| 01-00412-01812 |             | 12                        | 2.7                  | 1.75              | 12°                     | 4                 | 45                    |
| 01-00412-01814 |             | 14                        | 2.7                  | 1.75              | 12°                     | 4                 | 50                    |
| 01-00412-01816 |             | 16                        | 2.7                  | 1.75              | 12°                     | 4                 | 50                    |
| 01-00412-01818 |             | 18                        | 2.7                  | 1.75              | 12°                     | 4                 | 55                    |
| 01-00412-01820 |             | 20                        | 2.7                  | 1.75              | 12°                     | 4                 | 55                    |
| 01-00412-02006 | 2           | 6                         | 3                    | 1.94              | 12°                     | 4                 | 45                    |
| 01-00412-02008 |             | 8                         | 3                    | 1.94              | 12°                     | 4                 | 45                    |
| 01-00412-02010 |             | 10                        | 3                    | 1.94              | 12°                     | 4                 | 45                    |
| 01-00412-02012 |             | 12                        | 3                    | 1.94              | 12°                     | 4                 | 45                    |
| 01-00412-02014 |             | 14                        | 3                    | 1.94              | 12°                     | 4                 | 50                    |
| 01-00412-02016 |             | 16                        | 3                    | 1.94              | 12°                     | 4                 | 50                    |
| 01-00412-02018 |             | 18                        | 3                    | 1.94              | 12°                     | 4                 | 55                    |



Unit : mm

| Code No.       | Dia.<br>(D) | Under Neck Length<br>(ℓ1) | Length of Cut<br>(ℓ) | Neck Dia.<br>(d2) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|---------------------------|----------------------|-------------------|-------------------------|-------------------|-----------------------|
| 01-00412-02020 | 2           | 20                        | 3                    | 1.94              | 12°                     | 4                 | 55                    |
| 01-00412-02508 | 2.5         | 8                         | 3.7                  | 2.4               | 12°                     | 4                 | 45                    |
| 01-00412-02512 |             | 12                        | 3.7                  | 2.4               | 12°                     | 4                 | 45                    |
| 01-00412-02516 |             | 16                        | 3.7                  | 2.4               | 12°                     | 4                 | 55                    |
| 01-00412-02520 |             | 20                        | 3.7                  | 2.4               | 12°                     | 4                 | 60                    |
| 01-00412-03008 | 3           | 8                         | 4.5                  | 2.85              | 12°                     | 6                 | 45                    |
| 01-00412-03012 |             | 12                        | 4.5                  | 2.85              | 12°                     | 6                 | 45                    |
| 01-00412-03016 |             | 16                        | 4.5                  | 2.85              | 12°                     | 6                 | 55                    |
| 01-00412-03020 |             | 20                        | 4.5                  | 2.85              | 12°                     | 6                 | 60                    |
| 01-00412-03025 |             | 25                        | 4.5                  | 2.85              | 12°                     | 6                 | 65                    |
| 01-00412-03512 | 3.5         | 12                        | 5.25                 | 3.35              | 12°                     | 6                 | 45                    |
| 01-00412-03516 |             | 16                        | 5.25                 | 3.35              | 12°                     | 6                 | 55                    |
| 01-00412-03520 |             | 20                        | 5.25                 | 3.35              | 12°                     | 6                 | 60                    |
| 01-00412-03525 |             | 25                        | 5.25                 | 3.35              | 12°                     | 6                 | 65                    |
| 01-00412-03530 |             | 30                        | 5.25                 | 3.35              | 12°                     | 6                 | 75                    |
| 01-00412-04012 | 4           | 12                        | 6                    | 3.8               | 12°                     | 6                 | 45                    |
| 01-00412-04016 |             | 16                        | 6                    | 3.8               | 12°                     | 6                 | 55                    |
| 01-00412-04020 |             | 20                        | 6                    | 3.8               | 12°                     | 6                 | 60                    |
| 01-00412-04025 |             | 25                        | 6                    | 3.8               | 12°                     | 6                 | 65                    |
| 01-00412-04030 |             | 30                        | 6                    | 3.8               | 12°                     | 6                 | 70                    |
| 01-00412-04035 |             | 35                        | 6                    | 3.8               | 12°                     | 6                 | 75                    |
| 01-00412-05016 | 5           | 16                        | 7.5                  | 4.8               | 12°                     | 6                 | 55                    |
| 01-00412-05020 |             | 20                        | 7.5                  | 4.8               | 12°                     | 6                 | 60                    |
| 01-00412-05025 |             | 25                        | 7.5                  | 4.8               | 12°                     | 6                 | 65                    |
| 01-00412-05030 |             | 30                        | 7.5                  | 4.8               | 12°                     | 6                 | 75                    |
| 01-00412-05035 |             | 35                        | 7.5                  | 4.8               | 12°                     | 6                 | 80                    |
| 01-00412-05040 |             | 40                        | 7.5                  | 4.8               | 12°                     | 6                 | 90                    |

How to Order

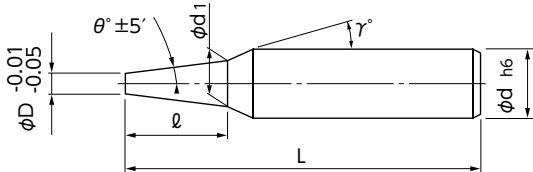
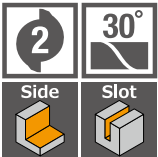
When you order, indicate NHR-2 (D)×(ℓ1).      ※( γ ) is reference value.

| Work Material |              | Carbon Steels・Alloy Steels・Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK                                                                                          |         | Aluminium Alloy   |           | Copper            |           | Resin             |         |
|---------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------|-----------|-------------------|-----------|-------------------|---------|
| Cutting Speed |              | 30～50m/min                                                                                                                                                         |         | 100～200m/min      |           | 50～150m/min       |           | 50～80m/min        |         |
| Dia.          | Depth of Cut | Spindle Speed                                                                                                                                                      | Feed    | Spindle Speed     | Feed      | Spindle Speed     | Feed      | Spindle Speed     | Feed    |
|               | mm           | min <sup>-1</sup>                                                                                                                                                  | mm/min  | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min  |
| 0.5           | 0.003～0.05   | 19,100～31,800                                                                                                                                                      | 200～500 | 50,000～           | 200～1,000 | 31,800～           | 200～1,000 | 31,800～           | 200～400 |
| 0.6           | 0.006～0.06   | 15,900～26,500                                                                                                                                                      | 200～500 | 50,000～           | 200～1,250 | 26,500～           | 200～1,000 | 26,500～42,500     | 200～400 |
| 0.7           | 0.01 ～0.07   | 13,600～22,700                                                                                                                                                      | 200～500 | 45,500～           | 200～1,250 | 22,700～           | 200～1,000 | 22,700～36,400     | 200～400 |
| 0.8           | 0.01 ～0.06   | 11,900～19,900                                                                                                                                                      | 200～500 | 39,800～           | 200～1,500 | 19,900～           | 200～1,250 | 19,900～31,800     | 200～400 |
| 0.9           | 0.009～0.03   | 10,600～17,700                                                                                                                                                      | 200～500 | 35,400～           | 200～2,000 | 17,700～           | 200～1,500 | 17,700～28,300     | 200～400 |
| 1             | 0.01 ～0.06   | 9,600～15,900                                                                                                                                                       | 200～650 | 31,800～           | 200～2,600 | 15,900～47,800     | 200～1,950 | 15,900～25,500     | 200～400 |
| 1.2           | 0.016～0.12   | 8,000～13,300                                                                                                                                                       | 200～550 | 26,500～           | 200～2,200 | 13,300～39,800     | 200～1,650 | 13,300～21,200     | 200～400 |
| 1.4           | 0.012～0.15   | 6,800～11,400                                                                                                                                                       | 200～450 | 22,700～45,500     | 200～1,800 | 11,400～34,100     | 200～1,350 | 11,400～18,200     | 200～400 |
| 1.5           | 0.008～0.17   | 6,400～10,600                                                                                                                                                       | 200～450 | 21,200～42,500     | 200～1,800 | 10,600～31,800     | 200～1,350 | 10,600～17,000     | 200～400 |
| 1.6           | 0.012～0.2    | 6,000～10,000                                                                                                                                                       | 200～450 | 19,900～39,800     | 200～1,800 | 10,000～29,900     | 200～1,350 | 10,000～15,900     | 200～400 |
| 1.8           | 0.02 ～0.22   | 5,300～ 8,800                                                                                                                                                       | 200～350 | 17,700～35,400     | 200～1,400 | 8,800～26,500      | 200～1,050 | 8,800～14,200      | 200～400 |
| 2             | 0.03 ～0.25   | 4,800～ 8,000                                                                                                                                                       | 200～350 | 15,900～31,800     | 200～1,400 | 8,000～23,900      | 200～1,050 | 8,000～12,700      | 200～400 |
| 2.5           | 0.08 ～0.25   | 3,800～ 6,400                                                                                                                                                       | 150～250 | 12,700～25,500     | 150～1,000 | 6,400～19,100      | 150～ 750  | 6,400～10,200      | 150～300 |
| 3             | 0.09 ～0.25   | 3,200～ 5,300                                                                                                                                                       | 130～250 | 10,600～21,200     | 130～1,000 | 5,300～15,900      | 130～ 750  | 5,300～ 8,500      | 130～260 |
| 3.5           | 0.09 ～0.25   | 2,700～ 4,500                                                                                                                                                       | 110～220 | 9,100～18,200      | 110～ 900  | 4,500～13,600      | 110～ 650  | 4,500～ 7,300      | 110～220 |
| 4             | 0.1 ～0.25    | 2,400～ 4,000                                                                                                                                                       | 100～200 | 8,000～15,900      | 100～ 800  | 4,000～11,900      | 100～ 600  | 4,000～ 6,400      | 100～200 |
| 5             | 0.18 ～0.25   | 1,900～ 3,200                                                                                                                                                       | 80～200  | 6,400～12,700      | 80～ 800   | 3,200～ 9,600      | 80～ 600   | 3,200～ 5,100      | 80～160  |
| Notes         |              | ※1 Adjust depth of cut, spindle speed and feed according to effective length.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Recommend reciprocating cutting. |         |                   |           |                   |           |                   |         |



2-Flute Taper End Mill

2-Flute Taper End Mill



● ■ : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels・Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|--------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                          |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                        | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

| Code No.         | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| ■ 01-00312-00051 | 0.5      | 30'             | 2                 | 0.53                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00052 |          | 1°              | 2                 | 0.57                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00053 |          | 1°30'           | 2                 | 0.60                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00054 |          | 2°              | 2                 | 0.64                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00055 |          | 2°30'           | 2                 | 0.67                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00056 |          | 3°              | 2                 | 0.71                   | 9°                   | 3              | 35                 |
| ■ 01-00313-00052 | 0.6      | 5°              | 2                 | 0.85                   | 9°                   | 3              | 35                 |
| ■ 01-00313-00054 |          | 10°             | 2                 | 1.21                   | 10°                  | 3              | 35                 |
| ■ 01-00313-00055 |          | 15°             | 2                 | 1.57                   | 15°                  | 3              | 35                 |
| ■ 01-00312-00061 |          | 30'             | 2                 | 0.63                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00062 |          | 1°              | 2                 | 0.67                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00063 |          | 1°30'           | 2                 | 0.70                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00064 | 0.7      | 2°              | 2                 | 0.74                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00065 |          | 2°30'           | 2                 | 0.78                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00066 |          | 3°              | 2                 | 0.81                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00071 |          | 30'             | 2                 | 0.73                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00072 |          | 1°              | 2                 | 0.77                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00073 |          | 1°30'           | 2                 | 0.80                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00074 | 0.8      | 2°              | 2                 | 0.84                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00075 |          | 2°30'           | 2                 | 0.88                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00076 |          | 3°              | 2                 | 0.91                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00081 |          | 30'             | 3                 | 0.85                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00082 |          | 1°              | 3                 | 0.90                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00083 |          | 1°30'           | 3                 | 0.96                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00084 | 0.9      | 2°              | 3                 | 1.01                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00085 |          | 2°30'           | 3                 | 1.06                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00086 |          | 3°              | 3                 | 1.11                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00091 |          | 30'             | 3                 | 0.95                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00092 |          | 1°              | 3                 | 1.00                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00093 |          | 1°30'           | 3                 | 1.06                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00094 | 2        | 2°              | 3                 | 1.11                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00095 |          | 2°30'           | 3                 | 1.16                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00096 |          | 3°              | 3                 | 1.21                   | 9°                   | 3              | 35                 |
| ■ 01-00312-00201 |          | 30'             | 6                 | 2.10                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00202 |          | 1°              | 6                 | 2.21                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00203 |          | 1°30'           | 6                 | 2.31                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00204 | 2        | 2°              | 6                 | 2.42                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00205 |          | 2°30'           | 6                 | 2.52                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00206 |          | 3°              | 6                 | 2.63                   | 9°                   | 4              | 45                 |
| ■ 01-00313-00201 |          | 4°              | 6                 | 2.84                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00207 |          | 5°              | 6                 | 3.05                   | 5°                   | 4              | 45                 |
| ■ 01-00313-00203 |          | 7°              | 6                 | 3.47                   | 7°                   | 4              | 45                 |
| ■ 01-00312-00208 | 2        | 10°             | 6                 | 4.12                   | 10°                  | 6              | 45                 |
| ■ 01-00313-00205 |          | 15°             | 6                 | 5.22                   | 15°                  | 6              | 45                 |
| ■ 01-00313-00206 |          | 20°             | 6.5               | 6.73                   | —                    | 6              | 50                 |
| ■ 01-00312-00101 | 1        | 30'             | 4                 | 1.07                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00102 |          | 1°              | 4                 | 1.14                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00103 |          | 1°30'           | 4                 | 1.21                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00104 |          | 2°              | 4                 | 1.28                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00105 |          | 2°30'           | 4                 | 1.35                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00106 |          | 3°              | 4                 | 1.42                   | 9°                   | 4              | 45                 |
| ■ 01-00313-00101 | 1.5      | 4°              | 4                 | 1.56                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00107 |          | 5°              | 4                 | 1.70                   | 9°                   | 4              | 45                 |
| ■ 01-00313-00103 |          | 7°              | 4                 | 1.98                   | 7°                   | 4              | 45                 |
| ■ 01-00312-00108 |          | 10°             | 4                 | 2.41                   | 10°                  | 4              | 45                 |
| ■ 01-00313-00105 |          | 15°             | 4                 | 3.14                   | 15°                  | 6              | 45                 |
| ■ 01-00313-00106 |          | 20°             | 4.12              | 4.00                   | 20°                  | 6              | 45                 |
| ■ 01-00312-00151 | 1.5      | 30'             | 5                 | 1.59                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00152 |          | 1°              | 5                 | 1.67                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00153 |          | 1°30'           | 5                 | 1.76                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00154 |          | 2°              | 5                 | 1.85                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00155 |          | 2°30'           | 5                 | 1.94                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00156 |          | 3°              | 5                 | 2.02                   | 9°                   | 4              | 45                 |
| ■ 01-00313-00151 | 2        | 4°              | 5                 | 2.20                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00157 |          | 5°              | 5                 | 2.37                   | 9°                   | 4              | 45                 |
| ■ 01-00313-00153 |          | 7°              | 5                 | 2.73                   | 7°                   | 4              | 45                 |
| ■ 01-00312-00158 |          | 10°             | 5                 | 3.26                   | 10°                  | 4              | 45                 |
| ■ 01-00313-00155 |          | 15°             | 5                 | 4.18                   | 15°                  | 6              | 45                 |
| ■ 01-00313-00156 |          | 20°             | 6.18              | 6.00                   | 20°                  | 6              | 50                 |
| ■ 01-00312-00201 | 2        | 30'             | 6                 | 2.10                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00202 |          | 1°              | 6                 | 2.21                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00203 |          | 1°30'           | 6                 | 2.31                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00204 |          | 2°              | 6                 | 2.42                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00205 |          | 2°30'           | 6                 | 2.52                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00206 |          | 3°              | 6                 | 2.63                   | 9°                   | 4              | 45                 |
| ■ 01-00313-00201 | 2        | 4°              | 6                 | 2.84                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00207 |          | 5°              | 6                 | 3.05                   | 5°                   | 4              | 45                 |
| ■ 01-00313-00203 |          | 7°              | 6                 | 3.47                   | 7°                   | 4              | 45                 |
| ■ 01-00312-00208 |          | 10°             | 6                 | 4.12                   | 10°                  | 6              | 45                 |
| ■ 01-00313-00205 |          | 15°             | 6                 | 5.22                   | 15°                  | 6              | 45                 |
| ■ 01-00313-00206 |          | 20°             | 6.5               | 6.73                   | —                    | 6              | 50                 |

Unit : mm

How to Order

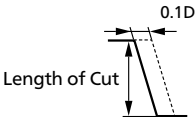
When you order, indicate NTE-2 (D)×(θ).  
※(d1) and (γ) is reference value.

Unit : mm

| Code No.         | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| ■ 01-00312-00251 | 2.5      | 30'             | 8                 | 2.64                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00252 |          | 1°              | 8                 | 2.78                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00253 |          | 1°30'           | 8                 | 2.92                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00254 |          | 2°              | 8                 | 3.06                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00255 |          | 2°30'           | 8                 | 3.20                   | 9°                   | 4              | 45                 |
| ■ 01-00312-00256 |          | 3°              | 8                 | 3.34                   | 3°                   | 4              | 45                 |
| ■ 01-00313-00251 | 3        | 4°              | 8                 | 3.62                   | 4°                   | 4              | 45                 |
| ■ 01-00312-00257 |          | 5°              | 8                 | 3.90                   | 5°                   | 4              | 45                 |
| ■ 01-00313-00253 |          | 7°              | 8                 | 4.46                   | 7°                   | 6              | 50                 |
| ■ 01-00313-00254 |          | 10°             | 8                 | 5.32                   | 10°                  | 6              | 50                 |
| ■ 01-00312-00301 |          | 30'             | 10                | 3.17                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00302 |          | 1°              | 10                | 3.35                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00303 | 3        | 1°30'           | 10                | 3.52                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00304 |          | 2°              | 10                | 3.69                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00305 |          | 2°30'           | 10                | 3.87                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00306 |          | 3°              | 10                | 4.05                   | 9°                   | 6              | 50                 |
| ■ 01-00313-00301 |          | 4°              | 10                | 4.40                   | 9°                   | 6              | 50                 |
| ■ 01-00313-00302 |          | 5°              | 10                | 4.75                   | 5°                   | 6              | 50                 |
| ■ 01-00313-00303 | 4        | 7°              | 10                | 5.46                   | 7°                   | 6              | 50                 |
| ■ 01-00313-00304 |          | 10°             | 10                | 6.53                   | —                    | 6              | 50                 |
| ■ 01-00313-00305 |          | 15°             | 10                | 8.36                   | —                    | 8              | 50                 |
| ■ 01-00313-00306 |          | 20°             | 10                | 10.28                  | —                    | 10             | 70                 |
| ■ 01-00312-00401 |          | 30'             | 15                | 4.26                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00402 |          | 1°              | 15                | 4.52                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00403 | 4        | 1°30'           | 15                | 4.79                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00404 |          | 2°              | 15                | 5.04                   | 9°                   | 6              | 50                 |
| ■ 01-00312-00405 |          | 2°30'           | 15                | 5.31                   | 2°30'                | 6              | 50                 |
| ■ 01-00312-00406 |          | 3°              | 15                | 5.57                   | 3°                   | 6              | 50                 |
| ■ 01-00313-00401 |          | 4°              | 15                | 6.10                   | —                    | 6              | 55                 |
| ■ 01-00313-00402 |          | 5°              | 15                | 6.62                   | —                    | 6              | 55                 |
| ■ 01-00313-00403 | 5        | 7°              | 15                | 7.68                   | —                    | 6              | 55                 |
| ■ 01-00313-00404 |          | 10°             | 15                | 9.29                   | —                    | 8              | 60                 |
| ■ 01-00312-00501 |          | 30'             | 20                | 5.34                   | 9°                   | 6              | 55                 |
| ■ 01-00312-00502 |          | 1°              | 20                | 5.70                   | 9°                   | 6              | 55                 |
| ■ 01-00312-00503 |          | 1°30'           | 20                | 6.04                   | —                    | 6              | 55                 |

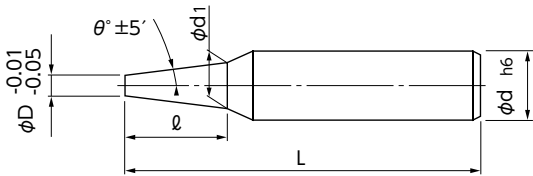
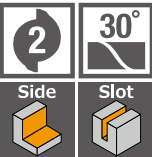
| Code No.         | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Length<br>of Cut<br>(L) | Dia. at<br>Large End<br>(d1) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|------------------|-------------|-----------------------|-------------------------|------------------------------|----------------------------|----------------------|--------------------------|
| ■ 01-00312-00504 | 5           | 2°                    | 20                      | 6.39                         | —                          | 6                    | 55                       |
| ■ 01-00312-00505 |             | 2°30'                 | 20                      | 6.74                         | —                          | 6                    | 55                       |
| ■ 01-00312-00506 |             | 3°                    | 20                      | 7.10                         | —                          | 6                    | 55                       |
| ■ 01-00313-00501 |             | 4°                    | 20                      | 7.80                         | —                          | 6                    | 60                       |
| ■ 01-00313-00502 |             | 5°                    | 20                      | 8.50                         | —                          | 8                    | 60                       |
| ■ 01-00313-00503 |             | 7°                    | 20                      | 9.91                         | —                          | 8                    | 60                       |
| ■ 01-00313-00504 |             | 10°                   | 20                      | 12.05                        | —                          | 12                   | 70                       |
| ■ 01-00312-00601 | 6           | 30'                   | 20                      | 6.35                         | —                          | 6                    | 55                       |
| ■ 01-00312-00602 |             | 1°                    | 20                      | 6.70                         | —                          | 6                    | 55                       |
| ■ 01-00312-00603 |             | 1°30'                 | 20                      | 7.05                         | —                          | 6                    | 55                       |
| ■ 01-00312-00604 |             | 2°                    | 20                      | 7.40                         | —                          | 6                    | 55                       |
| ■ 01-00312-00605 |             | 2°30'                 | 20                      | 7.75                         | —                          | 6                    | 55                       |
| ■ 01-00312-00606 |             | 3°                    | 20                      | 8.10                         | —                          | 8                    | 60                       |
| ■ 01-00313-00601 |             | 4°                    | 20                      | 8.80                         | —                          | 8                    | 65                       |
| ■ 01-00313-00602 |             | 5°                    | 20                      | 9.50                         | —                          | 8                    | 65                       |
| ■ 01-00313-00603 |             | 7°                    | 20                      | 10.91                        | —                          | 10                   | 70                       |
| ■ 01-00313-00604 |             | 10°                   | 20                      | 13.05                        | —                          | 12                   | 80                       |
| ■ 01-00312-00801 | 8           | 30'                   | 25                      | 8.44                         | —                          | 8                    | 65                       |
| ■ 01-00312-00802 |             | 1°                    | 25                      | 8.87                         | —                          | 8                    | 65                       |
| ■ 01-00312-00803 |             | 1°30'                 | 25                      | 9.31                         | —                          | 8                    | 65                       |
| ■ 01-00312-00804 |             | 2°                    | 25                      | 9.74                         | —                          | 8                    | 65                       |
| ■ 01-00312-00805 |             | 2°30'                 | 25                      | 10.18                        | —                          | 10                   | 70                       |
| ■ 01-00312-00806 |             | 3°                    | 25                      | 10.62                        | —                          | 10                   | 70                       |
| ■ 01-00313-00801 |             | 4°                    | 25                      | 11.50                        | —                          | 10                   | 80                       |
| ■ 01-00313-00802 |             | 5°                    | 25                      | 12.37                        | —                          | 12                   | 90                       |
| ■ 01-00313-00803 |             | 7°                    | 25                      | 14.14                        | —                          | 12                   | 90                       |
| ■ 01-00313-00804 |             | 10°                   | 25                      | 16.81                        | —                          | 16                   | 90                       |
| ■ 01-00312-01001 | 10          | 30'                   | 35                      | 10.61                        | —                          | 10                   | 85                       |
| ■ 01-00312-01002 |             | 1°                    | 35                      | 11.22                        | —                          | 10                   | 85                       |
| ■ 01-00312-01003 |             | 1°30'                 | 35                      | 11.83                        | —                          | 10                   | 85                       |
| ■ 01-00312-01004 |             | 2°                    | 35                      | 12.44                        | —                          | 12                   | 90                       |
| ■ 01-00312-01005 |             | 2°30'                 | 35                      | 13.06                        | —                          | 12                   | 90                       |
| ■ 01-00312-01006 |             | 3°                    | 35                      | 13.67                        | —                          | 12                   | 90                       |
| ■ 01-00313-01001 |             | 4°                    | 35                      | 14.89                        | —                          | 12                   | 90                       |
| ■ 01-00313-01002 |             | 5°                    | 35                      | 16.12                        | —                          | 16                   | 90                       |
| ■ 01-00313-01003 |             | 7°                    | 35                      | 18.59                        | —                          | 16                   | 90                       |
| ■ 01-00313-01004 |             | 10°                   | 35                      | 22.34                        | —                          | 20                   | 110                      |

Recommended Milling Conditions

| Work Material                 | Carbon Steels<br>S50C                                                                                                           |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed                 | 35m/min                                                                                                                         |        | 30m/min                     |        | 25m/min                       |        |
| Dia.                          | Spindle Speed                                                                                                                   | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                               | min <sup>-1</sup>                                                                                                               | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 0.5                           | 22,000                                                                                                                          | 70     | 19,000                      | 45     | 16,000                        | 30     |
| 0.6                           | 19,000                                                                                                                          | 70     | 16,000                      | 45     | 13,000                        | 30     |
| 0.7                           | 16,000                                                                                                                          | 70     | 13,600                      | 45     | 11,400                        | 30     |
| 0.8                           | 14,000                                                                                                                          | 110    | 12,000                      | 70     | 10,000                        | 50     |
| 0.9                           | 12,400                                                                                                                          | 110    | 10,600                      | 70     | 8,800                         | 50     |
| 1                             | 11,000                                                                                                                          | 160    | 9,500                       | 130    | 8,000                         | 100    |
| 1.5                           | 7,400                                                                                                                           | 160    | 6,400                       | 130    | 5,300                         | 100    |
| 2                             | 5,600                                                                                                                           | 160    | 4,800                       | 130    | 4,000                         | 100    |
| 2.5                           | 4,500                                                                                                                           | 160    | 3,800                       | 130    | 3,200                         | 100    |
| Depth of Cut<br><br>(D: Dia.) | <div>Taper Side Milling</div> <div></div>    |        |                             |        |                               |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 We recommend a down-cut at side milling. |        |                             |        |                               |        |



2-Flute Medium Taper End Mill



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.         | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|-----------------|-------------------|------------------------|----------------|--------------------|
| ● 01-00332-01010 | 1        | 4°              | 5                 | 1.70                   | 4              | 50                 |
| ● 01-00332-01016 |          | 7°              | 5                 | 2.23                   | 4              | 50                 |
| ● 01-00332-01024 |          | 15°             | 5                 | 3.68                   | 4              | 50                 |
| ● 01-00332-01510 | 1.5      | 4°              | 7.5               | 2.55                   | 4              | 50                 |
| ● 01-00332-01516 |          | 7°              | 7.5               | 3.34                   | 4              | 50                 |
| ● 01-00332-01524 |          | 15°             | 7.5               | 5.52                   | 6              | 50                 |
| ● 01-00332-02010 | 2        | 4°              | 10                | 3.40                   | 4              | 50                 |
| ● 01-00332-02016 |          | 7°              | 10                | 4.46                   | 6              | 50                 |
| ● 01-00332-02024 |          | 15°             | 10                | 7.36                   | 8              | 55                 |
| ● 01-00332-02510 | 2.5      | 4°              | 12.5              | 4.25                   | 6              | 50                 |
| ● 01-00332-02516 |          | 7°              | 12.5              | 5.57                   | 6              | 50                 |
| ● 01-00332-02519 |          | 10°             | 12.5              | 6.91                   | 6              | 55                 |
| ● 01-00332-02524 |          | 15°             | 12.5              | 9.20                   | 10             | 60                 |
| ● 01-00332-02525 |          | 20°             | 12.5              | 11.60                  | 12             | 65                 |
| ● 01-00332-03002 | 3        | 30′             | 15                | 3.26                   | 4              | 55                 |
| ● 01-00332-03004 |          | 1°              | 15                | 3.52                   | 4              | 55                 |
| ● 01-00332-03005 |          | 1°30′           | 15                | 3.79                   | 4              | 55                 |
| ● 01-00332-03006 |          | 2°              | 15                | 4.05                   | 6              | 55                 |
| ● 01-00332-03008 |          | 3°              | 15                | 4.57                   | 6              | 55                 |
| ● 01-00332-03010 |          | 4°              | 15                | 5.10                   | 6              | 60                 |
| ● 01-00332-03012 |          | 5°              | 15                | 5.62                   | 6              | 60                 |
| ● 01-00332-03016 |          | 7°              | 15                | 6.68                   | 6              | 60                 |
| ● 01-00332-03019 |          | 10°             | 15                | 8.29                   | 8              | 65                 |
| ● 01-00332-03024 |          | 15°             | 15                | 11.04                  | 10             | 70                 |
| ● 01-00332-03025 |          | 20°             | 15                | 13.92                  | 12             | 75                 |
| ● 01-00332-04002 | 4        | 30′             | 20                | 4.35                   | 6              | 60                 |
| ● 01-00332-04004 |          | 1°              | 20                | 4.70                   | 6              | 60                 |
| ● 01-00332-04005 |          | 1°30′           | 20                | 5.05                   | 6              | 60                 |
| ● 01-00332-04006 |          | 2°              | 20                | 5.40                   | 6              | 60                 |
| ● 01-00332-04008 |          | 3°              | 20                | 6.10                   | 6              | 60                 |
| ● 01-00332-04010 |          | 4°              | 20                | 6.80                   | 6              | 60                 |
| ● 01-00332-04012 |          | 5°              | 20                | 7.50                   | 8              | 65                 |
| ● 01-00332-04016 |          | 7°              | 20                | 8.91                   | 8              | 70                 |
| ● 01-00332-04019 |          | 10°             | 20                | 11.05                  | 10             | 70                 |
| ● 01-00332-04024 |          | 15°             | 20                | 14.72                  | 12             | 75                 |
| ● 01-00332-04025 |          | 20°             | 20                | 18.56                  | 16             | 90                 |

How to Order

When you order, indicate NTEM-2 (D)×(θ).



Tapered

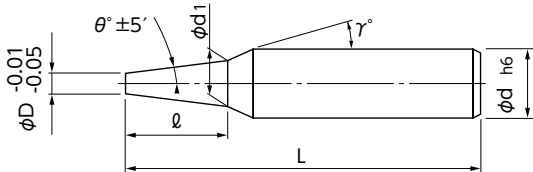
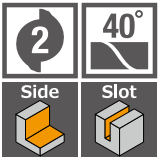


Tapered



2-Flute Long Taper End Mill

Recommended Milling Conditions



● : Semi-standard Products, please inquire for price and delivery.

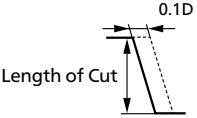
Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

| Code No.       | Dia.<br>(D) | Taper Angle<br>(θ) | Length of Cut<br>(L) | Dia. at Large End<br>(d1) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|--------------------|----------------------|---------------------------|-------------------------|-------------------|-----------------------|
| 01-00322-00101 | 1           | 30'                | 10                   | 1.17                      | 9°                      | 4                 | 45                    |
| 01-00322-00102 |             | 1°                 | 10                   | 1.35                      | 9°                      | 4                 | 45                    |
| 01-00322-00103 |             | 1°30'              | 10                   | 1.52                      | 9°                      | 4                 | 45                    |
| 01-00322-00104 |             | 2°                 | 10                   | 1.70                      | 9°                      | 4                 | 45                    |
| 01-00322-00105 |             | 2°30'              | 10                   | 1.87                      | 9°                      | 4                 | 45                    |
| 01-00322-00106 |             | 3°                 | 10                   | 2.05                      | 9°                      | 4                 | 45                    |
| 01-00323-00102 |             | 5°                 | 10                   | 2.75                      | 9°                      | 4                 | 45                    |
| 01-00323-00104 |             | 10°                | 10                   | 4.53                      | 10°                     | 6                 | 50                    |
| 01-00323-00105 |             | 15°                | 9.3                  | 6.00                      | 15°                     | 6                 | 60                    |
| 01-00323-00106 |             | 20°                | 8                    | 6.82                      | —                       | 6                 | 60                    |
| 01-00322-00151 | 1.5         | 30'                | 10                   | 1.67                      | 9°                      | 4                 | 45                    |
| 01-00322-00152 |             | 1°                 | 10                   | 1.85                      | 9°                      | 4                 | 45                    |
| 01-00322-00153 |             | 1°30'              | 10                   | 2.02                      | 9°                      | 4                 | 45                    |
| 01-00322-00154 |             | 2°                 | 10                   | 2.20                      | 9°                      | 4                 | 45                    |
| 01-00322-00155 |             | 2°30'              | 10                   | 2.37                      | 9°                      | 4                 | 45                    |
| 01-00322-00156 |             | 3°                 | 10                   | 2.55                      | 9°                      | 4                 | 45                    |
| 01-00323-00152 |             | 5°                 | 10                   | 3.25                      | 9°                      | 4                 | 45                    |
| 01-00323-00154 |             | 10°                | 10                   | 5.03                      | 10°                     | 6                 | 50                    |
| 01-00323-00155 |             | 15°                | 10                   | 6.86                      | —                       | 6                 | 60                    |
| 01-00323-00156 |             | 20°                | 10                   | 8.78                      | —                       | 8                 | 65                    |
| 01-00322-00201 | 2           | 30'                | 13                   | 2.22                      | 9°                      | 4                 | 50                    |
| 01-00322-00202 |             | 1°                 | 13                   | 2.45                      | 9°                      | 4                 | 50                    |
| 01-00322-00203 |             | 1°30'              | 13                   | 2.68                      | 9°                      | 4                 | 50                    |
| 01-00322-00204 |             | 2°                 | 13                   | 2.90                      | 9°                      | 4                 | 50                    |
| 01-00322-00205 |             | 2°30'              | 13                   | 3.13                      | 9°                      | 4                 | 50                    |
| 01-00322-00206 |             | 3°                 | 13                   | 3.36                      | 3°                      | 4                 | 50                    |
| 01-00322-00207 |             | 5°                 | 13                   | 4.27                      | 9°                      | 6                 | 50                    |
| 01-00323-00204 |             | 10°                | 13                   | 6.58                      | —                       | 6                 | 60                    |
| 01-00323-00205 |             | 15°                | 13                   | 8.97                      | —                       | 8                 | 65                    |
| 01-00323-00206 |             | 20°                | 13                   | 11.46                     | —                       | 10                | 80                    |

| Code No.       | Dia.<br>(D) | Taper Angle<br>(θ) | Length of Cut<br>(L) | Dia. at Large End<br>(d1) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|--------------------|----------------------|---------------------------|-------------------------|-------------------|-----------------------|
| 01-00322-00251 | 2.5         | 30'                | 15                   | 2.76                      | 9°                      | 4                 | 55                    |
| 01-00322-00252 |             | 1°                 | 15                   | 3.03                      | 9°                      | 4                 | 55                    |
| 01-00322-00253 |             | 1°30'              | 15                   | 3.29                      | 9°                      | 4                 | 55                    |
| 01-00322-00254 |             | 2°                 | 15                   | 3.55                      | 2°                      | 4                 | 55                    |
| 01-00322-00255 |             | 2°30'              | 15                   | 3.81                      | 2°30'                   | 4                 | 55                    |
| 01-00322-00256 |             | 3°                 | 15                   | 4.07                      | —                       | 4                 | 55                    |
| 01-00322-00257 |             | 5°                 | 15                   | 5.13                      | 5°                      | 6                 | 55                    |
| 01-00323-00304 | 3           | 10°                | 20                   | 10.05                     | —                       | 10                | 70                    |
| 01-00323-00305 |             | 15°                | 20                   | 13.72                     | —                       | 12                | 80                    |
| 01-00323-00306 |             | 20°                | 20                   | 17.56                     | —                       | 16                | 100                   |

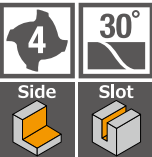
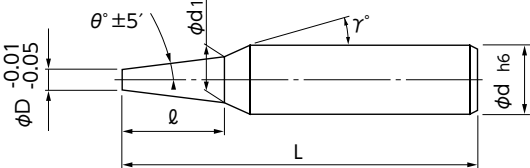
Unit : mm

| Work Material             | Carbon Steels<br>S50C                                                                                                           |        | Alloy Steels<br>SCM•SKD•SUS |        | Prehardened Steels<br>HPM•NAK |        |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed             | 17m/min                                                                                                                         |        | 15m/min                     |        | 12m/min                       |        |
| Dia.                      | Spindle Speed                                                                                                                   | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                           | min <sup>-1</sup>                                                                                                               | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 0.5                       | 11,000                                                                                                                          | 35     | 9,500                       | 20     | 8,000                         | 15     |
| 0.6                       | 9,500                                                                                                                           | 35     | 8,000                       | 20     | 6,500                         | 15     |
| 0.7                       | 8,000                                                                                                                           | 35     | 6,800                       | 20     | 5,700                         | 15     |
| 0.8                       | 7,000                                                                                                                           | 55     | 6,000                       | 35     | 5,000                         | 25     |
| 0.9                       | 6,200                                                                                                                           | 55     | 5,300                       | 35     | 4,400                         | 25     |
| 1                         | 5,500                                                                                                                           | 80     | 4,750                       | 65     | 4,000                         | 50     |
| 1.5                       | 3,700                                                                                                                           | 80     | 3,200                       | 65     | 2,650                         | 50     |
| 2                         | 2,800                                                                                                                           | 80     | 2,400                       | 65     | 2,000                         | 50     |
| 2.5                       | 2,250                                                                                                                           | 80     | 1,900                       | 65     | 1,600                         | 50     |
| Depth of Cut<br>(D: Dia.) | <div>Taper Side Milling</div>               |        |                             |        |                               |        |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 We recommend a down-cut at side milling. |        |                             |        |                               |        |



4-Flute Taper End Mill

4-Flute Taper End Mill



● ■ : Semi-standard Products, please inquire for price and delivery.  
● ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

| Code No.         | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| ■ 01-00314-00301 | 3        | 30'             | 10                | 3.17                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00302 |          | 1°              | 10                | 3.35                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00303 |          | 1°30'           | 10                | 3.52                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00304 |          | 2°              | 10                | 3.69                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00305 |          | 2°30'           | 10                | 3.87                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00306 |          | 3°              | 10                | 4.05                   | 9°                   | 6              | 50                 |
| ■ 01-00315-00301 |          | 4°              | 10                | 4.40                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00307 |          | 5°              | 10                | 4.75                   | 5°                   | 6              | 50                 |
| ■ 01-00315-00303 |          | 7°              | 10                | 5.46                   | 7°                   | 6              | 50                 |
| ■ 01-00315-00304 |          | 10°             | 10                | 6.53                   | —                    | 6              | 50                 |
| ■ 01-00315-00305 |          | 15°             | 10                | 8.36                   | —                    | 8              | 50                 |
| ■ 01-00314-00401 | 4        | 30'             | 15                | 4.26                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00402 |          | 1°              | 15                | 4.52                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00403 |          | 1°30'           | 15                | 4.79                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00404 |          | 2°              | 15                | 5.04                   | 9°                   | 6              | 50                 |
| ■ 01-00314-00405 |          | 2°30'           | 15                | 5.31                   | 2°30'                | 6              | 50                 |
| ■ 01-00314-00406 |          | 3°              | 15                | 5.57                   | 3°                   | 6              | 50                 |
| ■ 01-00315-00401 |          | 4°              | 15                | 6.10                   | —                    | 6              | 55                 |
| ■ 01-00314-00407 |          | 5°              | 15                | 6.62                   | —                    | 6              | 55                 |
| ■ 01-00315-00403 |          | 7°              | 15                | 7.68                   | —                    | 6              | 55                 |
| ■ 01-00315-00404 |          | 10°             | 15                | 9.29                   | —                    | 8              | 60                 |
| ■ 01-00314-00501 | 5        | 30'             | 20                | 5.34                   | 9°                   | 6              | 55                 |
| ■ 01-00314-00502 |          | 1°              | 20                | 5.70                   | 9°                   | 6              | 55                 |
| ■ 01-00314-00503 |          | 1°30'           | 20                | 6.04                   | —                    | 6              | 55                 |
| ■ 01-00314-00504 |          | 2°              | 20                | 6.39                   | —                    | 6              | 55                 |
| ■ 01-00314-00505 |          | 2°30'           | 20                | 6.74                   | —                    | 6              | 55                 |
| ■ 01-00314-00506 |          | 3°              | 20                | 7.10                   | —                    | 6              | 55                 |
| ■ 01-00315-00501 |          | 4°              | 20                | 7.80                   | —                    | 6              | 60                 |
| ■ 01-00314-00507 |          | 5°              | 20                | 8.50                   | —                    | 8              | 60                 |
| ■ 01-00315-00503 |          | 7°              | 20                | 9.91                   | —                    | 8              | 60                 |
| ■ 01-00315-00504 |          | 10°             | 20                | 12.05                  | —                    | 12             | 70                 |

How to Order

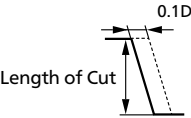
When you order, indicate NTE-4 (D)×(θ). ※(d1) and (γ) is reference value.

Unit : mm

| Code No.           | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| ■ 01-00314-00601   | 6        | 30'             | 20                | 6.35                   | —                    | 6              | 55                 |
| ■ 01-00314-00602   |          | 1°              | 20                | 6.70                   | —                    | 6              | 55                 |
| ■ 01-00314-00603   |          | 1°30'           | 20                | 7.05                   | —                    | 6              | 55                 |
| ■ 01-00314-00604   |          | 2°              | 20                | 7.40                   | —                    | 6              | 55                 |
| ■ 01-00314-00605   |          | 2°30'           | 20                | 7.75                   | —                    | 6              | 55                 |
| ■ 01-00314-00606   |          | 3°              | 20                | 8.10                   | —                    | 8              | 60                 |
| ■ 01-00315-00601   |          | 4°              | 20                | 8.80                   | —                    | 8              | 65                 |
| ■ 01-00314-00607   |          | 5°              | 20                | 9.50                   | —                    | 8              | 65                 |
| ■ 01-00315-00603   |          | 7°              | 20                | 10.91                  | —                    | 10             | 70                 |
| ■ 01-00315-00604   |          | 10°             | 20                | 13.05                  | —                    | 12             | 80                 |
| ▲ ■ 01-00314-00801 | 8        | 30'             | 25                | 8.44                   | —                    | 8              | 65                 |
| ▲ ■ 01-00314-00802 |          | 1°              | 25                | 8.87                   | —                    | 8              | 65                 |
| ▲ ■ 01-00314-00803 |          | 1°30'           | 25                | 9.31                   | —                    | 8              | 65                 |
| ▲ ■ 01-00314-00804 |          | 2°              | 25                | 9.74                   | —                    | 8              | 65                 |
| ▲ ■ 01-00314-00805 |          | 2°30'           | 25                | 10.18                  | —                    | 10             | 70                 |
| ▲ ■ 01-00314-00806 |          | 3°              | 25                | 10.62                  | —                    | 10             | 70                 |
| ■ 01-00315-00801   |          | 4°              | 25                | 11.50                  | —                    | 10             | 80                 |
| ▲ ■ 01-00314-00807 |          | 5°              | 25                | 12.37                  | —                    | 12             | 90                 |
| ■ 01-00315-00803   |          | 7°              | 25                | 14.14                  | —                    | 12             | 90                 |
| ■ 01-00315-00804   |          | 10°             | 25                | 16.81                  | —                    | 16             | 90                 |
| ▲ ■ 01-00314-01001 | 10       | 30'             | 35                | 10.61                  | —                    | 10             | 85                 |
| ▲ ■ 01-00314-01002 |          | 1°              | 35                | 11.22                  | —                    | 10             | 85                 |
| ▲ ■ 01-00314-01003 |          | 1°30'           | 35                | 11.83                  | —                    | 10             | 85                 |
| ▲ ■ 01-00314-01004 |          | 2°              | 35                | 12.44                  | —                    | 12             | 90                 |
| ▲ ■ 01-00314-01005 |          | 2°30'           | 35                | 13.06                  | —                    | 12             | 90                 |
| ▲ ■ 01-00314-01006 |          | 3°              | 35                | 13.67                  | —                    | 12             | 90                 |
| ■ 01-00315-01001   |          | 4°              | 35                | 14.89                  | —                    | 12             | 90                 |
| ▲ ■ 01-00314-01007 |          | 5°              | 35                | 16.12                  | —                    | 16             | 90                 |
| ■ 01-00315-01003   |          | 7°              | 35                | 18.59                  | —                    | 16             | 90                 |
| ■ 01-00315-01004   |          | 10°             | 35                | 22.34                  | —                    | 20             | 110                |
| ■ 01-00314-01201   | 12       | 30'             | 55                | 12.96                  | —                    | 12             | 110                |
| ■ 01-00314-01202   |          | 1°              | 55                | 13.92                  | —                    | 12             | 110                |
| ■ 01-00314-01203   |          | 1°30'           | 55                | 14.88                  | —                    | 12             | 110                |
| ■ 01-00314-01204   |          | 2°              | 55                | 15.84                  | 2°                   | 16             | 110                |
| ■ 01-00314-01205   |          | 2°30'           | 55                | 16.80                  | —                    | 16             | 110                |
| ■ 01-00314-01206   |          | 3°              | 55                | 17.76                  | —                    | 16             | 110                |
| ■ 01-00315-01201   |          | 4°              | 55                | 19.69                  | 4°                   | 20             | 110                |
| ■ 01-00315-01202   |          | 5°              | 55                | 21.62                  | —                    | 20             | 120                |
| ■ 01-00315-01203   |          | 7°              | 55                | 25.51                  | —                    | 25             | 120                |
| ■ 01-00315-01204   |          | 10°             | 55                | 31.39                  | —                    | 25             | 120                |
| ■ 01-00314-01601   | 16       | 30'             | 65                | 17.13                  | —                    | 16             | 130                |
| ■ 01-00314-01602   |          | 1°              | 65                | 18.27                  | —                    | 16             | 130                |
| ■ 01-00314-01603   |          | 1°30'           | 65                | 19.40                  | —                    | 16             | 130                |
| ■ 01-00314-01604   |          | 2°              | 65                | 20.53                  | —                    | 20             | 130                |
| ■ 01-00314-01605   |          | 2°30'           | 65                | 21.68                  | —                    | 20             | 130                |
| ■ 01-00314-01606   |          | 3°              | 65                | 22.81                  | —                    | 20             | 130                |
| ■ 01-00315-01601   |          | 4°              | 65                | 25.09                  | —                    | 25             | 140                |
| ■ 01-00315-01602   |          | 5°              | 65                | 27.37                  | —                    | 25             | 140                |
| ■ 01-00315-01603   |          | 7°              | 65                | 31.96                  | 7°                   | 32             | 140                |
| ■ 01-00315-01604   |          | 10°             | 65                | 38.92                  | —                    | 32             | 140                |



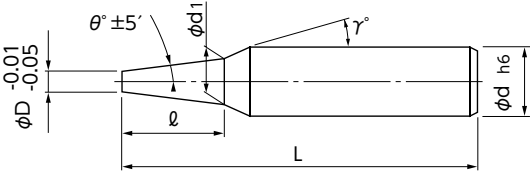
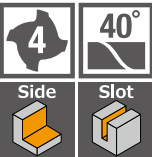
Recommended Milling Conditions

| Work Material             | Carbon Steels<br>S50C                                                                                                           |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed             | 35m/min                                                                                                                         |        | 30m/min                     |        | 25m/min                       |        |
| Dia.                      | Spindle Speed                                                                                                                   | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                           | min <sup>-1</sup>                                                                                                               | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 3                         | 3,700                                                                                                                           | 220    | 3,200                       | 180    | 2,650                         | 130    |
| 4                         | 2,800                                                                                                                           | 220    | 2,400                       | 180    | 2,000                         | 130    |
| 5                         | 2,200                                                                                                                           | 220    | 1,900                       | 180    | 1,600                         | 130    |
| 6                         | 1,900                                                                                                                           | 220    | 1,600                       | 180    | 1,300                         | 130    |
| 8                         | 1,400                                                                                                                           | 220    | 1,200                       | 180    | 1,000                         | 130    |
| 10                        | 1,100                                                                                                                           | 220    | 950                         | 180    | 800                           | 130    |
| Depth of Cut<br>(D: Dia.) | <div>Taper Side Milling</div> <div></div>     |        |                             |        |                               |        |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 We recommend a down-cut at side milling. |        |                             |        |                               |        |



4-Flute Long Taper End Mill

Recommended Milling Conditions



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|--------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                          |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                        | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 01-00324-00301 | 3        | 30'             | 20                | 3.35                   | 9°                   | 6              | 60                 |
| 01-00324-00302 |          | 1°              | 20                | 3.70                   | 9°                   | 6              | 60                 |
| 01-00324-00303 |          | 1°30'           | 20                | 4.05                   | 9°                   | 6              | 60                 |
| 01-00324-00304 |          | 2°              | 20                | 4.40                   | 9°                   | 6              | 60                 |
| 01-00324-00305 |          | 2°30'           | 20                | 4.75                   | 9°                   | 6              | 60                 |
| 01-00324-00306 |          | 3°              | 20                | 5.10                   | 3°                   | 6              | 60                 |
| 01-00325-00301 |          | 4°              | 20                | 5.80                   | 4°                   | 6              | 60                 |
| 01-00324-00307 |          | 5°              | 20                | 6.50                   | —                    | 6              | 60                 |
| 01-00324-00401 | 4        | 30'             | 25                | 4.44                   | 9°                   | 6              | 60                 |
| 01-00324-00402 |          | 1°              | 25                | 4.88                   | 9°                   | 6              | 60                 |
| 01-00324-00403 |          | 1°30'           | 25                | 5.31                   | 9°                   | 6              | 60                 |
| 01-00324-00404 |          | 2°              | 25                | 5.75                   | 2°                   | 6              | 60                 |
| 01-00324-00405 |          | 2°30'           | 25                | 6.19                   | —                    | 6              | 60                 |
| 01-00324-00406 |          | 3°              | 25                | 6.62                   | 9°                   | 8              | 60                 |
| 01-00325-00401 |          | 4°              | 25                | 7.50                   | 4°                   | 8              | 65                 |
| 01-00324-00407 |          | 5°              | 25                | 8.38                   | —                    | 8              | 65                 |
| 01-00324-00501 | 5        | 30'             | 30                | 5.52                   | 9°                   | 6              | 65                 |
| 01-00324-00502 |          | 1°              | 30                | 6.05                   | —                    | 6              | 65                 |
| 01-00324-00503 |          | 1°30'           | 30                | 6.57                   | 9°                   | 8              | 65                 |
| 01-00324-00504 |          | 2°              | 30                | 7.09                   | 9°                   | 8              | 70                 |
| 01-00324-00505 |          | 2°30'           | 30                | 7.62                   | 2°30'                | 8              | 70                 |
| 01-00324-00506 |          | 3°              | 30                | 8.14                   | —                    | 8              | 75                 |
| 01-00325-00501 |          | 4°              | 30                | 9.20                   | 4°                   | 10             | 80                 |
| 01-00324-00507 |          | 5°              | 30                | 10.25                  | —                    | 10             | 80                 |
| 01-00324-00601 | 6        | 30'             | 35                | 6.61                   | 9°                   | 8              | 70                 |
| 01-00324-00602 |          | 1°              | 35                | 7.22                   | 9°                   | 8              | 70                 |
| 01-00324-00603 |          | 1°30'           | 35                | 7.83                   | 1°30'                | 8              | 70                 |
| 01-00324-00604 |          | 2°              | 35                | 8.44                   | —                    | 8              | 80                 |
| 01-00324-00605 |          | 2°30'           | 35                | 9.05                   | 9°                   | 10             | 85                 |
| 01-00324-00606 |          | 3°              | 35                | 9.67                   | —                    | 10             | 85                 |
| 01-00325-00601 |          | 4°              | 35                | 10.89                  | —                    | 10             | 90                 |
| 01-00324-00607 |          | 5°              | 35                | 12.12                  | —                    | 12             | 90                 |

How to Order

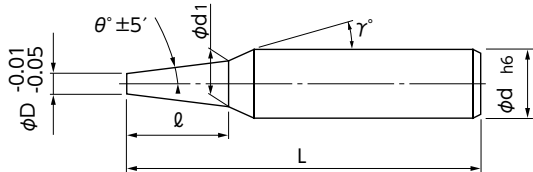
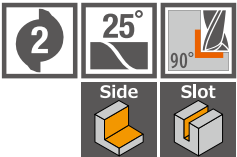
When you order, indicate NTEL-4 (D)×(θ). ※(d1) and (γ) is reference value.

| Work Material           | Carbon Steels S50C                                                                                                              |        | Alloy Steels SCM・SKD・SUS |        | Prehardened Steels HPM・NAK |        |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------|--------|----------------------------|--------|
| Cutting Speed           | 17m/min                                                                                                                         |        | 15m/min                  |        | 12m/min                    |        |
| Dia.                    | Spindle Speed                                                                                                                   | Feed   | Spindle Speed            | Feed   | Spindle Speed              | Feed   |
|                         | min <sup>-1</sup>                                                                                                               | mm/min | min <sup>-1</sup>        | mm/min | min <sup>-1</sup>          | mm/min |
| 3                       | 1,850                                                                                                                           | 110    | 1,600                    | 90     | 1,300                      | 65     |
| 4                       | 1,400                                                                                                                           | 110    | 1,200                    | 90     | 1,000                      | 65     |
| 5                       | 1,100                                                                                                                           | 110    | 950                      | 90     | 800                        | 65     |
| 6                       | 950                                                                                                                             | 110    | 800                      | 90     | 650                        | 65     |
| Depth of Cut (D : Dia.) | <div>Taper Side Milling</div> <div>0.1D</div> <div>Length of Cut</div>                                                          |        |                          |        |                            |        |
| Notes                   | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 We recommend a down-cut at side milling. |        |                          |        |                            |        |



2-Flute Taper End Mill for Nonferrous

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ○               | ○      | ○     |

▲ Discontinued Products

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Code No.         | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|------------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 07-00313-00101 | 1        | 30°             | 4                 | 1.07                   | 9°                   | 4              | 45                 | 07-00313-00401   | 4        | 30°             | 15                | 4.26                   | 9°                   | 6              | 50                 |
| 07-00313-00102 |          | 1°              | 4                 | 1.14                   | 9°                   | 4              | 45                 | 07-00313-00402   |          | 1°              | 15                | 4.52                   | 9°                   | 6              | 50                 |
| 07-00313-00103 |          | 1°30'           | 4                 | 1.21                   | 9°                   | 4              | 45                 | 07-00313-00403   |          | 1°30'           | 15                | 4.79                   | 9°                   | 6              | 50                 |
| 07-00313-00104 |          | 2°              | 4                 | 1.28                   | 9°                   | 4              | 45                 | 07-00313-00404   |          | 2°              | 15                | 5.05                   | 9°                   | 6              | 50                 |
| 07-00313-00105 |          | 3°              | 4                 | 1.42                   | 9°                   | 4              | 45                 | 07-00313-00405   |          | 3°              | 15                | 5.57                   | 3°                   | 6              | 50                 |
| 07-00313-00106 |          | 4°              | 4                 | 1.56                   | 9°                   | 4              | 45                 | 07-00313-00406   |          | 4°              | 15                | 6.10                   | —                    | 6              | 55                 |
| 07-00313-00107 |          | 5°              | 4                 | 1.70                   | 9°                   | 4              | 45                 | 07-00313-00407   |          | 5°              | 15                | 6.62                   | —                    | 6              | 55                 |
| 07-00313-00151 | 1.5      | 30°             | 5                 | 1.59                   | 9°                   | 4              | 45                 | 07-00313-00501   | 5        | 30°             | 20                | 5.35                   | 9°                   | 6              | 55                 |
| 07-00313-00152 |          | 1°              | 5                 | 1.67                   | 9°                   | 4              | 45                 | 07-00313-00502   |          | 1°              | 20                | 5.70                   | 1°                   | 6              | 55                 |
| 07-00313-00153 |          | 1°30'           | 5                 | 1.76                   | 9°                   | 4              | 45                 | 07-00313-00503   |          | 1°30'           | 20                | 6.05                   | —                    | 6              | 55                 |
| 07-00313-00154 |          | 2°              | 5                 | 1.85                   | 9°                   | 4              | 45                 | 07-00313-00504   |          | 2°              | 20                | 6.39                   | —                    | 6              | 55                 |
| 07-00313-00155 |          | 3°              | 5                 | 2.02                   | 9°                   | 4              | 45                 | 07-00313-00505   |          | 3°              | 20                | 7.10                   | —                    | 6              | 55                 |
| 07-00313-00156 |          | 4°              | 5                 | 2.20                   | 9°                   | 4              | 45                 | 07-00313-00506   |          | 4°              | 20                | 7.80                   | 4°                   | 8              | 60                 |
| 07-00313-00157 |          | 5°              | 5                 | 2.37                   | 5°                   | 4              | 45                 | 07-00313-00507   |          | 5°              | 20                | 8.50                   | —                    | 8              | 60                 |
| 07-00313-00201 | 2        | 30°             | 6                 | 2.10                   | 9°                   | 4              | 45                 | 07-00313-00601   | 6        | 30°             | 20                | 6.35                   | —                    | 6              | 60                 |
| 07-00313-00202 |          | 1°              | 6                 | 2.21                   | 9°                   | 4              | 45                 | 07-00313-00602   |          | 1°              | 20                | 6.70                   | —                    | 6              | 60                 |
| 07-00313-00203 |          | 1°30'           | 6                 | 2.31                   | 9°                   | 4              | 45                 | 07-00313-00603   |          | 1°30'           | 20                | 7.05                   | —                    | 6              | 60                 |
| 07-00313-00204 |          | 2°              | 6                 | 2.42                   | 9°                   | 4              | 45                 | 07-00313-00604   |          | 2°              | 20                | 7.40                   | —                    | 6              | 60                 |
| 07-00313-00205 |          | 3°              | 6                 | 2.63                   | 9°                   | 4              | 45                 | 07-00313-00605   |          | 3°              | 20                | 8.10                   | —                    | 8              | 60                 |
| 07-00313-00206 |          | 4°              | 6                 | 2.84                   | 4°                   | 4              | 45                 | 07-00313-00606   |          | 4°              | 20                | 8.80                   | —                    | 8              | 65                 |
| 07-00313-00207 |          | 5°              | 6                 | 3.05                   | 5°                   | 4              | 45                 | 07-00313-00607   |          | 5°              | 20                | 9.50                   | —                    | 8              | 65                 |
| 07-00313-00251 | 2.5      | 30°             | 8                 | 2.64                   | 9°                   | 4              | 45                 | ▲ 07-00313-00801 | 8        | 30°             | 25                | 8.44                   | —                    | 8              | 70                 |
| 07-00313-00252 |          | 1°              | 8                 | 2.78                   | 9°                   | 4              | 45                 | ▲ 07-00313-00802 |          | 1°              | 25                | 8.87                   | —                    | 8              | 70                 |
| 07-00313-00253 |          | 1°30'           | 8                 | 2.92                   | 9°                   | 4              | 45                 | ▲ 07-00313-00803 |          | 1°30'           | 25                | 9.31                   | —                    | 8              | 70                 |
| 07-00313-00254 |          | 2°              | 8                 | 3.06                   | 9°                   | 4              | 45                 | ▲ 07-00313-00804 |          | 2°              | 25                | 9.74                   | —                    | 8              | 70                 |
| 07-00313-00255 |          | 3°              | 8                 | 3.34                   | 3°                   | 4              | 45                 | ▲ 07-00313-00805 |          | 3°              | 25                | 10.62                  | —                    | 10             | 70                 |
| 07-00313-00256 |          | 4°              | 8                 | 3.62                   | 4°                   | 4              | 45                 | ▲ 07-00313-00806 |          | 4°              | 25                | 11.50                  | —                    | 10             | 80                 |
| 07-00313-00257 |          | 5°              | 8                 | 3.90                   | 5°                   | 4              | 45                 | ▲ 07-00313-00807 |          | 5°              | 25                | 12.37                  | —                    | 12             | 80                 |
| 07-00313-00301 | 3        | 30°             | 10                | 3.17                   | 9°                   | 6              | 50                 | ▲ 07-00313-01001 | 10       | 30°             | 35                | 10.61                  | —                    | 10             | 85                 |
| 07-00313-00302 |          | 1°              | 10                | 3.35                   | 9°                   | 6              | 50                 | ▲ 07-00313-01002 |          | 1°              | 35                | 11.22                  | —                    | 10             | 85                 |
| 07-00313-00303 |          | 1°30'           | 10                | 3.52                   | 9°                   | 6              | 50                 | ▲ 07-00313-01003 |          | 1°30'           | 35                | 11.83                  | —                    | 10             | 85                 |
| 07-00313-00304 |          | 2°              | 10                | 3.70                   | 9°                   | 6              | 50                 | ▲ 07-00313-01004 |          | 2°              | 35                | 12.44                  | —                    | 12             | 90                 |
| 07-00313-00305 |          | 3°              | 10                | 4.05                   | 9°                   | 6              | 50                 | ▲ 07-00313-01005 |          | 3°              | 35                | 13.67                  | —                    | 12             | 90                 |
| 07-00313-00306 |          | 4°              | 10                | 4.40                   | 9°                   | 6              | 50                 | ▲ 07-00313-01006 |          | 4°              | 35                | 14.89                  | —                    | 12             | 90                 |
| 07-00313-00307 |          | 5°              | 10                | 4.75                   | 5°                   | 6              | 50                 | ▲ 07-00313-01007 |          | 5°              | 35                | 16.12                  | —                    | 16             | 90                 |

How to Order

When you order, indicate DTE (D)×(θ). ※(d1) and (γ) is reference value.

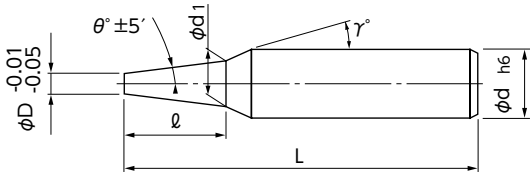
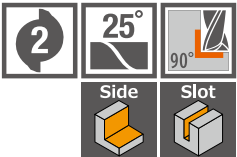
| Work Material              | Copper                                                                                                               |        | Aluminium Alloy   |        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed              | 20~30m/min                                                                                                           |        | 60~90m/min        |        |
| Dia.                       | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                            | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 1                          | 9,600                                                                                                                | 110    | 28,800            | 330    |
| 1.5                        | 6,400                                                                                                                | 110    | 19,200            | 330    |
| 2                          | 4,800                                                                                                                | 120    | 14,400            | 360    |
| 2.5                        | 3,800                                                                                                                | 120    | 11,400            | 360    |
| 3                          | 3,200                                                                                                                | 120    | 9,600             | 360    |
| 4                          | 2,400                                                                                                                | 120    | 7,200             | 360    |
| 5                          | 1,900                                                                                                                | 130    | 5,700             | 390    |
| 6                          | 1,600                                                                                                                | 130    | 4,800             | 390    |
| 8                          | 1,200                                                                                                                | 130    | 3,600             | 390    |
| 10                         | 1,000                                                                                                                | 130    | 3,000             | 390    |
| Depth of Cut<br>(D : Dia.) | <div>Taper Side Milling</div> <div>0.2D</div> <div>Length of Cut</div>                                               |        |                   |        |
| Notes                      | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |





2-Flute Long Taper End Mill for Nonferrous

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Code No.         | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|------------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 07-00322-00101 | 1        | 30°             | 8                 | 1.14                   | 9°                   | 4              | 50                 | 07-00322-00401   | 4        | 30°             | 32                | 4.56                   | —                    | 4              | 80                 |
| 07-00322-00102 |          | 1°              | 8                 | 1.28                   | 9°                   | 4              | 50                 | 07-00322-00402   |          | 1°              | 32                | 5.12                   | —                    | 4              | 80                 |
| 07-00322-00103 |          | 1°30′           | 8                 | 1.42                   | 9°                   | 4              | 50                 | 07-00322-00403   |          | 1°30′           | 32                | 5.68                   | —                    | 4              | 80                 |
| 07-00322-00104 |          | 2°              | 8                 | 1.56                   | 9°                   | 4              | 50                 | 07-00322-00404   |          | 2°              | 32                | 6.23                   | —                    | 6              | 80                 |
| 07-00322-00105 |          | 3°              | 8                 | 1.84                   | 9°                   | 4              | 50                 | 07-00322-00405   |          | 3°              | 32                | 7.35                   | —                    | 6              | 80                 |
| 07-00322-00106 |          | 4°              | 8                 | 2.12                   | 9°                   | 4              | 50                 | 07-00322-00406   |          | 4°              | 32                | 8.48                   | —                    | 8              | 80                 |
| 07-00322-00107 |          | 5°              | 8                 | 2.40                   | 5°                   | 4              | 50                 | 07-00322-00407   |          | 5°              | 32                | 9.60                   | 5°                   | 10             | 90                 |
| 07-00322-00151 | 1.5      | 30°             | 12                | 1.71                   | 9°                   | 4              | 50                 | 07-00322-00501   | 5        | 30°             | 40                | 5.70                   | —                    | 4              | 80                 |
| 07-00322-00152 |          | 1°              | 12                | 1.92                   | 9°                   | 4              | 50                 | 07-00322-00502   |          | 1°              | 40                | 6.40                   | —                    | 6              | 80                 |
| 07-00322-00153 |          | 1°30′           | 12                | 2.13                   | 9°                   | 4              | 50                 | 07-00322-00503   |          | 1°30′           | 40                | 7.09                   | —                    | 6              | 80                 |
| 07-00322-00154 |          | 2°              | 12                | 2.34                   | 9°                   | 4              | 50                 | 07-00322-00504   |          | 2°              | 40                | 7.79                   | —                    | 6              | 80                 |
| 07-00322-00155 |          | 3°              | 12                | 2.76                   | 9°                   | 4              | 50                 | 07-00322-00505   |          | 3°              | 40                | 9.19                   | —                    | 8              | 90                 |
| 07-00322-00156 |          | 4°              | 12                | 3.18                   | 4°                   | 4              | 50                 | 07-00322-00506   |          | 4°              | 40                | 10.59                  | —                    | 10             | 90                 |
| 07-00322-00157 |          | 5°              | 12                | 3.60                   | 5°                   | 4              | 50                 | 07-00322-00507   |          | 5°              | 40                | 12.00                  | —                    | 12             | 90                 |
| 07-00322-00201 | 2        | 30°             | 16                | 2.28                   | 9°                   | 4              | 50                 | 07-00322-00601   | 6        | 30°             | 48                | 6.84                   | —                    | 6              | 100                |
| 07-00322-00202 |          | 1°              | 16                | 2.56                   | 9°                   | 4              | 50                 | 07-00322-00602   |          | 1°              | 48                | 7.68                   | —                    | 6              | 100                |
| 07-00322-00203 |          | 1°30′           | 16                | 2.84                   | 9°                   | 4              | 50                 | 07-00322-00603   |          | 1°30′           | 48                | 8.51                   | —                    | 8              | 100                |
| 07-00322-00204 |          | 2°              | 16                | 3.12                   | 9°                   | 4              | 50                 | 07-00322-00604   |          | 2°              | 48                | 9.35                   | —                    | 8              | 100                |
| 07-00322-00205 |          | 3°              | 16                | 3.68                   | 3°                   | 4              | 50                 | 07-00322-00605   |          | 3°              | 48                | 11.03                  | —                    | 10             | 100                |
| 07-00322-00206 |          | 4°              | 16                | 4.24                   | —                    | 4              | 50                 | 07-00322-00606   |          | 4°              | 48                | 12.71                  | —                    | 12             | 100                |
| 07-00322-00207 |          | 5°              | 16                | 4.80                   | —                    | 4              | 60                 | 07-00322-00607   |          | 5°              | 48                | 14.40                  | —                    | 12             | 100                |
| 07-00322-00251 | 2.5      | 30°             | 20                | 2.85                   | 9°                   | 4              | 60                 | ▲ 07-00322-00801 | 8        | 30°             | 64                | 9.12                   | —                    | 8              | 120                |
| 07-00322-00252 |          | 1°              | 20                | 3.20                   | 9°                   | 4              | 60                 | ▲ 07-00322-00802 |          | 1°              | 64                | 10.23                  | —                    | 10             | 120                |
| 07-00322-00253 |          | 1°30′           | 20                | 3.55                   | 9°                   | 4              | 60                 | ▲ 07-00322-00803 |          | 1°30′           | 64                | 11.35                  | —                    | 10             | 120                |
| 07-00322-00254 |          | 2°              | 20                | 3.90                   | 2°                   | 4              | 60                 | ▲ 07-00322-00804 |          | 2°              | 64                | 12.47                  | —                    | 12             | 120                |
| 07-00322-00255 |          | 3°              | 20                | 4.60                   | —                    | 4              | 60                 | ▲ 07-00322-00805 |          | 3°              | 64                | 14.71                  | —                    | 12             | 120                |
| 07-00322-00256 |          | 4°              | 20                | 5.30                   | —                    | 4              | 60                 | ▲ 07-00322-00806 |          | 4°              | 64                | 16.95                  | —                    | 16             | 125                |
| 07-00322-00257 |          | 5°              | 20                | 6.00                   | —                    | 6              | 60                 | ▲ 07-00322-00807 |          | 5°              | 64                | 19.20                  | —                    | 20             | 130                |
| 07-00322-00301 | 3        | 30°             | 24                | 3.42                   | 9°                   | 4              | 60                 |                  |          |                 |                   |                        |                      |                |                    |
| 07-00322-00302 |          | 1°              | 24                | 3.84                   | 1°                   | 4              | 60                 |                  |          |                 |                   |                        |                      |                |                    |
| 07-00322-00303 |          | 1°30′           | 24                | 4.26                   | —                    | 4              | 60                 |                  |          |                 |                   |                        |                      |                |                    |
| 07-00322-00304 |          | 2°              | 24                | 4.68                   | —                    | 4              | 60                 |                  |          |                 |                   |                        |                      |                |                    |
| 07-00322-00305 |          | 3°              | 24                | 5.52                   | —                    | 4              | 60                 |                  |          |                 |                   |                        |                      |                |                    |
| 07-00322-00306 |          | 4°              | 24                | 6.36                   | —                    | 6              | 60                 |                  |          |                 |                   |                        |                      |                |                    |
| 07-00322-00307 |          | 5°              | 24                | 7.20                   | —                    | 6              | 60                 |                  |          |                 |                   |                        |                      |                |                    |

How to Order

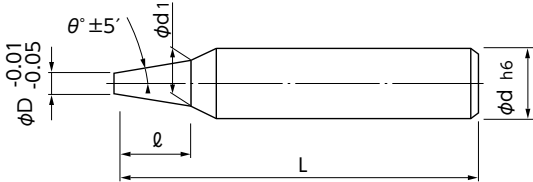
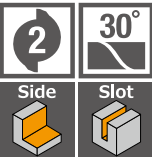
When you order, indicate DTEL (D)×(θ). ※(d1) and (γ) is reference value.

| Work Material             | Copper                                                                                                               |        | Aluminium Alloy   |        |
|---------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed             | 20~30m/min                                                                                                           |        | 40~60m/min        |        |
| Dia.                      | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                           | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 1                         | 6,400                                                                                                                | 110    | 12,800            | 220    |
| 1.5                       | 4,300                                                                                                                | 110    | 8,600             | 220    |
| 2                         | 3,200                                                                                                                | 120    | 6,400             | 240    |
| 2.5                       | 2,600                                                                                                                | 120    | 5,200             | 240    |
| 3                         | 2,100                                                                                                                | 120    | 4,200             | 240    |
| 4                         | 1,600                                                                                                                | 120    | 3,200             | 240    |
| 5                         | 1,300                                                                                                                | 130    | 2,600             | 260    |
| 6                         | 1,000                                                                                                                | 130    | 2,000             | 260    |
| 8                         | 800                                                                                                                  | 130    | 1,600             | 260    |
| Depth of Cut<br>(D: Dia.) | <div>Taper Side Milling</div> <div>0.1D</div> <div>Length of Cut</div>                                               |        |                   |        |
| Notes                     | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |



2-Flute Taper End Mill for Runner

Recommended Milling Conditions



● : Semi-standard Products, please inquire for price and delivery.

Work Material

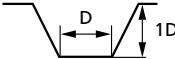
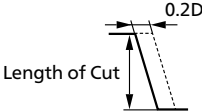
| Carbon Steels | Alloy Steels Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|--------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                          |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                        | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------|--------------------|
| 01-00712-02001 | 2        | 7°              | 5                 | 3.22                   | 4              | 45                 |
| 01-00712-02501 | 2.5      |                 | 6                 | 3.97                   | 4              | 45                 |
| 01-00712-03001 | 3        |                 | 7                 | 4.71                   | 6              | 55                 |
| 01-00712-03501 | 3.5      |                 | 7                 | 5.21                   | 6              | 55                 |
| 01-00712-04001 | 4        |                 | 8                 | 5.96                   | 6              | 55                 |
| 01-00712-04501 | 4.5      |                 | 9                 | 6.71                   | 8              | 60                 |
| 01-00712-05001 | 5        |                 | 10                | 7.45                   | 8              | 60                 |
| 01-00712-06001 | 6        |                 | 12                | 8.94                   | 10             | 70                 |
| 01-00712-02002 | 2        | 10°             | 5                 | 3.76                   | 4              | 45                 |
| 01-00712-02502 | 2.5      |                 | 6                 | 4.61                   | 6              | 55                 |
| 01-00712-03002 | 3        |                 | 7                 | 5.46                   | 6              | 55                 |
| 01-00712-03502 | 3.5      |                 | 7                 | 5.96                   | 6              | 55                 |
| 01-00712-04002 | 4        |                 | 8                 | 6.82                   | 8              | 60                 |
| 01-00712-04502 | 4.5      |                 | 9                 | 7.67                   | 8              | 60                 |
| 01-00712-05002 | 5        |                 | 10                | 8.52                   | 10             | 70                 |
| 01-00712-06002 | 6        |                 | 12                | 10.23                  | 10             | 70                 |
| 01-00712-02003 | 2        | 12°             | 5                 | 4.12                   | 4              | 45                 |
| 01-00712-02503 | 2.5      |                 | 6                 | 5.05                   | 6              | 55                 |
| 01-00712-03003 | 3        |                 | 7                 | 5.97                   | 6              | 55                 |
| 01-00712-03503 | 3.5      |                 | 7                 | 6.47                   | 8              | 60                 |
| 01-00712-04003 | 4        |                 | 8                 | 7.40                   | 8              | 60                 |
| 01-00712-04503 | 4.5      |                 | 9                 | 8.32                   | 8              | 60                 |
| 01-00712-05003 | 5        |                 | 10                | 9.25                   | 10             | 70                 |
| 01-00712-06003 | 6        |                 | 12                | 11.10                  | 10             | 70                 |
| 01-00712-02004 | 2        | 15°             | 5                 | 4.68                   | 6              | 55                 |
| 01-00712-02504 | 2.5      |                 | 6                 | 5.71                   | 6              | 55                 |
| 01-00712-03004 | 3        |                 | 7                 | 6.75                   | 6              | 55                 |
| 01-00712-03504 | 3.5      |                 | 7                 | 7.25                   | 8              | 60                 |
| 01-00712-04004 | 4        |                 | 8                 | 8.28                   | 8              | 60                 |
| 01-00712-04504 | 4.5      |                 | 9                 | 9.32                   | 10             | 70                 |
| 01-00712-05004 | 5        |                 | 10                | 10.35                  | 10             | 70                 |
| 01-00712-06004 | 6        |                 | 12                | 12.43                  | 12             | 75                 |

How to Order

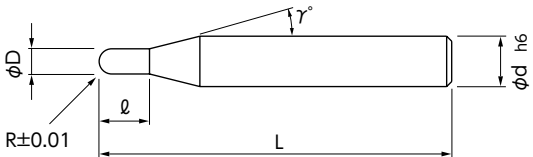
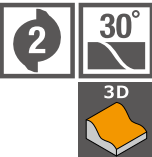
When you order, indicate NER-2 (D)×(θ).

| Work Material                 |             | Carbon Steels<br>S50C                                                                                                                         |              |          | Alloy Steels<br>SCM・SKD・SUS |                                                                                       |          | Prehardened Steels<br>HPM・NAK |              |          |
|-------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------|---------------------------------------------------------------------------------------|----------|-------------------------------|--------------|----------|
| Cutting Speed                 |             | 33～37m/min                                                                                                                                    |              |          | 30～32m/min                  |                                                                                       |          | 16～20m/min                    |              |          |
| Dia.                          | Taper Angle | Spindle Speed                                                                                                                                 | Feed         |          | Spindle Speed               | Feed                                                                                  |          | Spindle Speed                 | Feed         |          |
|                               |             | min <sup>-1</sup>                                                                                                                             | mm/min       |          | min <sup>-1</sup>           | mm/min                                                                                |          | min <sup>-1</sup>             | mm/min       |          |
|                               |             |                                                                                                                                               | Side Milling | Slotting |                             | Side Milling                                                                          | Slotting |                               | Side Milling | Slotting |
| 2                             | 7～10°       | 4,300                                                                                                                                         | 120          | 60       | 3,700                       | 100                                                                                   | 50       | 3,100                         | 70           | 35       |
|                               | 12～15°      | 3,800                                                                                                                                         | 130          | 65       | 3,200                       | 110                                                                                   | 55       | 2,700                         | 80           | 40       |
| 2.5                           | 7～10°       | 3,400                                                                                                                                         | 120          | 60       | 3,000                       | 100                                                                                   | 50       | 2,450                         | 70           | 35       |
|                               | 12～15°      | 3,000                                                                                                                                         | 130          | 65       | 2,600                       | 110                                                                                   | 55       | 2,150                         | 80           | 40       |
| 3                             | 7～10°       | 2,900                                                                                                                                         | 120          | 60       | 2,450                       | 100                                                                                   | 50       | 2,050                         | 70           | 35       |
|                               | 12～15°      | 2,500                                                                                                                                         | 130          | 65       | 2,150                       | 110                                                                                   | 55       | 1,800                         | 80           | 40       |
| 3.5                           | 7～10°       | 2,450                                                                                                                                         | 120          | 60       | 2,100                       | 100                                                                                   | 50       | 1,750                         | 70           | 35       |
|                               | 12～15°      | 2,100                                                                                                                                         | 130          | 65       | 1,800                       | 110                                                                                   | 55       | 1,500                         | 80           | 40       |
| 4                             | 7～10°       | 2,100                                                                                                                                         | 120          | 60       | 1,800                       | 100                                                                                   | 50       | 1,500                         | 70           | 35       |
|                               | 12～15°      | 1,900                                                                                                                                         | 130          | 65       | 1,600                       | 110                                                                                   | 55       | 1,350                         | 80           | 40       |
| 4.5                           | 7～10°       | 1,900                                                                                                                                         | 120          | 60       | 1,600                       | 100                                                                                   | 50       | 1,400                         | 70           | 35       |
|                               | 12～15°      | 1,650                                                                                                                                         | 130          | 65       | 1,400                       | 110                                                                                   | 55       | 1,200                         | 80           | 40       |
| 5                             | 7～10°       | 1,700                                                                                                                                         | 120          | 60       | 1,500                       | 100                                                                                   | 50       | 1,250                         | 70           | 35       |
|                               | 12～15°      | 1,500                                                                                                                                         | 130          | 65       | 1,300                       | 110                                                                                   | 55       | 1,100                         | 80           | 40       |
| 6                             | 7～10°       | 1,400                                                                                                                                         | 120          | 60       | 1,200                       | 100                                                                                   | 50       | 1,000                         | 70           | 35       |
|                               | 12～15°      | 1,250                                                                                                                                         | 130          | 65       | 1,100                       | 110                                                                                   | 55       | 900                           | 80           | 40       |
| Depth of Cut<br><br>(D: Dia.) |             | Taper Slotting                                                                                                                                |              |          |                             | Taper Side Milling                                                                    |          |                               |              |          |
|                               |             |                                                          |              |          |                             |  |          |                               |              |          |
| Notes                         |             | ※1 Use a high rigid and precise machine and chuck holder.<br>※2 Use cutting fluid.<br>※3 Adjust both spindle speed and feed at the same rate. |              |          |                             |                                                                                       |          |                               |              |          |



2-Flute Miniature Ball End Mill

Recommended Milling Conditions



● I : Semi-standard Products, please inquire for price and delivery.

Work Material

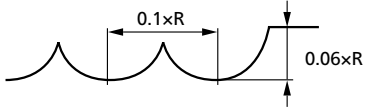
| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.         | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| I 01-00512-00200 | R0.2       | 0.8               | 0.4      | 9°                   | 3              | 35                 |
| I 01-00512-00250 | R0.25      | 1                 | 0.5      | 9°                   | 3              | 35                 |
| I 01-00512-00300 | R0.3       | 1.2               | 0.6      | 9°                   | 3              | 35                 |
| I 01-00512-00350 | R0.35      | 1.4               | 0.7      | 9°                   | 3              | 35                 |
| I 01-00512-00400 | R0.4       | 1.6               | 0.8      | 9°                   | 3              | 35                 |
| I 01-00512-00450 | R0.45      | 1.8               | 0.9      | 9°                   | 3              | 35                 |
| I 01-00512-00500 | R0.5       | 2                 | 1        | 9°                   | 3              | 35                 |
| I 01-00512-00600 | R0.6       | 2.4               | 1.2      | 9°                   | 3              | 35                 |
| I 01-00512-00700 | R0.7       | 2.8               | 1.4      | 9°                   | 3              | 35                 |
| I 01-00512-00750 | R0.75      | 3                 | 1.5      | 9°                   | 3              | 35                 |
| I 01-00512-00800 | R0.8       | 3.2               | 1.6      | 9°                   | 3              | 35                 |
| I 01-00512-00900 | R0.9       | 3.6               | 1.8      | 9°                   | 3              | 35                 |

How to Order

When you order, indicate NCB-2 (R). ※ (γ) is reference value.

| Work Material               | Carbon Steels・Alloy Steels・Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK             |        |
|-----------------------------|---------------------------------------------------------------------------------------|--------|
| Cutting Speed               | 50m/min                                                                               |        |
| Radius                      | Spindle Speed                                                                         | Feed   |
|                             | min <sup>-1</sup>                                                                     | mm/min |
| 0.2                         | 40,000                                                                                | 700    |
| 0.25                        | 32,000                                                                                | 750    |
| 0.3                         | 27,000                                                                                | 750    |
| 0.4                         | 20,000                                                                                | 870    |
| 0.5                         | 13,300                                                                                | 870    |
| 0.6                         | 11,400                                                                                | 870    |
| 0.7                         | 10,600                                                                                | 870    |
| 0.75                        | 10,000                                                                                | 870    |
| 0.8                         | 9,000                                                                                 | 870    |
| 0.9                         | 8,800                                                                                 | 850    |
| Depth of Cut<br>(R: Radius) |  |        |
| Notes                       | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.      |        |



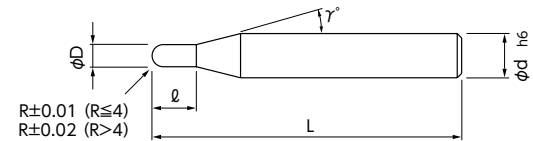
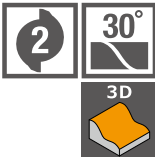
Ball



Ball

2-Flute Ball End Mill

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|--------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                          |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                        | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| ■ 01-00522-00100   | R1         | 3                 | 2        | 9°                   | 4              | 60                 |
| ■ 01-00522-00125   | R1.25      | 3.5               | 2.5      | 9°                   | 4              | 60                 |
| ■ 01-00522-00150   | R1.5       | 4                 | 3        | 9°                   | 6              | 60                 |
| ■ 01-00522-00175   | R1.75      | 5                 | 3.5      | 9°                   | 6              | 60                 |
| ■ 01-00522-00200   | R2         | 6                 | 4        | 9°                   | 6              | 60                 |
| ■ 01-00522-00250   | R2.5       | 8                 | 5        | 9°                   | 6              | 60                 |
| ■ 01-00522-00300   | R3         | 10                | 6        | —                    | 6              | 80                 |
| ▲ ■ 01-00522-00350 | R3.5       | 13                | 7        | 9°                   | 8              | 90                 |
| ▲ ■ 01-00522-00400 | R4         | 13                | 8        | —                    | 8              | 90                 |
| ▲ ■ 01-00522-00450 | R4.5       | 15                | 9        | 9°                   | 10             | 100                |
| ▲ ■ 01-00522-00500 | R5         | 15                | 10       | —                    | 10             | 100                |
| ▲ ■ 01-00522-00550 | R5.5       | 15                | 11       | 9°                   | 12             | 110                |
| ▲ ■ 01-00522-00600 | R6         | 15                | 12       | —                    | 12             | 110                |
| ▲ ■ 01-00522-00700 | R7         | 20                | 14       | 9°                   | 16             | 160                |
| ▲ ■ 01-00522-00800 | R8         | 20                | 16       | —                    | 16             | 160                |
| ▲ ■ 01-00522-00900 | R9         | 25                | 18       | 9°                   | 20             | 170                |
| ▲ ■ 01-00522-01000 | R10        | 25                | 20       | —                    | 20             | 170                |

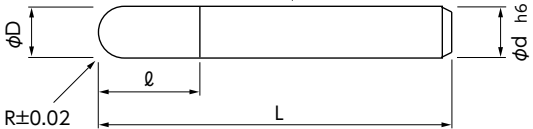
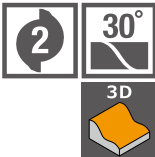
How to Order

When you order, indicate NSB-2 (R). ※ (γ) is reference value.

| Work Material            | Carbon Steels S50C                                                                                                                                                                                               |        | Alloy Steels SCM・SKD・SUS |        | Prehardened Steels HPM・NAK (～45HRC) |        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------|--------|-------------------------------------|--------|
| Cutting Speed            | 80m/min                                                                                                                                                                                                          |        | 70m/min                  |        | 60m/min                             |        |
| Radius                   | Spindle Speed                                                                                                                                                                                                    | Feed   | Spindle Speed            | Feed   | Spindle Speed                       | Feed   |
|                          | min <sup>-1</sup>                                                                                                                                                                                                | mm/min | min <sup>-1</sup>        | mm/min | min <sup>-1</sup>                   | mm/min |
| 1                        | 12,700                                                                                                                                                                                                           | 700    | 11,100                   | 580    | 9,600                               | 450    |
| 1.5                      | 8,500                                                                                                                                                                                                            | 700    | 7,400                    | 580    | 6,400                               | 450    |
| 2                        | 6,400                                                                                                                                                                                                            | 700    | 5,600                    | 580    | 4,800                               | 450    |
| 2.5                      | 5,100                                                                                                                                                                                                            | 700    | 4,500                    | 580    | 3,800                               | 450    |
| 3                        | 4,200                                                                                                                                                                                                            | 700    | 3,700                    | 580    | 3,200                               | 450    |
| 4                        | 3,200                                                                                                                                                                                                            | 700    | 2,800                    | 580    | 2,400                               | 450    |
| 5                        | 2,500                                                                                                                                                                                                            | 700    | 2,200                    | 580    | 1,900                               | 450    |
| 6                        | 2,100                                                                                                                                                                                                            | 700    | 1,900                    | 580    | 1,600                               | 450    |
| 8                        | 1,600                                                                                                                                                                                                            | 700    | 1,400                    | 580    | 1,200                               | 450    |
| 10                       | 1,300                                                                                                                                                                                                            | 700    | 1,100                    | 580    | 1,000                               | 450    |
| Depth of Cut (R: Radius) |                                                                                                                                                                                                                  |        |                          |        |                                     |        |
| Notes                    | ※1 Use cutting fluid.<br>※2 This table shows milling conditions of straight tool path. Adjust feed for inclined surface.<br>※3 Spindle speed and feed are changed according to overhang length and depth of cut. |        |                          |        |                                     |        |



2-Flute Long Ball End Mill



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|-------------------|----------|----------------|--------------------|
| ■ 01-00530-00300   | R3         | 15                | 6        | 6              | 120                |
| ■ 01-00530-00400   | R4         | 20                | 8        | 8              | 130                |
| ■ 01-00530-00500   | R5         | 25                | 10       | 10             | 150                |
| ■ 01-00530-00600   | R6         | 30                | 12       | 12             | 180                |
| ▲ ■ 01-00530-00800 | R8         | 40                | 16       | 16             | 200                |
| ▲ ■ 01-00530-01000 | R10        | 50                | 20       | 20             | 220                |

How to Order

When you order, indicate NSBL-2 (R).



Ball



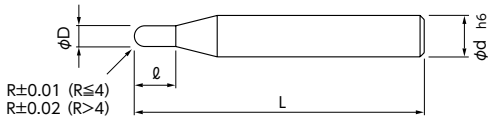
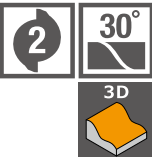
Ball





2-Flute Extra Long Ball End Mill

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.         | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-------------------|----------|----------------|--------------------|
| ■ 01-00528-00051 | R0.5       | 5                 | 1        | 4              | 50                 |
| ■ 01-00528-00071 | R0.75      | 8                 | 1.5      | 4              | 50                 |
| ■ 01-00528-00101 | R1         | 10                | 2        | 4              | 100                |
| ■ 01-00528-00121 | R1.25      | 13                | 2.5      | 4              | 100                |
| ■ 01-00528-00151 | R1.5       | 10                | 3        | 6              | 60                 |
| ■ 01-00528-00152 |            | 15                | 3        | 6              | 100                |
| ■ 01-00528-00171 | R1.75      | 10                | 3.5      | 6              | 60                 |
| ■ 01-00528-00172 |            | 18                | 3.5      | 6              | 100                |
| ■ 01-00528-00201 | R2         | 10                | 4        | 6              | 60                 |
| ■ 01-00528-00202 |            | 15                | 4        | 6              | 80                 |
| ■ 01-00528-00203 |            | 20                | 4        | 6              | 100                |
| ■ 01-00528-00221 | R2.25      | 22                | 4.5      | 6              | 100                |
| ■ 01-00528-00251 | R2.5       | 15                | 5        | 6              | 60                 |
| ■ 01-00528-00252 |            | 20                | 5        | 6              | 80                 |
| ■ 01-00528-00253 |            | 25                | 5        | 6              | 100                |
| ■ 01-00528-00271 | R2.75      | 28                | 5.5      | 6              | 100                |
| ■ 01-00528-00301 | R3         | 20                | 6        | 6              | 100                |
| ■ 01-00528-00302 |            | 30                | 6        | 6              | 150                |
| ■ 01-00528-00351 | R3.5       | 20                | 7        | 8              | 90                 |
| ■ 01-00528-00352 |            | 35                | 7        | 8              | 150                |
| ■ 01-00528-00401 | R4         | 20                | 8        | 8              | 90                 |
| ■ 01-00528-00402 |            | 40                | 8        | 8              | 150                |
| ■ 01-00528-00451 | R4.5       | 25                | 9        | 10             | 100                |
| ■ 01-00528-00452 |            | 45                | 9        | 10             | 150                |



Ball

How to Order

When you order, indicate NLBL-2 (R)×(ℓ).

Unit : mm

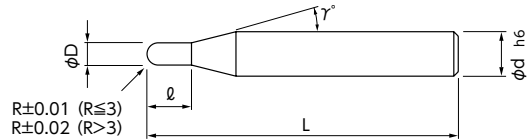
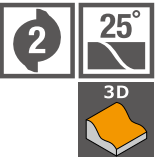
| Code No.         | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-------------------|----------|----------------|--------------------|
| ■ 01-00528-00501 | R5         | 30                | 10       | 10             | 100                |
| ■ 01-00528-00502 |            | 40                | 10       | 10             | 150                |
| ■ 01-00528-00503 |            | 50                | 10       | 10             | 200                |
| ■ 01-00528-00551 | R5.5       | 30                | 11       | 12             | 110                |
| ■ 01-00528-00552 |            | 50                | 11       | 12             | 150                |
| ■ 01-00528-00601 | R6         | 30                | 12       | 12             | 110                |
| ■ 01-00528-00602 |            | 55                | 12       | 12             | 150                |
| ■ 01-00528-00651 | R6.5       | 30                | 13       | 12             | 120                |
| ■ 01-00528-00652 |            | 55                | 13       | 12             | 150                |
| ■ 01-00528-00701 | R7         | 30                | 14       | 12             | 140                |
| ■ 01-00528-00702 |            | 55                | 14       | 12             | 200                |
| ■ 01-00528-00751 | R7.5       | 35                | 15       | 16             | 160                |
| ■ 01-00528-00752 |            | 60                | 15       | 16             | 200                |
| ■ 01-00528-00801 | R8         | 35                | 16       | 16             | 160                |
| ■ 01-00528-00802 |            | 50                | 16       | 16             | 200                |
| ■ 01-00528-00803 |            | 60                | 16       | 16             | 230                |
| ■ 01-00528-00851 | R8.5       | 35                | 17       | 16             | 160                |
| ■ 01-00528-00852 |            | 60                | 17       | 16             | 200                |
| ■ 01-00528-00901 | R9         | 40                | 18       | 20             | 170                |
| ■ 01-00528-00902 |            | 70                | 18       | 20             | 250                |
| ■ 01-00528-00951 | R9.5       | 40                | 19       | 20             | 170                |
| ■ 01-00528-00952 |            | 70                | 19       | 20             | 250                |
| ■ 01-00528-01001 | R10        | 40                | 20       | 20             | 170                |
| ■ 01-00528-01002 |            | 55                | 20       | 20             | 200                |
| ■ 01-00528-01003 |            | 70                | 20       | 20             | 250                |



Ball

2-Flute Ball End Mill for Nonferrous

Recommended Milling Conditions



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| ■ 07-00523-00050   | R0.5       | 2                 | 1        | 9°                   | 4              | 45                 |
| ■ 07-00523-00075   | R0.75      | 3                 | 1.5      | 9°                   | 4              | 45                 |
| ■ 07-00523-00100   | R1         | 4                 | 2        | 12°                  | 6              | 60                 |
| ■ 07-00523-00125   | R1.25      | 5                 | 2.5      | 9°                   | 6              | 60                 |
| ■ 07-00523-00150   | R1.5       | 6                 | 3        | 9°                   | 6              | 60                 |
| ■ 07-00523-00175   | R1.75      | 7                 | 3.5      | 9°                   | 6              | 60                 |
| ■ 07-00523-00200   | R2         | 8                 | 4        | 9°                   | 6              | 60                 |
| ■ 07-00523-00250   | R2.5       | 10                | 5        | 9°                   | 6              | 60                 |
| ■ 07-00523-00300   | R3         | 12                | 6        | —                    | 6              | 80                 |
| ▲ ■ 07-00523-00400 | R4         | 16                | 8        | —                    | 8              | 90                 |
| ▲ ■ 07-00523-00500 | R5         | 20                | 10       | —                    | 10             | 100                |
| ▲ ■ 07-00523-00600 | R6         | 24                | 12       | —                    | 12             | 110                |
| ▲ ■ 07-00523-00800 | R8         | 32                | 16       | —                    | 16             | 150                |
| ▲ ■ 07-00523-01000 | R10        | 40                | 20       | —                    | 20             | 170                |

How to Order

When you order, indicate DB (R). ※ ( γ ) is reference value.

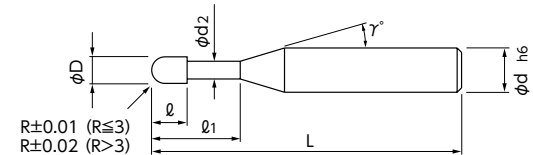
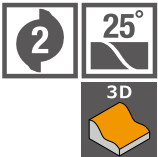
| Work Material              | Copper                                                                                                               |                |           | Aluminium Alloy                    |                |           |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|----------------|-----------|------------------------------------|----------------|-----------|
| Cutting Speed              | 70~100m/min                                                                                                          |                |           | 100~200m/min                       |                |           |
| Radius                     | Spindle Speed<br>min <sup>-1</sup>                                                                                   | Feed<br>mm/min |           | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |           |
|                            |                                                                                                                      | Roughing       | Finishing |                                    | Roughing       | Finishing |
|                            |                                                                                                                      |                |           |                                    |                |           |
| 0.5                        | 32,000                                                                                                               | 200            | 550       | 47,000                             | 320            | 860       |
| 0.75                       | 21,000                                                                                                               | 200            | 550       | 47,000                             | 320            | 860       |
| 1                          | 16,000                                                                                                               | 200            | 550       | 23,800                             | 600            | 860       |
| 1.25                       | 13,000                                                                                                               | 250            | 700       | 19,000                             | 750            | 1,650     |
| 1.5                        | 11,000                                                                                                               | 250            | 700       | 16,000                             | 750            | 1,650     |
| 1.75                       | 9,200                                                                                                                | 250            | 700       | 13,600                             | 750            | 1,650     |
| 2                          | 8,000                                                                                                                | 250            | 700       | 12,000                             | 750            | 1,650     |
| 2.5                        | 6,400                                                                                                                | 250            | 700       | 9,600                              | 750            | 1,650     |
| 3                          | 5,300                                                                                                                | 250            | 700       | 8,000                              | 750            | 1,650     |
| 4                          | 4,000                                                                                                                | 250            | 700       | 6,000                              | 750            | 1,650     |
| 5                          | 3,200                                                                                                                | 250            | 700       | 4,800                              | 750            | 1,650     |
| 6                          | 2,700                                                                                                                | 250            | 700       | 4,200                              | 750            | 1,650     |
| 8                          | 2,000                                                                                                                | 250            | 700       | 3,000                              | 750            | 1,650     |
| 10                         | 1,600                                                                                                                | 250            | 700       | 2,300                              | 750            | 1,650     |
| Depth of Cut<br>(R:Radius) | <div><div>Roughing</div><div>Finishing</div></div>                                                                   |                |           |                                    |                |           |
| Notes                      | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |                |           |                                    |                |           |





2-Flute Long Neck Ball End Mill for Nonferrous

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.           | Radius (R) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|------------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|
| ■ 07-00432-00504   | R0.5       | 4                      | 1.5               | 1        | 0.95           | 12°                  | 4              | 50                 |
| ■ 07-00432-00506   |            | 6                      | 1.5               | 1        | 0.95           | 12°                  | 4              | 50                 |
| ■ 07-00432-00510   |            | 10                     | 1.5               | 1        | 0.95           | 12°                  | 4              | 50                 |
| ■ 07-00432-00706   | R0.75      | 6                      | 2.25              | 1.5      | 1.45           | 12°                  | 4              | 50                 |
| ■ 07-00432-00710   |            | 10                     | 2.25              | 1.5      | 1.45           | 12°                  | 4              | 50                 |
| ■ 07-00432-00716   |            | 16                     | 2.25              | 1.5      | 1.45           | 12°                  | 4              | 50                 |
| ■ 07-00432-01008   | R1         | 8                      | 3                 | 2        | 1.94           | 12°                  | 4              | 50                 |
| ■ 07-00432-01014   |            | 14                     | 3                 | 2        | 1.94           | 12°                  | 4              | 50                 |
| ■ 07-00432-01020   |            | 20                     | 3                 | 2        | 1.94           | 12°                  | 4              | 50                 |
| ■ 07-00432-01515   | R1.5       | 15                     | 4.5               | 3        | 2.85           | 12°                  | 6              | 60                 |
| ■ 07-00432-01525   |            | 25                     | 4.5               | 3        | 2.85           | 12°                  | 6              | 60                 |
| ■ 07-00432-01535   |            | 35                     | 4.5               | 3        | 2.85           | 12°                  | 6              | 80                 |
| ■ 07-00432-02020   | R2         | 20                     | 6                 | 4        | 3.8            | 12°                  | 6              | 60                 |
| ■ 07-00432-02030   |            | 30                     | 6                 | 4        | 3.8            | 12°                  | 6              | 70                 |
| ■ 07-00432-02040   |            | 40                     | 6                 | 4        | 3.8            | 12°                  | 6              | 90                 |
| ■ 07-00432-02520   | R2.5       | 20                     | 7.5               | 5        | 4.8            | 12°                  | 6              | 60                 |
| ■ 07-00432-02530   |            | 30                     | 7.5               | 5        | 4.8            | 12°                  | 6              | 70                 |
| ■ 07-00432-02540   |            | 40                     | 7.5               | 5        | 4.8            | 12°                  | 6              | 90                 |
| ■ 07-00432-03020   | R3         | 20                     | 9                 | 6        | 5.8            | —                    | 6              | 60                 |
| ■ 07-00432-03030   |            | 30                     | 9                 | 6        | 5.8            | 12°                  | 8              | 90                 |
| ■ 07-00432-03050   |            | 50                     | 9                 | 6        | 5.8            | 12°                  | 8              | 110                |
| ▲ ■ 07-00432-04020 | R4         | 20                     | 12                | 8        | 7.8            | —                    | 8              | 70                 |
| ▲ ■ 07-00432-04040 |            | 40                     | 12                | 8        | 7.8            | 12°                  | 10             | 100                |
| ▲ ■ 07-00432-04060 |            | 60                     | 12                | 8        | 7.8            | 12°                  | 10             | 120                |
| ▲ ■ 07-00432-05030 | R5         | 30                     | 15                | 10       | 9.8            | —                    | 10             | 90                 |
| ▲ ■ 07-00432-05050 |            | 50                     | 15                | 10       | 9.8            | 12°                  | 12             | 120                |
| ▲ ■ 07-00432-05070 |            | 70                     | 15                | 10       | 9.8            | 12°                  | 12             | 140                |
| ▲ ■ 07-00432-06040 | R6         | 40                     | 18                | 12       | 11.8           | —                    | 12             | 110                |
| ▲ ■ 07-00432-06060 |            | 60                     | 18                | 12       | 11.8           | 12°                  | 16             | 130                |
| ▲ ■ 07-00432-06080 |            | 80                     | 18                | 12       | 11.8           | 12°                  | 16             | 160                |

How to Order

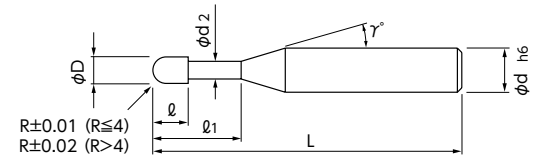
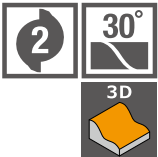
When you order, indicate DHB (R)×(ℓ1). ※(γ) is reference value.

| Work Material |              | Copper                                                                                                                                                          |           | Aluminium Alloy   |           | Resin             |         |
|---------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|-----------|-------------------|---------|
| Cutting Speed |              | 50~150m/min                                                                                                                                                     |           | 100~200m/min      |           | 40~60m/min        |         |
| Radius        | Depth of Cut | Spindle Speed                                                                                                                                                   | Feed      | Spindle Speed     | Feed      | Spindle Speed     | Feed    |
|               | mm           | min <sup>-1</sup>                                                                                                                                               | mm/min    | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min  |
| 0.5           | 0.015~0.18   | 15,900~47,800                                                                                                                                                   | 450~1,200 | 31,800~           | 750~1,600 | 12,700~19,100     | 250~320 |
| 0.75          | 0.02 ~0.25   | 10,600~31,800                                                                                                                                                   | 450~1,200 | 21,200~42,500     | 750~1,600 | 8,500~12,700      | 250~320 |
| 1             | 0.03 ~0.3    | 8,000~23,900                                                                                                                                                    | 450~1,200 | 15,900~31,800     | 750~1,600 | 6,400~ 9,600      | 250~320 |
| 1.5           | 0.03 ~0.3    | 5,300~15,900                                                                                                                                                    | 450~1,200 | 10,600~21,200     | 750~1,600 | 4,200~ 6,400      | 250~320 |
| 2             | 0.07 ~0.4    | 4,000~11,900                                                                                                                                                    | 450~1,200 | 8,000~15,900      | 750~1,600 | 3,200~ 4,800      | 190~240 |
| 2.5           | 1 ~2.5       | 3,200~ 9,600                                                                                                                                                    | 200~ 250  | 6,400~12,700      | 600~ 750  | 2,500~ 3,800      | 160~200 |
| 3             | 2 ~3         | 2,700~ 8,000                                                                                                                                                    | 200~ 250  | 5,300~10,600      | 600~ 750  | 2,100~ 3,200      | 160~200 |
| 4             | 2 ~4         | 2,000~ 6,000                                                                                                                                                    | 200~ 250  | 4,000~ 8,000      | 600~ 750  | 1,600~ 2,400      | 160~200 |
| 5             | 3 ~5         | 1,600~ 4,800                                                                                                                                                    | 200~ 250  | 3,200~ 6,400      | 600~ 750  | 1,300~ 1,900      | 160~200 |
| 6             | 3.5 ~6       | 1,300~ 4,000                                                                                                                                                    | 200~ 250  | 2,700~ 5,300      | 600~ 750  | 1,100~ 1,600      | 160~200 |
| Notes         |              | ※1 Adjust spindle speed, feed and depth of cut according to effective length.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Don't use for cutting steels. |           |                   |           |                   |         |



2-Flute Long Neck Ball End Mill

2-Flute Long Neck Ball End Mill



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels · Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                            |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                          | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.         | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------|
| ■ 01-00432-00401 | R0.4       | 6                                   | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00402 |            | 8                                   | 0.6               | 0.8      | 0.76                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00502 | R0.5       | 8                                   | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00503 |            | 12                                  | 0.75              | 1        | 0.95                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00602 | R0.6       | 8                                   | 0.9               | 1.2      | 1.15                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00603 |            | 12                                  | 0.9               | 1.2      | 1.15                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00702 | R0.7       | 8                                   | 1                 | 1.4      | 1.35                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00703 |            | 12                                  | 1                 | 1.4      | 1.35                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00704 |            | 16                                  | 1                 | 1.4      | 1.35                        | 12°                  | 4              | 50                 |
| ■ 01-00432-00752 | R0.75      | 8                                   | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00753 |            | 12                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00754 |            | 16                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 50                 |
| ■ 01-00432-00755 |            | 20                                  | 1.1               | 1.5      | 1.45                        | 12°                  | 4              | 55                 |
| ■ 01-00432-00802 | R0.8       | 8                                   | 1.2               | 1.6      | 1.55                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00803 |            | 12                                  | 1.2               | 1.6      | 1.55                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00804 |            | 16                                  | 1.2               | 1.6      | 1.55                        | 12°                  | 4              | 50                 |
| ■ 01-00432-00805 |            | 20                                  | 1.2               | 1.6      | 1.55                        | 12°                  | 4              | 55                 |
| ■ 01-00432-00902 | R0.9       | 8                                   | 1.3               | 1.8      | 1.75                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00903 |            | 12                                  | 1.3               | 1.8      | 1.75                        | 12°                  | 4              | 45                 |
| ■ 01-00432-00904 |            | 16                                  | 1.3               | 1.8      | 1.75                        | 12°                  | 4              | 50                 |
| ■ 01-00432-00905 |            | 20                                  | 1.3               | 1.8      | 1.75                        | 12°                  | 4              | 55                 |
| ■ 01-00432-01002 | R1         | 8                                   | 1.5               | 2        | 1.94                        | 12°                  | 4              | 45                 |
| ■ 01-00432-01003 |            | 12                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 45                 |
| ■ 01-00432-01004 |            | 16                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 50                 |
| ■ 01-00432-01005 |            | 20                                  | 1.5               | 2        | 1.94                        | 12°                  | 4              | 55                 |
| ■ 01-00432-01510 | R1.5       | 10                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 |
| ■ 01-00432-01515 |            | 15                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 60                 |
| ■ 01-00432-01520 |            | 20                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 65                 |
| ■ 01-00432-01525 |            | 25                                  | 2.5               | 3        | 2.85                        | 12°                  | 6              | 65                 |

How to Order

When you order, indicate NHB-2 (R)×(ℓ<sub>1</sub>). ※(γ) is reference value.

Unit : mm

| Code No.           | Radius (R) | Under Neck Length (ℓ <sub>1</sub> ) | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d <sub>2</sub> ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|-------------------------------------|-------------------|----------|-----------------------------|----------------------|----------------|--------------------|
| ■ 01-00432-02015   | R2         | 15                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 65                 |
| ■ 01-00432-02020   |            | 20                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 65                 |
| ■ 01-00432-02025   |            | 25                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 70                 |
| ■ 01-00432-02030   |            | 30                                  | 3                 | 4        | 3.8                         | 12°                  | 6              | 70                 |
| ■ 01-00432-02520   | R2.5       | 20                                  | 3.5               | 5        | 4.8                         | 12°                  | 6              | 70                 |
| ■ 01-00432-02525   |            | 25                                  | 3.5               | 5        | 4.8                         | 12°                  | 6              | 70                 |
| ■ 01-00432-02530   |            | 30                                  | 3.5               | 5        | 4.8                         | 12°                  | 6              | 80                 |
| ■ 01-00432-02535   |            | 35                                  | 3.5               | 5        | 4.8                         | 12°                  | 6              | 80                 |
| ■ 01-00432-03030   | R3         | 30                                  | 6                 | 6        | 5.8                         | 12°                  | 6              | 80                 |
| ■ 01-00432-03050   |            | 50                                  | 6                 | 6        | 5.8                         | 12°                  | 6              | 120                |
| ▲ ■ 01-00432-04040 | R4         | 40                                  | 8                 | 8        | 7.8                         | 12°                  | 8              | 90                 |
| ▲ ■ 01-00432-04060 |            | 60                                  | 8                 | 8        | 7.8                         | 12°                  | 8              | 130                |
| ▲ ■ 01-00432-05050 | R5         | 50                                  | 10                | 10       | 9.8                         | 12°                  | 10             | 100                |
| ▲ ■ 01-00432-05070 |            | 70                                  | 10                | 10       | 9.8                         | 12°                  | 10             | 150                |



Recommended Milling Conditions

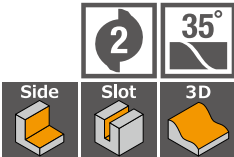
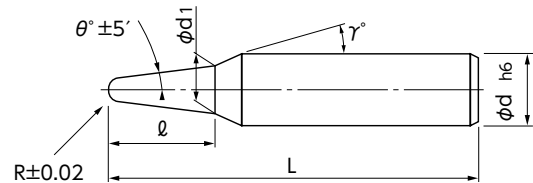
| Work Material |              | Carbon Steels・Alloy Steels・<br>Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK                                               |         | Aluminium Alloy   |           | Copper            |           | Resin             |         |
|---------------|--------------|-----------------------------------------------------------------------------------------------------------------------------|---------|-------------------|-----------|-------------------|-----------|-------------------|---------|
| Cutting Speed |              | 30～50m/min                                                                                                                  |         | 100～200m/min      |           | 50～150m/min       |           | 40～60m/min        |         |
| Radius        | Depth of Cut | Spindle Speed                                                                                                               | Feed    | Spindle Speed     | Feed      | Spindle Speed     | Feed      | Spindle Speed     | Feed    |
|               | mm           | min <sup>-1</sup>                                                                                                           | mm/min  | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min  |
| 0.4           | 0.01 ～0.02   | 12,000～20,000                                                                                                               | 100～250 | 40,000～           | 500～ 800  | 20,000～           | 300～ 750  | 16,000～24,000     | 190～240 |
| 0.5           | 0.01 ～0.03   | 9,600～16,000                                                                                                                | 150～400 | 32,000～           | 750～1,600 | 16,000～48,000     | 450～1,200 | 12,700～19,100     | 190～240 |
| 0.6           | 0.016～0.06   | 8,000～13,300                                                                                                                | 150～400 | 26,500～           | 750～1,600 | 13,300～40,000     | 450～1,200 | 10,600～16,000     | 250～320 |
| 0.7           | 0.012～0.1    | 6,800～11,400                                                                                                                | 150～400 | 22,700～45,500     | 750～1,600 | 11,400～34,100     | 450～1,200 | 9,100～13,600      | 250～320 |
| 0.75          | 0.008～0.12   | 6,400～10,600                                                                                                                | 150～400 | 20,000～40,000     | 750～1,600 | 10,600～32,000     | 450～1,200 | 8,500～12,700      | 250～320 |
| 0.8           | 0.012～0.15   | 6,000～10,000                                                                                                                | 150～400 | 19,900～39,800     | 750～1,600 | 10,000～30,000     | 450～1,200 | 8,000～12,000      | 250～320 |
| 0.9           | 0.02 ～0.18   | 5,300～ 8,800                                                                                                                | 150～400 | 17,700～35,400     | 750～1,600 | 8,800～26,500      | 450～1,200 | 7,100～10,600      | 250～320 |
| 1             | 0.03 ～0.2    | 4,800～ 8,000                                                                                                                | 150～400 | 16,000～32,000     | 750～1,600 | 8,000～24,000      | 450～1,200 | 6,400～ 9,600      | 250～320 |
| 1.5           | 0.08 ～0.3    | 3,200～ 5,300                                                                                                                | 150～400 | 10,600～21,200     | 750～1,600 | 5,300～16,000      | 450～1,200 | 4,200～ 6,400      | 250～320 |
| 2             | 0.12 ～0.3    | 2,400～ 4,000                                                                                                                | 150～400 | 8,000～16,000      | 750～1,600 | 4,000～12,000      | 450～1,200 | 3,200～ 4,800      | 190～240 |
| 2.5           | 0.2 ～0.3     | 1,900～ 3,200                                                                                                                | 150～400 | 6,400～12,700      | 750～1,600 | 3,200～ 9,600      | 450～1,200 | 2,500～ 3,800      | 160～200 |
| 3             | 0.2 ～0.3     | 1,600～ 2,700                                                                                                                | 150～400 | 5,300～10,600      | 750～1,600 | 2,700～ 8,000      | 450～1,200 | 2,100～ 3,200      | 160～200 |
| 4             | 0.2 ～0.3     | 1,200～ 2,000                                                                                                                | 150～400 | 4,000～ 8,000      | 750～1,600 | 2,000～ 6,000      | 450～1,200 | 1,600～ 2,400      | 160～200 |
| 5             | 0.2 ～0.3     | 1,000～ 1,600                                                                                                                | 150～400 | 3,200～ 6,400      | 750～1,600 | 1,600～ 4,800      | 450～1,200 | 1,300～ 1,900      | 160～200 |
| Notes         |              | ※1 Adjust spindle speed, feed and depth of cut according to effective length.<br>※2 Use cutting fluid with smoke retardant. |         |                   |           |                   |           |                   |         |





2-Flute Taper Ball End Mill

2-Flute Taper Ball End Mill



● : Semi-standard Products, please inquire for price and delivery.  
▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

Unit : mm

| Code No.       | Radius (R) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 01-00352-00501 | R0.5       | 30'             | 10                | 1.17                   | 9°                   | 4              | 50                 |
| 01-00352-00502 |            | 1°              | 10                | 1.33                   | 9°                   | 4              | 50                 |
| 01-00352-00503 |            | 1°30'           | 10                | 1.50                   | 9°                   | 4              | 50                 |
| 01-00352-00504 |            | 2°              | 10                | 1.66                   | 9°                   | 4              | 50                 |
| 01-00352-00505 |            | 3°              | 10                | 2.00                   | 9°                   | 4              | 50                 |
| 01-00352-00506 |            | 4°              | 10                | 2.33                   | 9°                   | 4              | 50                 |
| 01-00352-00507 |            | 5°              | 10                | 2.67                   | 9°                   | 4              | 50                 |
| 01-00352-00508 |            | 7°              | 10                | 3.34                   | 7°                   | 4              | 50                 |
| 01-00352-00509 |            | 10°             | 10                | 4.37                   | —                    | 4              | 50                 |
| 01-00352-00751 | R0.75      | 30'             | 10                | 1.66                   | 9°                   | 4              | 50                 |
| 01-00352-00752 |            | 1°              | 10                | 1.82                   | 9°                   | 4              | 50                 |
| 01-00352-00753 |            | 1°30'           | 10                | 1.99                   | 9°                   | 4              | 50                 |
| 01-00352-00754 |            | 2°              | 10                | 2.15                   | 9°                   | 4              | 50                 |
| 01-00352-00755 |            | 3°              | 10                | 2.47                   | 9°                   | 4              | 50                 |
| 01-00352-00756 |            | 4°              | 10                | 2.80                   | 9°                   | 4              | 50                 |
| 01-00352-00757 |            | 5°              | 10                | 3.12                   | 9°                   | 4              | 50                 |
| 01-00352-00758 |            | 7°              | 10                | 3.78                   | 7°                   | 4              | 50                 |
| 01-00352-00759 |            | 10°             | 10                | 4.79                   | —                    | 4              | 50                 |
| 01-00352-01001 | R1         | 30'             | 13                | 2.21                   | 9°                   | 4              | 55                 |
| 01-00352-01002 |            | 1°              | 13                | 2.42                   | 9°                   | 4              | 55                 |
| 01-00352-01003 |            | 1°30'           | 13                | 2.63                   | 9°                   | 4              | 55                 |
| 01-00352-01004 |            | 2°              | 13                | 2.84                   | 9°                   | 4              | 55                 |
| 01-00352-01005 |            | 3°              | 13                | 3.26                   | 9°                   | 4              | 55                 |
| 01-00352-01006 |            | 4°              | 13                | 3.68                   | 4°                   | 4              | 55                 |
| 01-00352-01007 |            | 5°              | 13                | 4.11                   | —                    | 4              | 55                 |
| 01-00352-01008 |            | 7°              | 13                | 4.96                   | —                    | 4              | 55                 |
| 01-00352-01009 |            | 10°             | 13                | 6.26                   | —                    | 6              | 55                 |
| 01-00352-01251 | R1.25      | 30'             | 15                | 2.74                   | 9°                   | 4              | 55                 |
| 01-00352-01252 |            | 1°              | 15                | 2.98                   | 9°                   | 4              | 55                 |
| 01-00352-01253 |            | 1°30'           | 15                | 3.22                   | 9°                   | 4              | 55                 |
| 01-00352-01254 |            | 2°              | 15                | 3.46                   | 9°                   | 4              | 55                 |
| 01-00352-01255 |            | 3°              | 15                | 3.94                   | 3°                   | 4              | 55                 |
| 01-00352-01256 |            | 4°              | 15                | 4.43                   | —                    | 4              | 55                 |
| 01-00352-01257 |            | 5°              | 15                | 4.92                   | —                    | 4              | 55                 |
| 01-00352-01258 |            | 7°              | 15                | 5.90                   | 7°                   | 6              | 55                 |
| 01-00352-01259 |            | 10°             | 15                | 7.39                   | —                    | 6              | 55                 |

How to Order

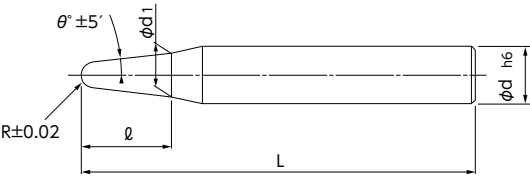
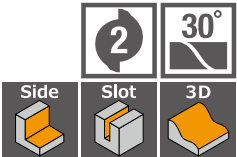
When you order, indicate NTB-2 (R)×(θ). ※(d1) and (γ) is reference value.

Unit : mm

| Code No.       | Radius (R) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|------------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 01-00352-01501 | R1.5       | 30'             | 20                | 3.32                   | 9°                   | 4              | 60                 |
| 01-00352-01502 |            | 1°              | 20                | 3.65                   | 9°                   | 4              | 60                 |
| 01-00352-01503 |            | 1°30'           | 20                | 3.97                   | 1°30'                | 4              | 60                 |
| 01-00352-01504 |            | 2°              | 20                | 4.29                   | —                    | 4              | 60                 |
| 01-00352-01505 |            | 3°              | 20                | 4.94                   | —                    | 4              | 60                 |
| 01-00352-01506 |            | 4°              | 20                | 5.60                   | 4°                   | 6              | 60                 |
| 01-00352-01507 |            | 5°              | 20                | 6.25                   | —                    | 6              | 65                 |
| 01-00352-01508 |            | 7°              | 20                | 7.57                   | 7°                   | 8              | 65                 |
| 01-00352-01509 |            | 10°             | 20                | 9.57                   | 10°                  | 10             | 70                 |
| 01-00352-02001 | R2         | 30'             | 25                | 4.40                   | —                    | 4              | 60                 |
| 01-00352-02002 |            | 1°              | 25                | 4.80                   | —                    | 4              | 60                 |
| 01-00352-02003 |            | 1°30'           | 25                | 5.21                   | 9°                   | 6              | 60                 |
| 01-00352-02004 |            | 2°              | 25                | 5.61                   | 2°                   | 6              | 60                 |
| 01-00352-02005 |            | 3°              | 25                | 6.42                   | —                    | 6              | 60                 |
| 01-00352-02006 |            | 4°              | 25                | 7.23                   | 4°                   | 8              | 65                 |
| 01-00352-02007 |            | 5°              | 25                | 8.04                   | —                    | 8              | 65                 |
| 01-00352-02008 |            | 7°              | 25                | 9.68                   | 7°                   | 10             | 70                 |
| 01-00352-02009 |            | 10°             | 25                | 12.17                  | —                    | 12             | 70                 |
| 01-00352-02501 | R2.5       | 30'             | 30                | 5.48                   | 9°                   | 6              | 65                 |
| 01-00352-02502 |            | 1°              | 30                | 5.96                   | 1°                   | 6              | 65                 |
| 01-00352-02503 |            | 1°30'           | 30                | 6.44                   | —                    | 6              | 65                 |
| 01-00352-02504 |            | 2°              | 30                | 6.92                   | —                    | 6              | 65                 |
| 01-00352-02505 |            | 3°              | 30                | 7.89                   | 3°                   | 8              | 70                 |
| 01-00352-02506 |            | 4°              | 30                | 8.86                   | —                    | 8              | 75                 |
| 01-00352-02507 |            | 5°              | 30                | 9.83                   | 5°                   | 10             | 80                 |
| 01-00352-02508 |            | 7°              | 30                | 11.79                  | 7°                   | 12             | 85                 |
| 01-00352-02509 |            | 10°             | 30                | 14.78                  | 10°                  | 16             | 90                 |
| 01-00352-03001 | R3         | 30'             | 35                | 6.56                   | —                    | 6              | 70                 |
| 01-00352-03002 |            | 1°              | 35                | 7.12                   | —                    | 6              | 70                 |
| 01-00352-03003 |            | 1°30'           | 35                | 7.68                   | —                    | 6              | 70                 |
| 01-00352-03004 |            | 2°              | 35                | 8.24                   | —                    | 8              | 80                 |
| 01-00352-03005 |            | 3°              | 35                | 9.36                   | —                    | 8              | 85                 |
| 01-00352-03006 |            | 4°              | 35                | 10.49                  | —                    | 10             | 90                 |
| 01-00352-03007 |            | 5°              | 35                | 11.62                  | 5°                   | 12             | 90                 |
| 01-00352-03008 |            | 7°              | 35                | 13.90                  | —                    | 12             | 95                 |
| 01-00352-03009 |            | 10°             | 35                | 17.38                  | —                    | 16             | 100                |
| 01-00352-04001 | R4         | 30'             | 40                | 8.63                   | —                    | 8              | 90                 |
| 01-00352-04002 |            | 1°              | 40                | 9.26                   | —                    | 8              | 90                 |
| 01-00352-04003 |            | 1°30'           | 40                | 9.89                   | 1°30'                | 10             | 90                 |
| 01-00352-04004 |            | 2°              | 40                | 10.52                  | —                    | 10             | 90                 |
| 01-00352-04005 |            | 3°              | 40                | 11.78                  | 3°                   | 12             | 100                |
| 01-00352-04006 |            | 4°              | 40                | 13.05                  | —                    | 12             | 100                |
| 01-00352-04007 |            | 5°              | 40                | 14.33                  | —                    | 12             | 100                |
| 01-00352-04008 |            | 7°              | 40                | 16.90                  | —                    | 16             | 110                |
| 01-00352-04009 |            | 10°             | 40                | 20.82                  | —                    | 20             | 110                |
| 01-00352-05001 | R5         | 30'             | 45                | 10.70                  | —                    | 10             | 105                |
| 01-00352-05002 |            | 1°              | 45                | 11.40                  | —                    | 10             | 105                |
| 01-00352-05003 |            | 1°30'           | 45                | 12.10                  | —                    | 12             | 105                |
| 01-00352-05004 |            | 2°              | 45                | 12.80                  | —                    | 12             | 110                |
| 01-00352-05005 |            | 3°              | 45                | 14.20                  | —                    | 12             | 110                |
| 01-00352-05006 |            | 4°              | 45                | 15.62                  | 4°                   | 16             | 120                |
| 01-00352-05007 |            | 5°              | 45                | 17.04                  | —                    | 16             | 120                |
| 01-00352-05008 |            | 7°              | 45                | 19.90                  | 7°                   | 20             | 130                |
| 01-00352-05009 |            | 10°             | 45                | 24.26                  | 10°                  | 25             | 140                |



2-Flute Taper Ball End Mill for Runner



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

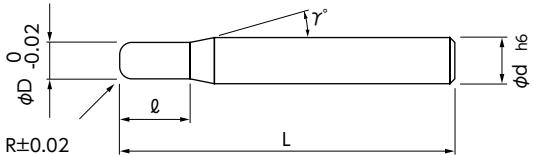
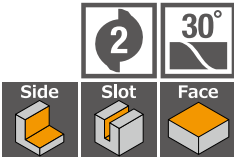
| Code No.         | Radius (R) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-----------------|-------------------|------------------------|----------------|--------------------|
| ● 01-00722-01002 | R1         | 10°             | 4                 | 3.09                   | 4              | 50                 |
| ● 01-00722-01004 |            | 15°             | 4                 | 3.68                   | 4              | 50                 |
| ● 01-00722-01005 |            | 20°             | 4                 | 4.31                   | 6              | 55                 |
| ● 01-00722-01252 | R1.25      | 10°             | 5                 | 3.86                   | 4              | 50                 |
| ● 01-00722-01254 |            | 15°             | 5                 | 4.60                   | 6              | 55                 |
| ● 01-00722-01255 |            | 20°             | 5                 | 5.39                   | 6              | 55                 |
| ● 01-00722-01502 | R1.5       | 10°             | 6                 | 4.63                   | 6              | 55                 |
| ● 01-00722-01504 |            | 15°             | 6                 | 5.52                   | 6              | 55                 |
| ● 01-00722-01505 |            | 20°             | 6                 | 6.47                   | 8              | 60                 |
| ● 01-00722-01752 | R1.75      | 10°             | 7                 | 5.41                   | 6              | 55                 |
| ● 01-00722-01754 |            | 15°             | 7                 | 6.44                   | 8              | 60                 |
| ● 01-00722-01755 |            | 20°             | 7                 | 7.55                   | 8              | 60                 |
| ● 01-00722-02002 | R2         | 10°             | 8                 | 6.18                   | 6              | 55                 |
| ● 01-00722-02004 |            | 15°             | 8                 | 7.36                   | 8              | 60                 |
| ● 01-00722-02005 |            | 20°             | 8                 | 8.62                   | 10             | 70                 |
| ● 01-00722-02502 | R2.5       | 10°             | 10                | 7.72                   | 8              | 60                 |
| ● 01-00722-02504 |            | 15°             | 10                | 9.20                   | 10             | 70                 |
| ● 01-00722-02505 |            | 20°             | 10                | 10.78                  | 12             | 80                 |
| ● 01-00722-03002 | R3         | 10°             | 12                | 9.27                   | 10             | 70                 |
| ● 01-00722-03004 |            | 15°             | 12                | 11.03                  | 12             | 80                 |
| ● 01-00722-03005 |            | 20°             | 12                | 12.94                  | 12             | 90                 |

How to Order When you order, indicate NERB-2 (R)×(θ).



2-Flute Radius End Mill

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ◎               | ◎      | ◎     |

▲ Discontinued Products

| Unit : mm        |             |                         |                         |                                     |                      |                          |                  |             |                         |                         |                                     |                      |                          |
|------------------|-------------|-------------------------|-------------------------|-------------------------------------|----------------------|--------------------------|------------------|-------------|-------------------------|-------------------------|-------------------------------------|----------------------|--------------------------|
| Code No.         | Dia.<br>(D) | Corner<br>Radius<br>(R) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Code No.         | Dia.<br>(D) | Corner<br>Radius<br>(R) | Length of<br>Cut<br>(L) | Neck Taper<br>Angle<br>( $\gamma$ ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
| ● 01-00772-00102 | 1           | R0.2                    | 3                       | 9°                                  | 4                    | 45                       | ▲ 01-00772-01005 | 10          | R0.5                    | 30                      | -                                   | 10                   | 80                       |
| ● 01-00772-00152 | 1.5         | R0.2                    | 4.5                     | 9°                                  | 4                    | 45                       | ▲ 01-00772-01010 |             | R1                      |                         |                                     |                      |                          |
| ● 01-00772-00155 |             | R0.5                    |                         |                                     |                      |                          | ▲ 01-00772-01015 |             | R1.5                    |                         |                                     |                      |                          |
| ● 01-00772-00202 | 2           | R0.2                    | 6                       | 9°                                  | 4                    | 45                       | ▲ 01-00772-01020 |             | R2                      |                         |                                     |                      |                          |
| ● 01-00772-00205 | 2.5         | R0.5                    | 8                       | 9°                                  | 4                    | 45                       | ▲ 01-00772-01025 |             | R2.5                    |                         |                                     |                      |                          |
| ● 01-00772-00252 |             | R0.2                    |                         |                                     |                      |                          | ▲ 01-00772-01030 | 12          | R3                      | 36                      | -                                   | 12                   | 85                       |
| ● 01-00772-00255 |             | R0.5                    |                         |                                     |                      |                          | ▲ 01-00772-01205 |             | R0.5                    |                         |                                     |                      |                          |
| ● 01-00772-00302 | 3           | R0.2                    | 10                      | 9°                                  | 6                    | 45                       | ▲ 01-00772-01210 |             | R1                      |                         |                                     |                      |                          |
| ● 01-00772-00305 |             | R0.5                    |                         |                                     |                      |                          | ▲ 01-00772-01215 |             | R1.5                    |                         |                                     |                      |                          |
| ● 01-00772-00310 |             | R1                      |                         |                                     |                      |                          | ▲ 01-00772-01220 |             | R2                      |                         |                                     |                      |                          |
| ● 01-00772-00402 | 4           | R0.2                    | 12                      | 9°                                  | 6                    | 50                       | ▲ 01-00772-01225 | 16          | R2.5                    | 50                      | -                                   | 16                   | 110                      |
| ● 01-00772-00405 |             | R0.5                    |                         |                                     |                      |                          | ▲ 01-00772-01230 |             | R3                      |                         |                                     |                      |                          |
| ● 01-00772-00410 |             | R1                      |                         |                                     |                      |                          | ▲ 01-00772-01610 |             | R1                      |                         |                                     |                      |                          |
| ● 01-00772-00502 | 5           | R0.2                    | 15                      | 9°                                  | 6                    | 55                       | ▲ 01-00772-01615 |             | R1.5                    |                         |                                     |                      |                          |
| ● 01-00772-00505 |             | R0.5                    |                         |                                     |                      |                          | ▲ 01-00772-01620 |             | R2                      |                         |                                     |                      |                          |
| ● 01-00772-00510 |             | R1                      |                         |                                     |                      |                          | ▲ 01-00772-01625 |             | R2.5                    |                         |                                     |                      |                          |
| ● 01-00772-00515 |             | R1.5                    |                         |                                     |                      |                          | ▲ 01-00772-01630 |             | R3                      |                         |                                     |                      |                          |
| ● 01-00772-00602 | 6           | R0.2                    | 18                      | -                                   | 6                    | 60                       | ▲ 01-00772-01630 | 20          | R4                      | 60                      | -                                   | 20                   | 135                      |
| ● 01-00772-00605 |             | R0.5                    |                         |                                     |                      |                          | ▲ 01-00772-01640 |             | R5                      |                         |                                     |                      |                          |
| ● 01-00772-00610 |             | R1                      |                         |                                     |                      |                          | ▲ 01-00772-01650 |             | R1                      |                         |                                     |                      |                          |
| ● 01-00772-00615 |             | R1.5                    |                         |                                     |                      |                          | ▲ 01-00772-02010 |             | R1.5                    |                         |                                     |                      |                          |
| ● 01-00772-00620 |             | R2                      |                         |                                     |                      |                          | ▲ 01-00772-02015 |             | R2                      |                         |                                     |                      |                          |
| ▲ 01-00772-00805 | 8           | R0.5                    | 24                      | -                                   | 8                    | 70                       | ▲ 01-00772-02020 |             | R2.5                    |                         |                                     |                      |                          |
| ▲ 01-00772-00810 |             | R1                      |                         |                                     |                      |                          | ▲ 01-00772-02025 |             | R3                      |                         |                                     |                      |                          |
| ▲ 01-00772-00815 |             | R1.5                    |                         |                                     |                      |                          | ▲ 01-00772-02030 |             | R4                      |                         |                                     |                      |                          |
| ▲ 01-00772-00820 |             | R2                      |                         |                                     |                      |                          | ▲ 01-00772-02040 |             | R5                      |                         |                                     |                      |                          |
| ▲ 01-00772-00825 |             | R2.5                    |                         |                                     |                      |                          | ▲ 01-00772-02050 |             |                         |                         |                                     |                      |                          |
| ▲ 01-00772-00830 |             | R3                      |                         |                                     |                      |                          |                  |             |                         |                         |                                     |                      |                          |

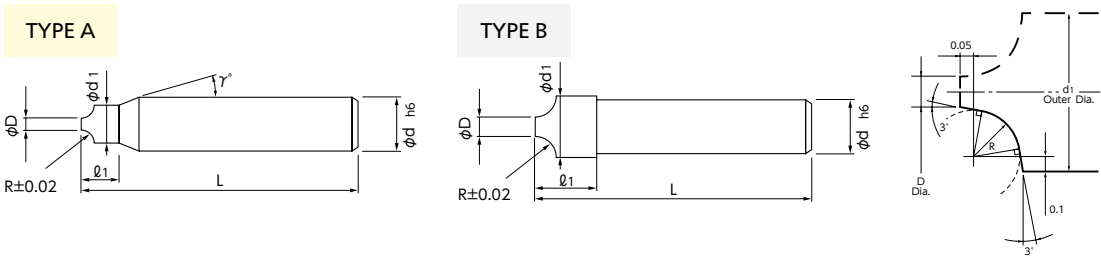
How to Order

When you order, indicate NSR-2 (D)×(R). ※( $\gamma$ ) is reference value.

| Work Material             | Carbon Steels<br>S50C                                                                                                                                                                                                                           |                 |          | Alloy Steels<br>SCM・SKD・SUS |                 |          | Prehardened Steels<br>HPM・NAK |                 |          |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|-----------------------------|-----------------|----------|-------------------------------|-----------------|----------|
| Cutting Speed             | 40~50m/min                                                                                                                                                                                                                                      |                 |          | 35~45m/min                  |                 |          | 25~35m/min                    |                 |          |
| Dia.                      | Spindle<br>Speed                                                                                                                                                                                                                                | Feed            |          | Spindle<br>Speed            | Feed            |          | Spindle<br>Speed              | Feed            |          |
|                           | min <sup>-1</sup>                                                                                                                                                                                                                               | mm/min          |          | min <sup>-1</sup>           | mm/min          |          | min <sup>-1</sup>             | mm/min          |          |
|                           |                                                                                                                                                                                                                                                 | Side<br>Milling | Slotting |                             | Side<br>Milling | Slotting |                               | Side<br>Milling | Slotting |
| 1                         | 14,300                                                                                                                                                                                                                                          | 130             | 50       | 12,700                      | 90              | 40       | 9,600                         | 80              | 35       |
| 1.5                       | 9,600                                                                                                                                                                                                                                           | 130             | 50       | 8,500                       | 90              | 40       | 6,400                         | 80              | 35       |
| 2                         | 7,200                                                                                                                                                                                                                                           | 130             | 50       | 6,400                       | 90              | 40       | 4,800                         | 80              | 35       |
| 2.5                       | 5,700                                                                                                                                                                                                                                           | 130             | 50       | 5,100                       | 90              | 40       | 3,800                         | 80              | 35       |
| 3                         | 4,800                                                                                                                                                                                                                                           | 150             | 60       | 4,200                       | 120             | 50       | 3,200                         | 90              | 40       |
| 4                         | 3,600                                                                                                                                                                                                                                           | 150             | 60       | 3,200                       | 120             | 50       | 2,400                         | 90              | 40       |
| 5                         | 2,900                                                                                                                                                                                                                                           | 170             | 70       | 2,500                       | 140             | 55       | 1,900                         | 110             | 45       |
| 6                         | 2,400                                                                                                                                                                                                                                           | 170             | 70       | 2,100                       | 140             | 55       | 1,600                         | 110             | 45       |
| 8                         | 1,800                                                                                                                                                                                                                                           | 170             | 70       | 1,600                       | 140             | 55       | 1,200                         | 110             | 45       |
| 10                        | 1,400                                                                                                                                                                                                                                           | 170             | 70       | 1,300                       | 140             | 55       | 1,000                         | 110             | 45       |
| 12                        | 1,200                                                                                                                                                                                                                                           | 170             | 70       | 1,100                       | 140             | 55       | 800                           | 110             | 45       |
| Depth of Cut<br>(D: Dia.) | <div>Side Milling</div> <div>Slotting</div> <div><math>a_p</math><br/><math>\phi 1 \sim 2.5 = 0.5D</math><br/><math>\phi 3 \sim 12 = 1D</math></div>                                                                                            |                 |          |                             |                 |          |                               |                 |          |
| Notes                     | ※ 1 Adjust feed according to inclined angle.<br>※ 2 When corner machining, reduce the feed by approximately 30%~50%.<br>※ 3 Adjust spindle speed and feed at the same rate also reduce Depth of Cut, if the machine spindle speed insufficient. |                 |          |                             |                 |          |                               |                 |          |

2-Flute Inner Radius Cutter

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
| ○             | ○                           | ○                  | ~ 55HRC         | 55HRC ~ | ○                |                | ◎               | ◎      | ◎     |

Unit : mm

| Code No.         | Radius (R) | Dia. (D) | Outer Dia. (d1) | Outer Dia. Length (l1) | Neck Taper Angle (γ) | Type | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|----------|-----------------|------------------------|----------------------|------|----------------|--------------------|
| ■ 01-00912-00500 | R0.5       | 1.5      | 2.7             | 4                      | 9°                   | A    | 4              | 45                 |
| ■ 01-00912-00750 | R0.75      | 1.5      | 3.2             | 4                      | 9°                   |      | 4              | 45                 |
| ■ 01-00912-01000 | R1         | 1.5      | 3.7             | 4                      | 9°                   |      | 4              | 45                 |
| ■ 01-00912-01250 | R1.25      | 1.5      | 4.2             | 4                      | —                    | B    | 4              | 45                 |
| ■ 01-00912-01500 | R1.5       | 1.5      | 4.7             | 4                      | 9°                   | A    | 6              | 45                 |
| ■ 01-00912-01750 | R1.75      | 1.5      | 5.2             | 4                      | 9°                   |      | 6              | 45                 |
| ■ 01-00912-02000 | R2         | 1.5      | 5.7             | 4                      | 9°                   |      | 6              | 45                 |
| ■ 01-00912-02250 | R2.25      | 1.5      | 6.2             | 6                      | —                    | B    | 6              | 50                 |
| ■ 01-00912-02500 | R2.5       | 1.5      | 6.7             | 6                      | —                    |      | 6              | 50                 |
| ■ 01-00912-02750 | R2.75      | 1.5      | 7.2             | 6                      | 9°                   | A    | 8              | 70                 |
| ■ 01-00912-03000 | R3         | 1.5      | 7.7             | 6                      | 9°                   |      | 8              | 50                 |
| ■ 01-00912-03250 | R3.25      | 3        | 9.7             | 12                     | 9°                   | B    | 10             | 75                 |
| ■ 01-00912-03500 | R3.5       | 3        | 10.2            | 11.5                   | —                    |      | 10             | 75                 |
| ■ 01-00912-03750 | R3.75      | 3        | 10.7            | 15                     | —                    |      | 10             | 75                 |
| ■ 01-00912-04000 | R4         | 3        | 11.2            | 14.5                   | —                    |      | 10             | 75                 |
| ■ 01-00912-04250 | R4.25      | 3        | 11.7            | 14.5                   | —                    |      | 10             | 80                 |
| ■ 01-00912-04500 | R4.5       | 3.5      | 12.7            | 14.5                   | —                    |      | 12             | 80                 |
| ■ 01-00912-04750 | R4.75      | 3.5      | 13.2            | 14.5                   | —                    |      | 12             | 80                 |
| ■ 01-00912-05000 | R5         | 3.5      | 13.7            | 14.5                   | —                    |      | 12             | 80                 |

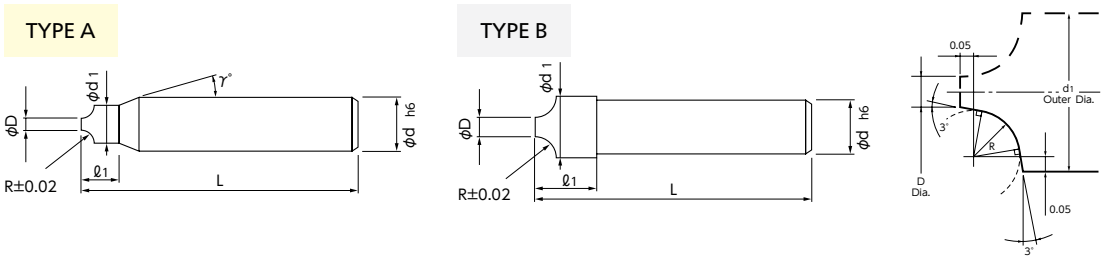
How to Order

When you order, indicate NCR-2 (R). ※(γ) is reference value.

| Work Material                | Carbon Steels<br>S50C                                                    |          |           | Alloy Steels<br>SCM・SKD・SUS |          |           | Prehardened Steels<br>HPM・NAK |          |           |
|------------------------------|--------------------------------------------------------------------------|----------|-----------|-----------------------------|----------|-----------|-------------------------------|----------|-----------|
| Cutting Speed                | 25~35m/min                                                               |          |           | 20~30m/min                  |          |           | 15~25m/min                    |          |           |
| R                            | Spindle Speed                                                            | Feed     |           | Spindle Speed               | Feed     |           | Spindle Speed                 | Feed     |           |
|                              | min <sup>-1</sup>                                                        | mm/min   |           | min <sup>-1</sup>           | mm/min   |           | min <sup>-1</sup>             | mm/min   |           |
|                              |                                                                          | Roughing | Finishing |                             | Roughing | Finishing |                               | Roughing | Finishing |
| 0.5                          | 4,800                                                                    | 55       | 80        | 4,000                       | 40       | 60        | 3,200                         | 30       | 45        |
| 0.75                         | 4,250                                                                    | 55       | 80        | 3,500                       | 40       | 60        | 2,800                         | 30       | 45        |
| 1                            | 3,800                                                                    | 55       | 80        | 3,200                       | 40       | 60        | 2,550                         | 30       | 45        |
| 1.25                         | 3,500                                                                    | 55       | 80        | 2,900                       | 40       | 60        | 2,300                         | 30       | 45        |
| 1.5                          | 3,200                                                                    | 55       | 80        | 2,650                       | 40       | 60        | 2,100                         | 30       | 45        |
| 1.75                         | 2,950                                                                    | 55       | 80        | 2,450                       | 40       | 60        | 1,950                         | 30       | 45        |
| 2                            | 2,700                                                                    | 55       | 80        | 2,300                       | 40       | 60        | 1,800                         | 30       | 45        |
| 2.5                          | 2,400                                                                    | 55       | 80        | 2,000                       | 40       | 60        | 1,600                         | 30       | 45        |
| 3                            | 2,100                                                                    | 55       | 80        | 1,750                       | 40       | 60        | 1,400                         | 30       | 45        |
| Depth of Cut<br>(R : Radius) | <div><div>Roughing</div><div>Finishing</div></div>                       |          |           |                             |          |           |                               |          |           |
| Notes                        | ※1 Use cutting fluid.<br>※2 Divide the cutting depth into several paths. |          |           |                             |          |           |                               |          |           |

2-Flute Inner Radius Cutter for Nonferrous

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.  
● ▲ : The sizes will no longer be on sale after the stock runs out.

| Work Material |                             |                    |                 |         |                  |                |                 |        |       |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

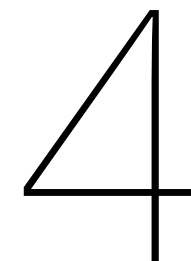
▲ Discontinued Products Unit : mm

| Code No.           | Radius (R) | Dia. (D) | Outer Dia. (d1) | Outer Dia. Length (L1) | Neck Taper Angle (γ) | Type | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|----------|-----------------|------------------------|----------------------|------|----------------|--------------------|
| ■ 07-00913-00100   | R0.1       | 0.5      | 0.8             | 3                      | 12°                  | A    | 4              | 45                 |
| ■ 07-00913-00150   | R0.15      | 0.5      | 0.9             | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00200   | R0.2       | 0.5      | 1               | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00250   | R0.25      | 0.5      | 1.1             | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00300   | R0.3       | 0.5      | 1.2             | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00350   | R0.35      | 0.5      | 1.3             | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00400   | R0.4       | 0.5      | 1.4             | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00450   | R0.45      | 0.5      | 1.5             | 3                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00500   | R0.5       | 0.5      | 1.6             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00550   | R0.55      | 0.5      | 1.7             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00600   | R0.6       | 0.5      | 1.8             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00650   | R0.65      | 0.5      | 1.9             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00700   | R0.7       | 0.5      | 2               | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00750   | R0.75      | 0.5      | 2.1             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00800   | R0.8       | 0.8      | 2.5             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00850   | R0.85      | 0.8      | 2.6             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00900   | R0.9       | 0.8      | 2.7             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-00950   | R0.95      | 0.8      | 2.8             | 5                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-01000   | R1         | 0.8      | 2.9             | 8                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-01250   | R1.25      | 0.8      | 3.4             | 8                      | 12°                  |      | 4              | 45                 |
| ■ 07-00913-01500   | R1.5       | 1.5      | 4.6             | 8                      | —                    | B    | 4              | 45                 |
| ■ 07-00913-01750   | R1.75      | 1.5      | 5.1             | 8                      | —                    |      | 4              | 45                 |
| ■ 07-00913-02000   | R2         | 1.5      | 5.6             | 10                     | —                    |      | 4              | 45                 |
| ■ 07-00913-02500   | R2.5       | 1.5      | 6.6             | 10                     | —                    | A    | 6              | 45                 |
| ■ 07-00913-03000   | R3         | 1.5      | 7.6             | 12                     | 45°                  |      | 8              | 55                 |
| ▲ ■ 07-00913-03500 | R3.5       | 2        | 9.1             | 12                     | 45°                  |      | 10             | 55                 |
| ▲ ■ 07-00913-04000 | R4         | 2        | 10.1            | 12                     | —                    | B    | 10             | 55                 |
| ▲ ■ 07-00913-04500 | R4.5       | 2        | 11.1            | 15                     | 45°                  | A    | 12             | 65                 |
| ▲ ■ 07-00913-05000 | R5         | 2        | 12.1            | 15                     | —                    | B    | 12             | 65                 |

How to Order When you order, indicate DIR (R). ※ (γ) is reference value.

| Work Material               | Copper                                                                                                                                                                                                                                          |                |           | Aluminium Alloy                    |                |           |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------|------------------------------------|----------------|-----------|
| Cutting Speed               | 80m/min                                                                                                                                                                                                                                         |                |           | 80~150m/min                        |                |           |
| R                           | Spindle Speed<br>min <sup>-1</sup>                                                                                                                                                                                                              | Feed<br>mm/min |           | Spindle Speed<br>min <sup>-1</sup> | Feed<br>mm/min |           |
|                             |                                                                                                                                                                                                                                                 | Roughing       | Finishing |                                    | Roughing       | Finishing |
|                             |                                                                                                                                                                                                                                                 |                |           |                                    |                |           |
| 0.1                         | 32,000                                                                                                                                                                                                                                          | 300            | 450       | 50,000                             | 470            | 860       |
| 0.2                         | 26,000                                                                                                                                                                                                                                          | 300            | 450       | 50,000                             | 470            | 860       |
| 0.3                         | 21,000                                                                                                                                                                                                                                          | 300            | 450       | 42,000                             | 600            | 900       |
| 0.4                         | 18,000                                                                                                                                                                                                                                          | 200            | 300       | 36,000                             | 400            | 600       |
| 0.5                         | 16,000                                                                                                                                                                                                                                          | 200            | 300       | 32,000                             | 400            | 600       |
| 0.6                         | 14,000                                                                                                                                                                                                                                          | 200            | 300       | 28,000                             | 400            | 600       |
| 0.7                         | 13,000                                                                                                                                                                                                                                          | 200            | 300       | 26,000                             | 400            | 600       |
| 0.8                         | 10,000                                                                                                                                                                                                                                          | 200            | 300       | 20,000                             | 400            | 600       |
| 0.9                         | 9,500                                                                                                                                                                                                                                           | 200            | 300       | 19,000                             | 400            | 600       |
| 1                           | 8,800                                                                                                                                                                                                                                           | 200            | 300       | 17,600                             | 400            | 600       |
| 1.25                        | 7,500                                                                                                                                                                                                                                           | 200            | 300       | 15,000                             | 400            | 600       |
| 1.5                         | 5,600                                                                                                                                                                                                                                           | 150            | 250       | 11,200                             | 300            | 500       |
| 1.75                        | 5,000                                                                                                                                                                                                                                           | 150            | 250       | 10,000                             | 300            | 500       |
| 2                           | 4,600                                                                                                                                                                                                                                           | 150            | 250       | 9,200                              | 300            | 500       |
| 2.5                         | 3,900                                                                                                                                                                                                                                           | 150            | 250       | 7,800                              | 300            | 500       |
| 3                           | 3,400                                                                                                                                                                                                                                           | 150            | 250       | 6,800                              | 300            | 500       |
| 3.5                         | 2,800                                                                                                                                                                                                                                           | 120            | 200       | 5,600                              | 240            | 400       |
| 4                           | 2,500                                                                                                                                                                                                                                           | 120            | 200       | 5,000                              | 240            | 400       |
| 4.5                         | 2,300                                                                                                                                                                                                                                           | 120            | 200       | 4,600                              | 240            | 400       |
| 5                           | 2,100                                                                                                                                                                                                                                           | 120            | 200       | 4,200                              | 240            | 400       |
| Depth of Cut<br>(R: Radius) | <div><div>Roughing</div><div>Finishing</div><div><math>R+0.05\text{mm}</math></div><div><math>a</math></div><div><math>a</math></div><div><math>R 0.1\sim 0.4=0.02\text{mm}</math></div><div><math>R 0.5\sim 5=0.05\text{mm}</math></div></div> |                |           |                                    |                |           |
| Notes                       | ※ 1 Use cutting fluid.<br>※ 2 Adjust both spindle speed and feed at the same rate.<br>※ 3 Don't use for cutting steels.                                                                                                                         |                |           |                                    |                |           |





NS TOOL

## Original Products

Specified distributor inventory (Semi-standard products)

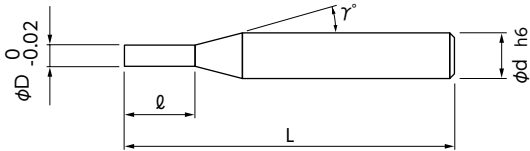
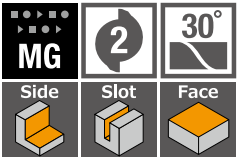
PAGE

## Original Products

Specified distributor inventory (Semi-standard products)

U-002

| Model                                                                                       | Size                                                                                                               | Maximum Cutting Depth | Length of Cut | Material / Coating | Number of Flute | Helix Angle                                           | Work Material |             |                   |                 |                 |        |       |                       | Number of Sizes | Page  |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|--------------------|-----------------|-------------------------------------------------------|---------------|-------------|-------------------|-----------------|-----------------|--------|-------|-----------------------|-----------------|-------|
|                                                                                             |                                                                                                                    |                       |               |                    |                 |                                                       | P             | P           | P                 | M               | N               | N      | N     | N                     |                 |       |
|                                                                                             |                                                                                                                    |                       |               |                    |                 |                                                       | Carbon Steel  | Alloy Steel | Prehardened Steel | Stainless Steel | Aluminium Alloy | Copper | Resin | Hard Brittle Material |                 |       |
| Square                                                                                      |                                                                                                                    |                       |               |                    |                 |                                                       |               |             |                   |                 |                 |        |       |                       |                 |       |
|  NX-30X    | $\phi 1 \sim \phi 12$                                                                                              | 2D                    | 2~24          | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 11              | U-004 |
|  DHS       | $\phi 6 \sim \phi 20$                                                                                              | 2.5D                  | 15~50         | SMG                | 3               | 40°                                                   | -             | -           | -                 | -               | ○               | ○      | ○     | -                     | 6               | U-006 |
| Long Neck Square                                                                            |                                                                                                                    |                       |               |                    |                 |                                                       |               |             |                   |                 |                 |        |       |                       |                 |       |
|  CED100    | $\phi 0.1 \sim \phi 2$                                                                                             | 2D                    | 0.05~1        | SCD                | 1               | 0°                                                    | -             | -           | -                 | -               | ○               | ○      | -     | ◎                     | 9               | U-008 |
|  NHR-2X    | $\phi 0.5 \sim \phi 5$                                                                                             | 13D                   | 0.7~7.5       | X                  | 2               | 30°<br>( $\phi < 2.5$ )<br>45°<br>( $\phi \geq 2.5$ ) | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 87              | U-010 |
| Tapered Square                                                                              |                                                                                                                    |                       |               |                    |                 |                                                       |               |             |                   |                 |                 |        |       |                       |                 |       |
|  NTE-2X   | $\phi 0.5 \times \text{taper angle} 30^\circ$<br>~ $\phi 2.5 \times \text{taper angle} 5^\circ$                    | 4D                    | 2~8           | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 49              | U-014 |
|  NTE-4X  | $\phi 3 \times \text{taper angle} 30^\circ$<br>~ $\phi 10 \times \text{taper angle} 5^\circ$                       | 4D                    | 10~35         | X                  | 4               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 36              | U-016 |
|  NTEM-2X | $\phi 0.5 \times \text{taper angle} 30^\circ$<br>~ $\phi 6 \times \text{taper angle} 15^\circ$                     | 8D                    | 4~30          | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 94              | U-018 |
|  NRF-4   | $\phi 0.5 \times \text{taper angle} 30^\circ$<br>~ $\phi 2 \times \text{taper angle} 3^\circ$                      | 22D                   | 2~36          | MG                 | 4               | -11°                                                  | ○             | ○           | ○                 | -               | -               | -      | -     | -                     | 120             | U-020 |
| Ball                                                                                        |                                                                                                                    |                       |               |                    |                 |                                                       |               |             |                   |                 |                 |        |       |                       |                 |       |
|  NCB-2X  | R0.2 ~ R0.9                                                                                                        | 2D                    | 0.8~3.6       | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 12              | U-024 |
|  NSB-2X  | R1 ~ R10                                                                                                           | 2D                    | 3~25          | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 79              | U-026 |
| Tapered Corner Radius                                                                       |                                                                                                                    |                       |               |                    |                 |                                                       |               |             |                   |                 |                 |        |       |                       |                 |       |
|  NTER-2X | $\phi 1 \times \text{taper angle} 30^\circ \times R0.2$<br>~ $\phi 6 \times \text{taper angle} 10^\circ \times R2$ | 4D                    | 4~20          | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 270             | U-030 |
|  NERR-2X | $\phi 2 \times \text{taper angle} 7^\circ \times R0.3$<br>~ $\phi 6 \times \text{taper angle} 15^\circ \times R2$  | 2.5D                  | 5~12          | X                  | 2               | 30°                                                   | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 100             | U-034 |
| Chamfering                                                                                  |                                                                                                                    |                       |               |                    |                 |                                                       |               |             |                   |                 |                 |        |       |                       |                 |       |
|  NCR-2X  | R0.5 ~ R3                                                                                                          | -                     | -             | X                  | 2               | -                                                     | ○             | ○           | ○                 | ○               | ○               | ○      | ○     | -                     | 9               | U-036 |



- ■ : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels・Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|--------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                          |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                        | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

- Specified distributor inventory
- ▲ Discontinued Products

Unit : mm

| Code No.           | Dia. (D) | Length of Cut (ℓ) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|----------|-------------------|----------------------|----------------|--------------------|
| ▲ ■ 01-00031-00100 | 1        | 2                 | 9°                   | 4              | 40                 |
| ▲ ■ 01-00031-00150 | 1.5      | 3                 | 9°                   | 4              | 40                 |
| ▲ ■ 01-00031-00200 | 2        | 4                 | 9°                   | 4              | 40                 |
| ▲ ■ 01-00031-00250 | 2.5      | 5                 | 9°                   | 4              | 40                 |
| ▲ ■ 01-00031-00300 | 3        | 6                 | 9°                   | 6              | 45                 |
| ▲ ■ 01-00031-00400 | 4        | 8                 | 9°                   | 6              | 45                 |
| ▲ ■ 01-00031-00500 | 5        | 10                | 9°                   | 6              | 50                 |
| ▲ ■ 01-00031-00600 | 6        | 12                | —                    | 6              | 50                 |
| ▲ ■ 01-00031-00800 | 8        | 16                | —                    | 8              | 60                 |
| ▲ ■ 01-00031-01000 | 10       | 20                | —                    | 10             | 70                 |
| ▲ ■ 01-00031-01200 | 12       | 24                | —                    | 12             | 75                 |

How to Order

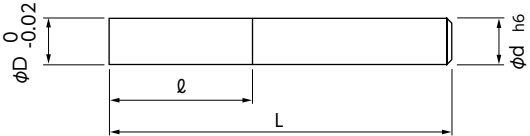
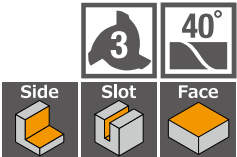
When you order, indicate NX-30X (D). ※(γ) is reference value.

| Work Material | Carbon Steels S50C                                                                                                                     |              |          | Alloy Steels SCM・SKD・SUS |              |          | Prehardened Steels HPM・NAK |              |          | Aluminium Alloy   |              |          | Copper            |              |          |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|--------------------------|--------------|----------|----------------------------|--------------|----------|-------------------|--------------|----------|-------------------|--------------|----------|
| Cutting Speed | 40~50m/min                                                                                                                             |              |          | 35~45m/min               |              |          | 25~35m/min                 |              |          | 60~100m/min       |              |          | 40~80m/min        |              |          |
| Dia.          | Spindle Speed                                                                                                                          | Feed         |          | Spindle Speed            | Feed         |          | Spindle Speed              | Feed         |          | Spindle Speed     | Feed         |          | Spindle Speed     | Feed         |          |
|               | min <sup>-1</sup>                                                                                                                      | mm/min       |          | min <sup>-1</sup>        | mm/min       |          | min <sup>-1</sup>          | mm/min       |          | min <sup>-1</sup> | mm/min       |          | min <sup>-1</sup> | mm/min       |          |
|               |                                                                                                                                        | Side Milling | Slotting |                          | Side Milling | Slotting |                            | Side Milling | Slotting |                   | Side Milling | Slotting |                   | Side Milling | Slotting |
| 1             | 14,300                                                                                                                                 | 150          | 60       | 12,700                   | 100          | 50       | 9,600                      | 90           | 45       | 25,500            | 300          | 120      | 19,100            | 220          | 100      |
| 1.5           | 9,600                                                                                                                                  | 150          | 60       | 8,500                    | 100          | 50       | 6,400                      | 90           | 45       | 17,000            | 300          | 120      | 12,700            | 220          | 100      |
| 2             | 7,200                                                                                                                                  | 150          | 60       | 6,400                    | 100          | 50       | 4,800                      | 90           | 45       | 12,700            | 300          | 120      | 9,600             | 220          | 100      |
| 2.5           | 5,700                                                                                                                                  | 150          | 60       | 5,100                    | 100          | 50       | 3,800                      | 90           | 45       | 10,200            | 300          | 120      | 7,600             | 220          | 100      |
| 3             | 4,800                                                                                                                                  | 180          | 70       | 4,200                    | 130          | 55       | 3,200                      | 100          | 50       | 8,500             | 350          | 150      | 6,400             | 250          | 110      |
| 4             | 3,600                                                                                                                                  | 180          | 70       | 3,200                    | 130          | 55       | 2,400                      | 100          | 50       | 6,400             | 350          | 150      | 4,800             | 250          | 110      |
| 5             | 2,900                                                                                                                                  | 200          | 80       | 2,500                    | 150          | 60       | 1,900                      | 120          | 55       | 5,100             | 400          | 180      | 3,800             | 300          | 130      |
| 6             | 2,400                                                                                                                                  | 200          | 80       | 2,100                    | 150          | 60       | 1,600                      | 120          | 55       | 4,200             | 400          | 180      | 3,200             | 300          | 130      |
| 8             | 1,800                                                                                                                                  | 200          | 80       | 1,600                    | 150          | 60       | 1,200                      | 120          | 55       | 3,200             | 400          | 180      | 2,400             | 300          | 130      |
| 10            | 1,400                                                                                                                                  | 200          | 80       | 1,300                    | 150          | 60       | 1,000                      | 120          | 55       | 2,500             | 400          | 180      | 1,900             | 300          | 130      |
| 12            | 1,200                                                                                                                                  | 200          | 80       | 1,100                    | 150          | 60       | 800                        | 120          | 55       | 2,100             | 400          | 180      | 1,600             | 300          | 130      |
| Depth of Cut  | <div>Side Milling</div> <div>Slotting</div> <div><math>a_p</math><br/><math>\phi</math> 1~2.5=0.5D<br/><math>\phi</math> 3~12=1D</div> |              |          |                          |              |          |                            |              |          |                   |              |          |                   |              |          |
| (D: Dia.)     |                                                                                                                                        |              |          |                          |              |          |                            |              |          |                   |              |          |                   |              |          |
| Notes         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.                                                       |              |          |                          |              |          |                            |              |          |                   |              |          |                   |              |          |



3-Flute Semi-finishing End Mill for Nonferrous

Recommended Milling Conditions



- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
|               |                             |                    |                 |         |                  |                | ◎               | ◎      | ◎     |

■ Specified distributor inventory

▲ Discontinued Products

Unit : mm

| Code No.           | Dia.<br>(D) | Length of Cut<br>( $\ell$ ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|-----------------------------|-------------------|-----------------------|
| ▲ ■ 07-00333-00600 | 6           | 15                          | 6                 | 70                    |
| ▲ ■ 07-00333-00800 | 8           | 20                          | 8                 | 80                    |
| ▲ ■ 07-00333-01000 | 10          | 25                          | 10                | 90                    |
| ▲ ■ 07-00333-01200 | 12          | 30                          | 12                | 90                    |
| ▲ ■ 07-00333-01600 | 16          | 40                          | 16                | 100                   |
| ▲ ■ 07-00333-02000 | 20          | 50                          | 20                | 120                   |

How to Order

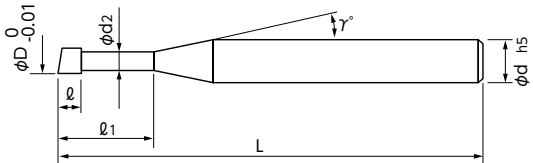
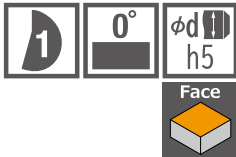
When you order, indicate DHS (D).

※ (  $\gamma$  ) is reference value.

| Work Material                  | Copper                                                                                                               |        | Aluminium Alloy   |        |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|--------|
| Cutting Speed                  | 80m/min                                                                                                              |        | 80~150m/min       |        |
| Dia.                           | Spindle Speed                                                                                                        | Feed   | Spindle Speed     | Feed   |
|                                | min <sup>-1</sup>                                                                                                    | mm/min | min <sup>-1</sup> | mm/min |
| 6                              | 4,200                                                                                                                | 320    | 8,000             | 1,200  |
| 8                              | 3,200                                                                                                                | 320    | 6,000             | 1,200  |
| 10                             | 2,600                                                                                                                | 320    | 4,800             | 1,200  |
| 12                             | 2,100                                                                                                                | 320    | 4,000             | 1,200  |
| 16                             | 1,600                                                                                                                | 320    | 3,000             | 1,200  |
| 20                             | 1,300                                                                                                                | 320    | 2,400             | 1,200  |
| Depth of Cut<br><br>(D : Dia.) | <div>Side Milling</div> <div>Slotting</div>                                                                          |        |                   |        |
| Notes                          | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 Don't use for cutting steels. |        |                   |        |



Monocrystalline Diamond End Mill “CLEAR EDGE”



- Direct machining to cemented carbide.
- Enable high-accurate machining to brittle materials.
- Unique design to maximize performance of monocrystalline diamond.

Work Material

| Cemented Carbide | Ceramics | Quartz glass | Monocrystal silicon | Aluminium Alloy | Copper |
|------------------|----------|--------------|---------------------|-----------------|--------|
| ○                | ○        | ○            | ○                   | ○               | ○      |

▲ Discontinued Products

Unit : mm

| Code No.         | Dia. (D) | Under Neck Length (ℓ1) | Length of Cut (ℓ) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| ▲ 04-00100-00100 | 0.1      | 0.2                    | 0.05              | 0.09           | 15°                  | 4              | 40                 |
| ▲ 04-00100-00200 | 0.2      | 0.4                    | 0.1               | 0.18           | 15°                  | 4              | 40                 |
| ▲ 04-00100-00300 | 0.3      | 0.6                    | 0.15              | 0.27           | 15°                  | 4              | 40                 |
| ▲ 04-00100-00400 | 0.4      | 0.8                    | 0.2               | 0.36           | 15°                  | 4              | 40                 |
| ▲ 04-00100-00500 | 0.5      | 1                      | 0.25              | 0.46           | 15°                  | 4              | 40                 |
| ▲ 04-00100-01000 | 1        | 2                      | 0.5               | 0.9            | 15°                  | 4              | 40                 |
| ▲ 04-00100-01200 | 1.2      | 2.4                    | 0.6               | 1.08           | 15°                  | 4              | 40                 |
| ▲ 04-00100-01500 | 1.5      | 3                      | 0.75              | 1.42           | 15°                  | 4              | 40                 |
| ▲ 04-00100-02000 | 2        | 4                      | 1                 | 1.9            | 15°                  | 4              | 40                 |

How to Order

When you order, indicate CED100 (D).

※(γ) is reference value.

Machining Case 1

Work Material: Cemented Carbide (95HRA) Tool size :  $\phi$  0.1

Work size :  $\phi$  10mm Cutting depth : 0.03mm



Surface roughness (Rz) : 1μm

|                |                         |
|----------------|-------------------------|
| Spindle speed  | 12,000min <sup>-1</sup> |
| Feed           | 6mm/min                 |
| Depth of cut   | 0.002mm×0.03mm (ap×ae)  |
| Cutting length | 2.7m                    |
| Machining time | 7hr 30min               |
| Coolant        | Oil mist                |

Machining Case 2

Work Material: Quartz glass Tool size :  $\phi$  0.3

Work size : 75×25×1mm Cutting depth : 0.05mm



Surface roughness (Rz) : 2μm

|                |                         |
|----------------|-------------------------|
| Spindle speed  | 40,000min <sup>-1</sup> |
| Feed           | 15mm/min                |
| Depth of cut   | 0.001mm ap              |
| Cutting length | 3.2m                    |
| Machining time | 4hr                     |
| Coolant        | Oil mist                |

Machining Case 3

Work Material: Mono crystalline silicon Tool size :  $\phi$  0.5

Work size : 45×20×0.7mm



Surface roughness (Rz) : 1.4μm

|                |                          |
|----------------|--------------------------|
| Spindle speed  | 20,000min <sup>-1</sup>  |
| Feed           | 100mm/min                |
| Depth of cut   | 0.0025mm×0.125mm (ap×ae) |
| Cutting length | 21.2m                    |
| Machining time | 3hr 30min                |
| Coolant        | Oil mist                 |

Measuring instrument : KEYENCE: VK9500

- Electro-conductive tool presetter can not be used due to characteristic of the diamond.
- Machining by use of outer flute is not recommended.
- CLEAR EDGE is under lisence production.

Machining Case 4

Work Material: No-electrolytic NiS-plated layer Tool size :  $\phi$  0.1

Work size : 30×10mm



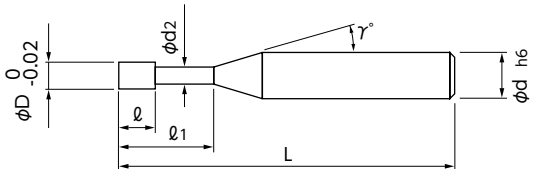
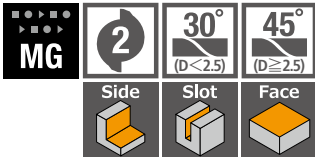
Bottom Surface roughness (Rz) : 1μm

|                |                         |
|----------------|-------------------------|
| Spindle speed  | 12,000min <sup>-1</sup> |
| Feed           | 200mm/min               |
| Depth of cut   | 0.003mm×0.1mm (ap×ae)   |
| Cutting length | 5.5m                    |
| Machining time | 5hr                     |
| Coolant        | Oil mist                |



X COATING 2-Flute Long Neck End Mill

X COATING 2-Flute Long Neck End Mill



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.       | Dia. (D) | Under Neck Length (L1) | Length of Cut (L) | Neck Dia. (d2) | Neck Taper Angle (r) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| 01-00413-00502 | 0.5      | 2                      | 0.7               | 0.46           | 12°                  | 3              | 35                 |
| 01-00413-00504 |          | 4                      | 0.7               | 0.46           | 12°                  | 3              | 35                 |
| 01-00413-00506 |          | 6                      | 0.7               | 0.46           | 12°                  | 3              | 35                 |
| 01-00413-00602 | 0.6      | 2                      | 0.9               | 0.56           | 12°                  | 3              | 35                 |
| 01-00413-00604 |          | 4                      | 0.9               | 0.56           | 12°                  | 3              | 35                 |
| 01-00413-00606 |          | 6                      | 0.9               | 0.56           | 12°                  | 3              | 35                 |
| 01-00413-00702 | 0.7      | 2                      | 1                 | 0.66           | 12°                  | 4              | 45                 |
| 01-00413-00704 |          | 4                      | 1                 | 0.66           | 12°                  | 4              | 45                 |
| 01-00413-00706 |          | 6                      | 1                 | 0.66           | 12°                  | 4              | 45                 |
| 01-00413-00804 | 0.8      | 4                      | 1.2               | 0.76           | 12°                  | 4              | 45                 |
| 01-00413-00806 |          | 6                      | 1.2               | 0.76           | 12°                  | 4              | 45                 |
| 01-00413-00808 |          | 8                      | 1.2               | 0.76           | 12°                  | 4              | 45                 |
| 01-00413-00906 | 0.9      | 6                      | 1.35              | 0.86           | 12°                  | 4              | 45                 |
| 01-00413-00908 |          | 8                      | 1.35              | 0.86           | 12°                  | 4              | 45                 |
| 01-00413-00910 |          | 10                     | 1.35              | 0.86           | 12°                  | 4              | 45                 |
| 01-00413-01006 | 1        | 6                      | 1.5               | 0.95           | 12°                  | 4              | 45                 |
| 01-00413-01008 |          | 8                      | 1.5               | 0.95           | 12°                  | 4              | 45                 |
| 01-00413-01010 |          | 10                     | 1.5               | 0.95           | 12°                  | 4              | 45                 |
| 01-00413-01012 | 1.2      | 12                     | 1.5               | 0.95           | 12°                  | 4              | 45                 |
| 01-00413-01206 |          | 6                      | 1.8               | 1.15           | 12°                  | 4              | 45                 |
| 01-00413-01208 |          | 8                      | 1.8               | 1.15           | 12°                  | 4              | 45                 |
| 01-00413-01210 | 1.4      | 10                     | 1.8               | 1.15           | 12°                  | 4              | 45                 |
| 01-00413-01212 |          | 12                     | 1.8               | 1.15           | 12°                  | 4              | 45                 |
| 01-00413-01406 |          | 6                      | 2.1               | 1.35           | 12°                  | 4              | 45                 |
| 01-00413-01408 | 1.5      | 8                      | 2.1               | 1.35           | 12°                  | 4              | 45                 |
| 01-00413-01410 |          | 10                     | 2.1               | 1.35           | 12°                  | 4              | 45                 |
| 01-00413-01412 |          | 12                     | 2.1               | 1.35           | 12°                  | 4              | 45                 |
| 01-00413-01414 | 1.5      | 14                     | 2.1               | 1.35           | 12°                  | 4              | 50                 |
| 01-00413-01416 |          | 16                     | 2.1               | 1.35           | 12°                  | 4              | 50                 |
| 01-00413-01506 |          | 6                      | 2.3               | 1.45           | 12°                  | 4              | 45                 |
| 01-00413-01508 | 1.5      | 8                      | 2.3               | 1.45           | 12°                  | 4              | 45                 |
| 01-00413-01510 |          | 10                     | 2.3               | 1.45           | 12°                  | 4              | 45                 |
| 01-00413-01512 |          | 12                     | 2.3               | 1.45           | 12°                  | 4              | 45                 |
| 01-00413-01514 | 1.5      | 14                     | 2.3               | 1.45           | 12°                  | 4              | 50                 |
| 01-00413-01516 |          | 16                     | 2.3               | 1.45           | 12°                  | 4              | 50                 |
| 01-00413-01518 |          | 18                     | 2.3               | 1.45           | 12°                  | 4              | 55                 |
| 01-00413-01520 | 1.5      | 20                     | 2.3               | 1.45           | 12°                  | 4              | 55                 |

How to Order

When you order, indicate NHR-2X (D) × (L1). ※(r) is reference value.

Unit : mm

| Code No.       | Dia. (D) | Under Neck Length (L1) | Length of Cut (L) | Neck Dia. (d2) | Neck Taper Angle (r) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|------------------------|-------------------|----------------|----------------------|----------------|--------------------|
| 01-00413-01606 | 1.6      | 6                      | 2.4               | 1.55           | 12°                  | 4              | 45                 |
| 01-00413-01608 |          | 8                      | 2.4               | 1.55           | 12°                  | 4              | 45                 |
| 01-00413-01610 |          | 10                     | 2.4               | 1.55           | 12°                  | 4              | 45                 |
| 01-00413-01612 |          | 12                     | 2.4               | 1.55           | 12°                  | 4              | 45                 |
| 01-00413-01614 |          | 14                     | 2.4               | 1.55           | 12°                  | 4              | 50                 |
| 01-00413-01616 |          | 16                     | 2.4               | 1.55           | 12°                  | 4              | 50                 |
| 01-00413-01618 |          | 18                     | 2.4               | 1.55           | 12°                  | 4              | 55                 |
| 01-00413-01620 |          | 20                     | 2.4               | 1.55           | 12°                  | 4              | 55                 |
| 01-00413-01806 | 1.8      | 6                      | 2.7               | 1.75           | 12°                  | 4              | 45                 |
| 01-00413-01808 |          | 8                      | 2.7               | 1.75           | 12°                  | 4              | 45                 |
| 01-00413-01810 |          | 10                     | 2.7               | 1.75           | 12°                  | 4              | 45                 |
| 01-00413-01812 |          | 12                     | 2.7               | 1.75           | 12°                  | 4              | 45                 |
| 01-00413-01814 |          | 14                     | 2.7               | 1.75           | 12°                  | 4              | 50                 |
| 01-00413-01816 |          | 16                     | 2.7               | 1.75           | 12°                  | 4              | 50                 |
| 01-00413-01818 |          | 18                     | 2.7               | 1.75           | 12°                  | 4              | 55                 |
| 01-00413-01820 |          | 20                     | 2.7               | 1.75           | 12°                  | 4              | 55                 |
| 01-00413-02006 | 2        | 6                      | 3                 | 1.94           | 12°                  | 4              | 45                 |
| 01-00413-02008 |          | 8                      | 3                 | 1.94           | 12°                  | 4              | 45                 |
| 01-00413-02010 |          | 10                     | 3                 | 1.94           | 12°                  | 4              | 45                 |
| 01-00413-02012 |          | 12                     | 3                 | 1.94           | 12°                  | 4              | 45                 |
| 01-00413-02014 |          | 14                     | 3                 | 1.94           | 12°                  | 4              | 50                 |
| 01-00413-02016 |          | 16                     | 3                 | 1.94           | 12°                  | 4              | 50                 |
| 01-00413-02018 |          | 18                     | 3                 | 1.94           | 12°                  | 4              | 55                 |
| 01-00413-02020 |          | 20                     | 3                 | 1.94           | 12°                  | 4              | 55                 |
| 01-00413-02508 | 2.5      | 8                      | 3.7               | 2.4            | 12°                  | 4              | 45                 |
| 01-00413-02512 |          | 12                     | 3.7               | 2.4            | 12°                  | 4              | 45                 |
| 01-00413-02516 |          | 16                     | 3.7               | 2.4            | 12°                  | 4              | 55                 |
| 01-00413-02520 |          | 20                     | 3.7               | 2.4            | 12°                  | 4              | 60                 |
| 01-00413-03008 | 3        | 8                      | 4.5               | 2.85           | 12°                  | 6              | 45                 |
| 01-00413-03012 |          | 12                     | 4.5               | 2.85           | 12°                  | 6              | 45                 |
| 01-00413-03016 |          | 16                     | 4.5               | 2.85           | 12°                  | 6              | 55                 |
| 01-00413-03020 |          | 20                     | 4.5               | 2.85           | 12°                  | 6              | 60                 |
| 01-00413-03025 | 3.5      | 25                     | 4.5               | 2.85           | 12°                  | 6              | 65                 |
| 01-00413-03512 |          | 12                     | 5.25              | 3.35           | 12°                  | 6              | 45                 |
| 01-00413-03516 |          | 16                     | 5.25              | 3.35           | 12°                  | 6              | 55                 |
| 01-00413-03520 |          | 20                     | 5.25              | 3.35           | 12°                  | 6              | 60                 |
| 01-00413-03525 | 4        | 25                     | 5.25              | 3.35           | 12°                  | 6              | 65                 |
| 01-00413-03530 |          | 30                     | 5.25              | 3.35           | 12°                  | 6              | 75                 |
| 01-00413-04012 |          | 12                     | 6                 | 3.8            | 12°                  | 6              | 45                 |
| 01-00413-04016 |          | 16                     | 6                 | 3.8            | 12°                  | 6              | 55                 |
| 01-00413-04020 | 5        | 20                     | 6                 | 3.8            | 12°                  | 6              | 60                 |
| 01-00413-04025 |          | 25                     | 6                 | 3.8            | 12°                  | 6              | 65                 |
| 01-00413-04030 |          | 30                     | 6                 | 3.8            | 12°                  | 6              | 70                 |
| 01-00413-04035 |          | 35                     | 6                 | 3.8            | 12°                  | 6              | 75                 |
| 01-00413-05016 | 5        | 16                     | 7.5               | 4.8            | 12°                  | 6              | 55                 |
| 01-00413-05020 |          | 20                     | 7.5               | 4.8            | 12°                  | 6              | 60                 |
| 01-00413-05025 |          | 25                     | 7.5               | 4.8            | 12°                  | 6              | 65                 |
| 01-00413-05030 |          | 30                     | 7.5               | 4.8            | 12°                  | 6              | 75                 |
| 01-00413-05035 |          | 35                     | 7.5               | 4.8            | 12°                  | 6              | 80                 |
| 01-00413-05040 |          | 40                     | 7.5               | 4.8            | 12°                  | 6              | 90                 |

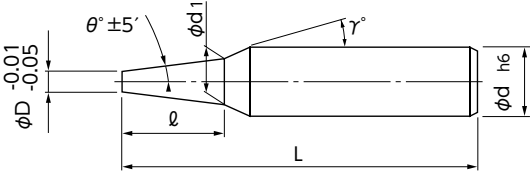
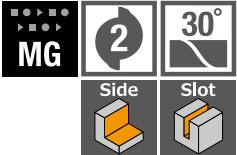
Recommended Milling Conditions

| Work Material |              | Carbon Steels•Alloy Steels•Prehard-ened Steels<br>S50C•SCM•SKD•SUS•HPM•NAK                                                                                         |         | Aluminium Alloy   |           | Copper            |           | Resin             |         |
|---------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------------|-----------|-------------------|-----------|-------------------|---------|
| Cutting Speed |              | 30~50m/min                                                                                                                                                         |         | 100~200m/min      |           | 50~150m/min       |           | 50~80m/min        |         |
| Dia.          | Depth of Cut | Spindle Speed                                                                                                                                                      | Feed    | Spindle Speed     | Feed      | Spindle Speed     | Feed      | Spindle Speed     | Feed    |
|               | mm           | min <sup>-1</sup>                                                                                                                                                  | mm/min  | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min    | min <sup>-1</sup> | mm/min  |
| 0.5           | 0.003~0.05   | 19,100~31,800                                                                                                                                                      | 200~500 | 50,000~           | 200~1,000 | 31,800~           | 200~1,000 | 31,800~           | 200~400 |
| 0.6           | 0.006~0.06   | 15,900~26,500                                                                                                                                                      | 200~500 | 50,000~           | 200~1,250 | 26,500~           | 200~1,000 | 26,500~42,500     | 200~400 |
| 0.7           | 0.01 ~0.07   | 13,600~22,700                                                                                                                                                      | 200~500 | 45,500~           | 200~1,250 | 22,700~           | 200~1,000 | 22,700~36,400     | 200~400 |
| 0.8           | 0.01 ~0.06   | 11,900~19,900                                                                                                                                                      | 200~500 | 39,800~           | 200~1,500 | 19,900~           | 200~1,250 | 19,900~31,800     | 200~400 |
| 0.9           | 0.009~0.03   | 10,600~17,700                                                                                                                                                      | 200~500 | 35,400~           | 200~2,000 | 17,700~           | 200~1,500 | 17,700~28,300     | 200~400 |
| 1             | 0.01 ~0.06   | 9,600~15,900                                                                                                                                                       | 200~650 | 31,800~           | 200~2,600 | 15,900~47,800     | 200~1,950 | 15,900~25,500     | 200~400 |
| 1.2           | 0.016~0.12   | 8,000~13,300                                                                                                                                                       | 200~550 | 26,500~           | 200~2,200 | 13,300~39,800     | 200~1,650 | 13,300~21,200     | 200~400 |
| 1.4           | 0.012~0.15   | 6,800~11,400                                                                                                                                                       | 200~450 | 22,700~45,500     | 200~1,800 | 11,400~34,100     | 200~1,350 | 11,400~18,200     | 200~400 |
| 1.5           | 0.008~0.17   | 6,400~10,600                                                                                                                                                       | 200~450 | 21,200~42,500     | 200~1,800 | 10,600~31,800     | 200~1,350 | 10,600~17,000     | 200~400 |
| 1.6           | 0.012~0.2    | 6,000~10,000                                                                                                                                                       | 200~450 | 19,900~39,800     | 200~1,800 | 10,000~29,900     | 200~1,350 | 10,000~15,900     | 200~400 |
| 1.8           | 0.02 ~0.22   | 5,300~ 8,800                                                                                                                                                       | 200~350 | 17,700~35,400     | 200~1,400 | 8,800~26,500      | 200~1,050 | 8,800~14,200      | 200~400 |
| 2             | 0.03 ~0.25   | 4,800~ 8,000                                                                                                                                                       | 200~350 | 15,900~31,800     | 200~1,400 | 8,000~23,900      | 200~1,050 | 8,000~12,700      | 200~400 |
| 2.5           | 0.08 ~0.25   | 3,800~ 6,400                                                                                                                                                       | 150~250 | 12,700~25,500     | 150~1,000 | 6,400~19,100      | 150~ 750  | 6,400~10,200      | 150~300 |
| 3             | 0.09 ~0.25   | 3,200~ 5,300                                                                                                                                                       | 130~250 | 10,600~21,200     | 130~1,000 | 5,300~15,900      | 130~ 750  | 5,300~ 8,500      | 130~260 |
| 3.5           | 0.09 ~0.25   | 2,700~ 4,500                                                                                                                                                       | 110~220 | 9,100~18,200      | 110~ 900  | 4,500~13,600      | 110~ 650  | 4,500~ 7,300      | 110~220 |
| 4             | 0.1 ~0.25    | 2,400~ 4,000                                                                                                                                                       | 100~200 | 8,000~15,900      | 100~ 800  | 4,000~11,900      | 100~ 600  | 4,000~ 6,400      | 100~200 |
| 5             | 0.18 ~0.25   | 1,900~ 3,200                                                                                                                                                       | 80~200  | 6,400~12,700      | 80~ 800   | 3,200~ 9,600      | 80~ 600   | 3,200~ 5,100      | 80~160  |
| Notes         |              | ※1 Adjust depth of cut, spindle speed and feed according to effective length.<br>※2 Use cutting fluid with smoke retardant.<br>※3 Recommend reciprocating cutting. |         |                   |           |                   |           |                   |         |



X COATING 2-Flute Taper End Mill

Recommended Milling Conditions



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.         | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Length<br>of Cut<br>(L) | Dia. at<br>Large End<br>(d1) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Code No.         | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Length<br>of Cut<br>(L) | Dia. at<br>Large End<br>(d1) | Neck Taper<br>Angle<br>(γ) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|------------------|-------------|-----------------------|-------------------------|------------------------------|----------------------------|----------------------|--------------------------|------------------|-------------|-----------------------|-------------------------|------------------------------|----------------------------|----------------------|--------------------------|
| ▲ 01-00316-00051 | 0.5         | 30'                   | 2                       | 0.53                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00151 | 1.5         | 30'                   | 5                       | 1.59                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00052 |             | 1°                    | 2                       | 0.57                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00152 |             | 1°                    | 5                       | 1.67                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00053 |             | 1°30'                 | 2                       | 0.60                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00153 |             | 1°30'                 | 5                       | 1.76                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00054 |             | 2°                    | 2                       | 0.64                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00154 |             | 2°                    | 5                       | 1.85                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00056 |             | 3°                    | 2                       | 0.71                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00156 |             | 3°                    | 5                       | 2.02                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00061 | 0.6         | 30'                   | 2                       | 0.63                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00157 | 2           | 5°                    | 5                       | 2.37                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00062 |             | 1°                    | 2                       | 0.67                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00201 |             | 30'                   | 6                       | 2.10                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00063 |             | 1°30'                 | 2                       | 0.70                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00202 |             | 1°                    | 6                       | 2.21                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00064 |             | 2°                    | 2                       | 0.74                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00203 |             | 1°30'                 | 6                       | 2.31                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00066 | 0.7         | 3°                    | 2                       | 0.81                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00204 |             | 2°                    | 6                       | 2.41                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00071 |             | 30'                   | 2                       | 0.73                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00206 | 2.5         | 3°                    | 6                       | 2.62                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00072 |             | 1°                    | 2                       | 0.77                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00207 |             | 5°                    | 6                       | 3.05                         | 5°                         | 4                    | 45                       |
| ▲ 01-00316-00073 |             | 1°30'                 | 2                       | 0.80                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00251 |             | 30'                   | 8                       | 2.64                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00074 |             | 2°                    | 2                       | 0.84                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00252 |             | 1°                    | 8                       | 2.78                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00076 | 0.8         | 3°                    | 2                       | 0.91                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00253 | 2.5         | 1°30'                 | 8                       | 2.92                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00081 |             | 30'                   | 3                       | 0.85                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00254 |             | 2°                    | 8                       | 3.05                         | 9°                         | 4                    | 45                       |
| ▲ 01-00316-00082 |             | 1°                    | 3                       | 0.90                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00256 |             | 3°                    | 8                       | 3.33                         | 3°                         | 4                    | 45                       |
| ▲ 01-00316-00083 |             | 1°30'                 | 3                       | 0.96                         | 9°                         | 3                    | 35                       | ▲ 01-00316-00257 |             | 5°                    | 8                       | 3.90                         | 5°                         | 4                    | 45                       |
| ▲ 01-00316-00084 |             | 2°                    | 3                       | 1.01                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00086 | 0.9         | 3°                    | 3                       | 1.11                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00091 |             | 30'                   | 3                       | 0.95                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00092 |             | 1°                    | 3                       | 1.00                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00093 |             | 1°30'                 | 3                       | 1.06                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00094 |             | 2°                    | 3                       | 1.11                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00096 | 1           | 3°                    | 3                       | 1.21                         | 9°                         | 3                    | 35                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00101 |             | 30'                   | 4                       | 1.07                         | 9°                         | 4                    | 45                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00102 |             | 1°                    | 4                       | 1.14                         | 9°                         | 4                    | 45                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00103 |             | 1°30'                 | 4                       | 1.21                         | 9°                         | 4                    | 45                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00104 |             | 2°                    | 4                       | 1.28                         | 9°                         | 4                    | 45                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00106 | 1           | 3°                    | 4                       | 1.42                         | 9°                         | 4                    | 45                       |                  |             |                       |                         |                              |                            |                      |                          |
| ▲ 01-00316-00107 |             | 5°                    | 4                       | 1.70                         | 9°                         | 4                    | 45                       |                  |             |                       |                         |                              |                            |                      |                          |

How to Order

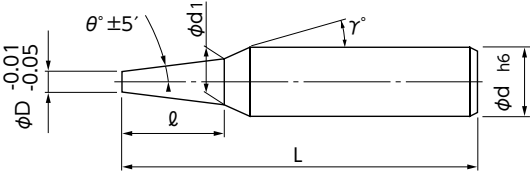
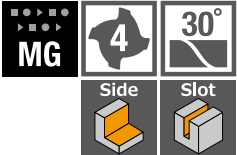
When you order, indicate NTE-2X (D)×(θ). ※(d1) and (γ) is reference value.

| Work Material                 | Carbon Steels<br>S50C                                                                                                           |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK |        |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|-------------------------------|--------|
| Cutting Speed                 | 35~45m/min                                                                                                                      |        | 30~40m/min                  |        | 25~30m/min                    |        |
| Dia.                          | Spindle Speed                                                                                                                   | Feed   | Spindle Speed               | Feed   | Spindle Speed                 | Feed   |
|                               | min <sup>-1</sup>                                                                                                               | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>             | mm/min |
| 1                             | 11,000                                                                                                                          | 160    | 9,500                       | 130    | 8,000                         | 100    |
| 1.5                           | 7,400                                                                                                                           | 160    | 6,400                       | 130    | 5,300                         | 100    |
| 2                             | 5,600                                                                                                                           | 160    | 4,800                       | 130    | 4,000                         | 100    |
| 2.5                           | 4,500                                                                                                                           | 160    | 3,800                       | 130    | 3,200                         | 100    |
| Depth of Cut<br><br>(D: Dia.) | <div>Taper Side Milling</div> <div>0.1D</div> <div>Length of Cut</div>                                                          |        |                             |        |                               |        |
| Notes                         | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 We recommend a down-cut at side milling. |        |                             |        |                               |        |



X COATING 4-Flute Taper End Mill

Recommended Milling Conditions



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (L) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 01-00317-00301 | 3        | 30°             | 10                | 3.17                   | 9°                   | 6              | 50                 |
| 01-00317-00302 |          | 1°              | 10                | 3.35                   | 9°                   | 6              | 50                 |
| 01-00317-00303 |          | 1°30'           | 10                | 3.52                   | 9°                   | 6              | 50                 |
| 01-00317-00304 |          | 2°              | 10                | 3.69                   | 9°                   | 6              | 50                 |
| 01-00317-00306 |          | 3°              | 10                | 4.05                   | 9°                   | 6              | 50                 |
| 01-00317-00307 |          | 5°              | 10                | 4.75                   | 9°                   | 6              | 50                 |
| 01-00317-00401 | 4        | 30°             | 15                | 4.26                   | 9°                   | 6              | 50                 |
| 01-00317-00402 |          | 1°              | 15                | 4.52                   | 9°                   | 6              | 50                 |
| 01-00317-00403 |          | 1°30'           | 15                | 4.79                   | 9°                   | 6              | 50                 |
| 01-00317-00404 |          | 2°              | 15                | 5.04                   | 9°                   | 6              | 50                 |
| 01-00317-00406 |          | 3°              | 15                | 5.57                   | 9°                   | 6              | 50                 |
| 01-00317-00407 |          | 5°              | 15                | 6.62                   | —                    | 6              | 55                 |
| 01-00317-00501 | 5        | 30°             | 20                | 5.34                   | 9°                   | 6              | 55                 |
| 01-00317-00502 |          | 1°              | 20                | 5.70                   | 9°                   | 6              | 55                 |
| 01-00317-00503 |          | 1°30'           | 20                | 6.05                   | —                    | 6              | 55                 |
| 01-00317-00504 |          | 2°              | 20                | 6.39                   | —                    | 6              | 55                 |
| 01-00317-00506 |          | 3°              | 20                | 7.10                   | —                    | 6              | 55                 |
| 01-00317-00507 |          | 5°              | 20                | 8.50                   | —                    | 8              | 60                 |
| 01-00317-00601 | 6        | 30°             | 20                | 6.35                   | —                    | 6              | 55                 |
| 01-00317-00602 |          | 1°              | 20                | 6.70                   | —                    | 6              | 55                 |
| 01-00317-00603 |          | 1°30'           | 20                | 7.05                   | —                    | 6              | 55                 |
| 01-00317-00604 |          | 2°              | 20                | 7.40                   | —                    | 6              | 55                 |
| 01-00317-00606 |          | 3°              | 20                | 8.10                   | —                    | 8              | 60                 |
| 01-00317-00607 |          | 5°              | 20                | 9.50                   | —                    | 8              | 65                 |
| 01-00317-00801 | 8        | 30°             | 25                | 8.44                   | —                    | 8              | 55                 |
| 01-00317-00802 |          | 1°              | 25                | 8.87                   | —                    | 8              | 65                 |
| 01-00317-00803 |          | 1°30'           | 25                | 9.31                   | —                    | 8              | 65                 |
| 01-00317-00804 |          | 2°              | 25                | 9.75                   | —                    | 8              | 65                 |
| 01-00317-00806 |          | 3°              | 25                | 10.62                  | —                    | 10             | 70                 |
| 01-00317-00807 |          | 5°              | 25                | 12.37                  | —                    | 12             | 90                 |
| 01-00317-01001 | 10       | 30°             | 35                | 10.61                  | —                    | 10             | 85                 |
| 01-00317-01002 |          | 1°              | 35                | 11.22                  | —                    | 10             | 85                 |
| 01-00317-01003 |          | 1°30'           | 35                | 11.83                  | —                    | 10             | 85                 |
| 01-00317-01004 |          | 2°              | 35                | 12.44                  | —                    | 12             | 90                 |
| 01-00317-01006 |          | 3°              | 35                | 13.67                  | —                    | 12             | 90                 |
| 01-00317-01007 |          | 5°              | 35                | 16.12                  | —                    | 16             | 90                 |

How to Order

When you order, indicate NTE-4X (D)×(θ). ※(d1) and (γ) is reference value.

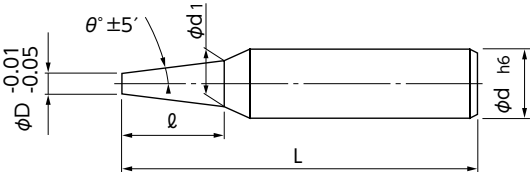
| Work Material          | Carbon Steels S50C                                                                                                              |        | Alloy Steels SCM・SKD・SUS |        | Prehardened Steels HPM・NAK |        |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------|--------|----------------------------|--------|
| Cutting Speed          | 35~45m/min                                                                                                                      |        | 30~40m/min               |        | 25~30m/min                 |        |
| Dia.                   | Spindle Speed                                                                                                                   | Feed   | Spindle Speed            | Feed   | Spindle Speed              | Feed   |
|                        | min <sup>-1</sup>                                                                                                               | mm/min | min <sup>-1</sup>        | mm/min | min <sup>-1</sup>          | mm/min |
| 3                      | 3,700                                                                                                                           | 220    | 3,200                    | 180    | 2,650                      | 130    |
| 4                      | 2,800                                                                                                                           | 220    | 2,400                    | 180    | 2,000                      | 130    |
| 5                      | 2,200                                                                                                                           | 220    | 1,900                    | 180    | 1,600                      | 130    |
| 6                      | 1,900                                                                                                                           | 220    | 1,600                    | 180    | 1,300                      | 130    |
| Depth of Cut (D: Dia.) | <div>Taper Side Milling</div> <div>0.1D</div> <div>Length of Cut</div>                                                          |        |                          |        |                            |        |
| Notes                  | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate.<br>※3 We recommend a down-cut at side milling. |        |                          |        |                            |        |



X COATING 2-Flute Medium Taper End Mill

X COATING 2-Flute Medium Taper End Mill

Unit : mm



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------|--------------------|
| 01-00336-00502 | 0.5      | 30°             | 4                 | 0.57                   | 3              | 35                 |
| 01-00336-00504 |          | 1°              | 4                 | 0.64                   | 3              | 35                 |
| 01-00336-00505 |          | 1°30'           | 4                 | 0.71                   | 3              | 35                 |
| 01-00336-00506 |          | 2°              | 4                 | 0.78                   | 3              | 35                 |
| 01-00336-00508 |          | 3°              | 4                 | 0.92                   | 3              | 35                 |
| 01-00336-00510 |          | 4°              | 4                 | 1.06                   | 3              | 35                 |
| 01-00336-00512 |          | 5°              | 4                 | 1.20                   | 3              | 35                 |
| 01-00336-00802 | 0.8      | 30°             | 5                 | 0.89                   | 3              | 35                 |
| 01-00336-00804 |          | 1°              | 5                 | 0.97                   | 3              | 35                 |
| 01-00336-00805 |          | 1°30'           | 5                 | 1.06                   | 3              | 35                 |
| 01-00336-00806 |          | 2°              | 5                 | 1.15                   | 3              | 35                 |
| 01-00336-00808 |          | 3°              | 5                 | 1.32                   | 3              | 35                 |
| 01-00336-00810 |          | 4°              | 5                 | 1.50                   | 3              | 35                 |
| 01-00336-00812 |          | 5°              | 5                 | 1.67                   | 3              | 35                 |
| 01-00336-01002 | 1        | 30°             | 6                 | 1.10                   | 4              | 45                 |
| 01-00336-01004 |          | 1°              | 6                 | 1.21                   | 4              | 45                 |
| 01-00336-01005 |          | 1°30'           | 6                 | 1.31                   | 4              | 45                 |
| 01-00336-01006 |          | 2°              | 6                 | 1.42                   | 4              | 45                 |
| 01-00336-01008 |          | 3°              | 6                 | 1.63                   | 4              | 45                 |
| 01-00336-01010 |          | 4°              | 6                 | 1.84                   | 4              | 45                 |
| 01-00336-01012 |          | 5°              | 6                 | 2.05                   | 4              | 45                 |
| 01-00336-01016 |          | 7°              | 6                 | 2.47                   | 4              | 45                 |
| 01-00336-01019 |          | 10°             | 6                 | 3.12                   | 4              | 45                 |
| 01-00336-01024 |          | 15°             | 6                 | 4.22                   | 6              | 45                 |
| 01-00336-01502 | 1.5      | 30°             | 8                 | 1.64                   | 4              | 45                 |
| 01-00336-01504 |          | 1°              | 8                 | 1.78                   | 4              | 45                 |
| 01-00336-01505 |          | 1°30'           | 8                 | 1.92                   | 4              | 45                 |
| 01-00336-01506 |          | 2°              | 8                 | 2.06                   | 4              | 45                 |
| 01-00336-01508 |          | 3°              | 8                 | 2.34                   | 4              | 45                 |
| 01-00336-01510 |          | 4°              | 8                 | 2.62                   | 4              | 45                 |
| 01-00336-01512 |          | 5°              | 8                 | 2.90                   | 4              | 45                 |
| 01-00336-01516 |          | 7°              | 8                 | 3.46                   | 4              | 45                 |
| 01-00336-01519 |          | 10°             | 8                 | 4.32                   | 6              | 45                 |
| 01-00336-01524 |          | 15°             | 8                 | 5.79                   | 6              | 45                 |
| 01-00336-02002 | 2        | 30°             | 10                | 2.17                   | 4              | 50                 |
| 01-00336-02004 |          | 1°              | 10                | 2.35                   | 4              | 50                 |
| 01-00336-02005 |          | 1°30'           | 10                | 2.52                   | 4              | 50                 |

How to Order

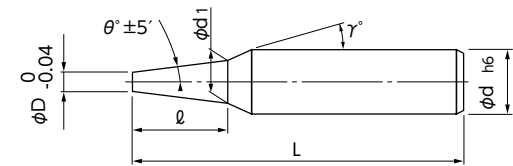
When you order, indicate NTEM-2X (D)×(θ).

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------|--------------------|
| 01-00336-02006 | 2        | 2°              | 10                | 2.70                   | 4              | 50                 |
| 01-00336-02008 |          | 3°              | 10                | 3.05                   | 4              | 50                 |
| 01-00336-02010 |          | 4°              | 10                | 3.40                   | 4              | 50                 |
| 01-00336-02012 |          | 5°              | 10                | 3.75                   | 4              | 50                 |
| 01-00336-02016 |          | 7°              | 10                | 4.46                   | 6              | 50                 |
| 01-00336-02019 |          | 10°             | 10                | 5.53                   | 6              | 50                 |
| 01-00336-02024 |          | 15°             | 10                | 7.36                   | 6              | 55                 |
| 01-00336-02502 | 2.5      | 30°             | 12                | 2.71                   | 4              | 50                 |
| 01-00336-02504 |          | 1°              | 12                | 2.92                   | 4              | 50                 |
| 01-00336-02505 |          | 1°30'           | 12                | 3.13                   | 4              | 50                 |
| 01-00336-02506 |          | 2°              | 12                | 3.34                   | 4              | 50                 |
| 01-00336-02508 |          | 3°              | 12                | 3.76                   | 4              | 50                 |
| 01-00336-02510 |          | 4°              | 12                | 4.18                   | 6              | 50                 |
| 01-00336-02512 |          | 5°              | 12                | 4.60                   | 6              | 50                 |
| 01-00336-02516 |          | 7°              | 12                | 5.45                   | 6              | 50                 |
| 01-00336-02519 |          | 10°             | 12                | 6.73                   | 8              | 60                 |
| 01-00336-02524 |          | 15°             | 12                | 8.93                   | 8              | 60                 |
| 01-00336-03002 | 3        | 30°             | 15                | 3.26                   | 6              | 55                 |
| 01-00336-03004 |          | 1°              | 15                | 3.52                   | 6              | 55                 |
| 01-00336-03005 |          | 1°30'           | 15                | 3.79                   | 6              | 55                 |
| 01-00336-03006 |          | 2°              | 15                | 4.05                   | 6              | 55                 |
| 01-00336-03008 |          | 3°              | 15                | 4.57                   | 6              | 55                 |
| 01-00336-03010 |          | 4°              | 15                | 5.10                   | 6              | 55                 |
| 01-00336-03012 |          | 5°              | 15                | 5.62                   | 6              | 55                 |
| 01-00336-03016 |          | 7°              | 15                | 6.68                   | 6              | 55                 |
| 01-00336-03019 |          | 10°             | 15                | 8.29                   | 8              | 60                 |
| 01-00336-03024 |          | 15°             | 15                | 11.04                  | 10             | 65                 |
| 01-00336-04002 | 4        | 30°             | 20                | 4.35                   | 6              | 55                 |
| 01-00336-04004 |          | 1°              | 20                | 4.70                   | 6              | 55                 |
| 01-00336-04005 |          | 1°30'           | 20                | 5.05                   | 6              | 55                 |
| 01-00336-04006 |          | 2°              | 20                | 5.40                   | 6              | 55                 |
| 01-00336-04008 |          | 3°              | 20                | 6.10                   | 6              | 55                 |
| 01-00336-04010 |          | 4°              | 20                | 6.80                   | 8              | 60                 |
| 01-00336-04012 |          | 5°              | 20                | 7.50                   | 8              | 60                 |
| 01-00336-04016 |          | 7°              | 20                | 8.91                   | 10             | 65                 |
| 01-00336-04019 |          | 10°             | 20                | 11.05                  | 10             | 70                 |
| 01-00336-04024 |          | 15°             | 20                | 14.72                  | 12             | 80                 |
| 01-00336-05002 | 5        | 30°             | 25                | 5.44                   | 6              | 65                 |
| 01-00336-05004 |          | 1°              | 25                | 5.87                   | 6              | 65                 |
| 01-00336-05005 |          | 1°30'           | 25                | 6.31                   | 6              | 65                 |
| 01-00336-05006 |          | 2°              | 25                | 6.75                   | 6              | 65                 |
| 01-00336-05008 |          | 3°              | 25                | 7.62                   | 6              | 65                 |
| 01-00336-05010 |          | 4°              | 25                | 8.50                   | 8              | 70                 |
| 01-00336-05012 |          | 5°              | 25                | 9.37                   | 8              | 70                 |
| 01-00336-05016 |          | 7°              | 25                | 11.14                  | 10             | 70                 |
| 01-00336-05019 |          | 10°             | 25                | 13.82                  | 12             | 80                 |
| 01-00336-05024 |          | 15°             | 25                | 18.40                  | 16             | 90                 |
| 01-00336-06002 | 6        | 30°             | 30                | 6.52                   | 8              | 70                 |
| 01-00336-06004 |          | 1°              | 30                | 7.05                   | 8              | 70                 |
| 01-00336-06005 |          | 1°30'           | 30                | 7.57                   | 8              | 70                 |
| 01-00336-06006 |          | 2°              | 30                | 8.10                   | 8              | 70                 |
| 01-00336-06008 |          | 3°              | 30                | 9.14                   | 10             | 80                 |
| 01-00336-06010 |          | 4°              | 30                | 10.20                  | 10             | 80                 |
| 01-00336-06012 |          | 5°              | 30                | 11.25                  | 10             | 80                 |
| 01-00336-06016 |          | 7°              | 30                | 13.37                  | 12             | 80                 |
| 01-00336-06019 |          | 10°             | 30                | 16.58                  | 16             | 90                 |
| 01-00336-06024 |          | 15°             | 30                | 22.08                  | 20             | 90                 |



4-Flute Taper End Mill for Deep Rib

4-Flute Taper End Mill for Deep Rib



2 cutting edges on end. (D=0.5)

- : Semi-standard Products, please inquire for price and delivery.
- ▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         |                  |                |                 |        |       |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 01-00425-00502 | 0.5      | 30'             | 2                 | 0.53                   | 9°                   | 4              | 55                 |
| 01-00425-00504 |          | 1°              |                   | 0.57                   | 9°                   | 4              | 55                 |
| 01-00425-00505 |          | 1°30'           |                   | 0.60                   | 9°                   | 4              | 55                 |
| 01-00425-00506 |          | 2°              |                   | 0.64                   | 9°                   | 4              | 55                 |
| 01-00425-00512 |          | 30'             | 4                 | 0.57                   | 9°                   | 4              | 55                 |
| 01-00425-00514 |          | 1°              |                   | 0.64                   | 9°                   | 4              | 55                 |
| 01-00425-00515 |          | 1°30'           |                   | 0.71                   | 9°                   | 4              | 55                 |
| 01-00425-00516 |          | 2°              |                   | 0.78                   | 9°                   | 4              | 55                 |
| 01-00425-00518 |          | 3°              | 8                 | 0.92                   | 9°                   | 4              | 55                 |
| 01-00425-00522 |          | 30'             |                   | 0.60                   | 9°                   | 4              | 55                 |
| 01-00425-00524 |          | 1°              |                   | 0.71                   | 9°                   | 4              | 55                 |
| 01-00425-00525 |          | 1°30'           |                   | 0.81                   | 9°                   | 4              | 55                 |
| 01-00425-00526 |          | 2°              |                   | 0.92                   | 9°                   | 4              | 55                 |
| 01-00425-00528 |          | 3°              | 10                | 1.13                   | 9°                   | 4              | 55                 |
| 01-00425-00538 |          | 3°              |                   | 1.34                   | 9°                   | 4              | 60                 |
| 01-00425-00812 | 0.8      | 30'             | 4                 | 0.87                   | 9°                   | 4              | 55                 |
| 01-00425-00814 |          | 1°              |                   | 0.94                   | 9°                   | 4              | 55                 |
| 01-00425-00815 |          | 1°30'           |                   | 1.01                   | 9°                   | 4              | 55                 |
| 01-00425-00822 |          | 30'             |                   | 0.90                   | 9°                   | 4              | 55                 |
| 01-00425-00824 |          | 1°              | 6                 | 1.01                   | 9°                   | 4              | 55                 |
| 01-00425-00825 |          | 1°30'           |                   | 1.11                   | 9°                   | 4              | 55                 |
| 01-00425-00826 |          | 2°              |                   | 1.22                   | 9°                   | 4              | 55                 |
| 01-00425-00828 |          | 3°              |                   | 1.43                   | 9°                   | 4              | 55                 |
| 01-00425-00836 |          | 2°              | 8                 | 1.36                   | 9°                   | 4              | 60                 |
| 01-00425-00838 |          | 3°              |                   | 1.64                   | 9°                   | 4              | 60                 |
| 01-00425-00842 |          | 30'             |                   | 0.97                   | 9°                   | 4              | 60                 |
| 01-00425-00844 |          | 1°              |                   | 1.15                   | 9°                   | 4              | 60                 |
| 01-00425-00845 |          | 1°30'           | 10                | 1.32                   | 9°                   | 4              | 60                 |
| 01-00425-00856 |          | 2°              |                   | 1.64                   | 9°                   | 4              | 60                 |
| 01-00425-00858 |          | 3°              |                   | 2.06                   | 9°                   | 4              | 60                 |

How to Order

When you order, indicate NRF-4 (D)×(θ)×(ℓ). ※(d1) and (γ) is reference value.



| Code No.       | Dia. (D) | Taper Angle (θ) | Length of Cut (ℓ) | Dia. at Large End (d1) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|----------------|----------|-----------------|-------------------|------------------------|----------------------|----------------|--------------------|
| 01-00425-01012 | 1        | 30'             | 4                 | 1.07                   | 9°                   | 4              | 60                 |
| 01-00425-01014 |          | 1°              |                   | 1.14                   | 9°                   | 4              | 60                 |
| 01-00425-01022 |          | 30'             | 6                 | 1.10                   | 9°                   | 4              | 60                 |
| 01-00425-01024 |          | 1°              |                   | 1.21                   | 9°                   | 4              | 60                 |
| 01-00425-01035 |          | 1°30'           | 8                 | 1.42                   | 9°                   | 4              | 60                 |
| 01-00425-01036 |          | 2°              |                   | 1.56                   | 9°                   | 4              | 60                 |
| 01-00425-01038 |          | 3°              |                   | 1.84                   | 9°                   | 4              | 60                 |
| 01-00425-01052 |          | 30'             |                   | 1.21                   | 9°                   | 4              | 60                 |
| 01-00425-01054 |          | 1°              | 12                | 1.42                   | 9°                   | 4              | 60                 |
| 01-00425-01055 |          | 1°30'           |                   | 1.63                   | 9°                   | 4              | 60                 |
| 01-00425-01056 |          | 2°              |                   | 1.84                   | 9°                   | 4              | 60                 |
| 01-00425-01058 |          | 3°              |                   | 2.26                   | 9°                   | 4              | 60                 |
| 01-00425-01075 |          | 1°30'           | 21                | 2.10                   | 9°                   | 4              | 70                 |
| 01-00425-01076 |          | 2°              |                   | 2.47                   | 9°                   | 4              | 70                 |
| 01-00425-01078 |          | 3°              |                   | 3.20                   | 3°                   | 4              | 70                 |
| 01-00425-01212 | 1.2      | 30'             | 4                 | 1.27                   | 9°                   | 4              | 60                 |
| 01-00425-01214 |          | 1°              |                   | 1.34                   | 9°                   | 4              | 60                 |
| 01-00425-01222 |          | 30'             | 6                 | 1.30                   | 9°                   | 4              | 60                 |
| 01-00425-01224 |          | 1°              |                   | 1.41                   | 9°                   | 4              | 60                 |
| 01-00425-01235 |          | 1°30'           | 8                 | 1.62                   | 9°                   | 4              | 60                 |
| 01-00425-01236 |          | 2°              |                   | 1.76                   | 9°                   | 4              | 60                 |
| 01-00425-01238 |          | 3°              |                   | 2.04                   | 9°                   | 4              | 60                 |
| 01-00425-01252 |          | 30'             |                   | 1.41                   | 9°                   | 4              | 60                 |
| 01-00425-01254 |          | 1°              | 12                | 1.62                   | 9°                   | 4              | 60                 |
| 01-00425-01255 |          | 1°30'           |                   | 1.83                   | 9°                   | 4              | 60                 |
| 01-00425-01256 |          | 2°              |                   | 2.04                   | 9°                   | 4              | 60                 |
| 01-00425-01258 |          | 3°              |                   | 2.46                   | 9°                   | 4              | 60                 |
| 01-00425-01275 |          | 1°30'           | 21                | 2.30                   | 9°                   | 4              | 70                 |
| 01-00425-01276 |          | 2°              |                   | 2.67                   | 9°                   | 4              | 70                 |
| 01-00425-01278 |          | 3°              |                   | 3.40                   | 3°                   | 4              | 70                 |
| 01-00425-01412 | 1.4      | 30'             | 8                 | 1.54                   | 9°                   | 4              | 60                 |
| 01-00425-01414 |          | 1°              |                   | 1.68                   | 9°                   | 4              | 60                 |
| 01-00425-01425 |          | 1°30'           | 10                | 1.92                   | 9°                   | 4              | 60                 |
| 01-00425-01432 |          | 30'             |                   | 1.61                   | 9°                   | 4              | 60                 |
| 01-00425-01434 |          | 1°              |                   | 1.82                   | 9°                   | 4              | 60                 |
| 01-00425-01436 |          | 2°              |                   | 2.24                   | 9°                   | 4              | 60                 |
| 01-00425-01438 |          | 3°              |                   | 2.66                   | 9°                   | 4              | 60                 |
| 01-00425-01442 |          | 30'             | 16                | 1.68                   | 9°                   | 4              | 65                 |
| 01-00425-01445 |          | 1°30'           |                   | 2.24                   | 9°                   | 4              | 65                 |
| 01-00425-01454 |          | 1°              |                   | 2.13                   | 9°                   | 4              | 70                 |
| 01-00425-01456 |          | 2°              |                   | 2.87                   | 9°                   | 4              | 70                 |
| 01-00425-01458 |          | 3°              |                   | 3.60                   | 3°                   | 4              | 70                 |
| 01-00425-01465 |          | 1°30'           | 26                | 2.76                   | 9°                   | 4              | 75                 |
| 01-00425-01476 |          | 2°              |                   | 3.57                   | 2°                   | 4              | 80                 |
| 01-00425-01478 |          | 3°              |                   | 4.65                   | 9°                   | 6              | 80                 |



Unit : mm

| Code No.           | Dia.<br>(D) | Taper Angle<br>(θ) | Length of Cut<br>(ℓ) | Dia. at Large End<br>(d1) | Neck Taper Angle<br>(γ) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|--------------------|-------------|--------------------|----------------------|---------------------------|-------------------------|-------------------|-----------------------|
| ▲ ■ 01-00425-01512 | 1.5         | 30′                | 8                    | 1.64                      | 30′                     | 4                 | 60                    |
| ▲ ■ 01-00425-01514 |             | 1°                 |                      | 1.78                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01525 |             | 1°30′              | 10                   | 2.02                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01532 |             | 30′                | 12                   | 1.71                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01534 |             | 1°                 |                      | 1.92                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01536 |             | 2°                 |                      | 2.34                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01538 |             | 3°                 | 16                   | 2.76                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01542 |             | 30′                |                      | 1.78                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-01545 |             | 1°30′              | 21                   | 2.34                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-01554 |             | 1°                 |                      | 2.23                      | 9°                      | 4                 | 70                    |
| ▲ ■ 01-00425-01556 |             | 2°                 |                      | 2.97                      | 9°                      | 4                 | 70                    |
| ▲ ■ 01-00425-01558 |             | 3°                 | 26                   | 3.70                      | 3°                      | 4                 | 70                    |
| ▲ ■ 01-00425-01565 |             | 1°30′              |                      | 2.86                      | 9°                      | 4                 | 75                    |
| ▲ ■ 01-00425-01576 |             | 2°                 | 31                   | 3.67                      | 2°                      | 4                 | 80                    |
| ▲ ■ 01-00425-01578 |             | 3°                 |                      | 4.75                      | 9°                      | 6                 | 80                    |
| ▲ ■ 01-00425-01812 | 1.8         | 30′                | 8                    | 1.94                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01824 |             | 1°                 | 10                   | 2.15                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01825 |             | 1°30′              |                      | 2.32                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01832 |             | 30′                | 12                   | 2.01                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01836 |             | 2°                 |                      | 2.64                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01838 |             | 3°                 |                      | 3.06                      | 3°                      | 4                 | 60                    |
| ▲ ■ 01-00425-01844 |             | 1°                 | 16                   | 2.36                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-01845 |             | 1°30′              |                      | 2.64                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-01852 |             | 30′                | 21                   | 2.17                      | 9°                      | 4                 | 70                    |
| ▲ ■ 01-00425-01856 |             | 2°                 |                      | 3.27                      | 2°                      | 4                 | 70                    |
| ▲ ■ 01-00425-01858 |             | 3°                 |                      | 4.00                      | 9°                      | 6                 | 70                    |
| ▲ ■ 01-00425-01864 |             | 1°                 | 26                   | 2.71                      | 9°                      | 4                 | 75                    |
| ▲ ■ 01-00425-01875 |             | 1°30′              | 31                   | 3.42                      | 1°30′                   | 4                 | 80                    |
| ▲ ■ 01-00425-01886 |             | 2°                 | 36                   | 4.31                      | 9°                      | 6                 | 85                    |
| ▲ ■ 01-00425-01888 |             | 3°                 |                      | 5.57                      | 3°                      | 6                 | 85                    |
| ▲ ■ 01-00425-02012 | 2           | 30′                | 8                    | 2.14                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-02024 |             | 1°                 | 10                   | 2.35                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-02025 |             | 1°30′              |                      | 2.52                      | 9°                      | 4                 | 60                    |
| ▲ ■ 01-00425-02032 |             | 30′                | 12                   | 2.21                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-02036 |             | 2°                 |                      | 2.84                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-02038 |             | 3°                 |                      | 3.26                      | 3°                      | 4                 | 65                    |
| ▲ ■ 01-00425-02044 |             | 1°                 | 16                   | 2.56                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-02045 |             | 1°30′              |                      | 2.84                      | 9°                      | 4                 | 65                    |
| ▲ ■ 01-00425-02052 |             | 30′                | 21                   | 2.37                      | 9°                      | 4                 | 70                    |
| ▲ ■ 01-00425-02056 |             | 2°                 |                      | 3.47                      | 2°                      | 4                 | 70                    |
| ▲ ■ 01-00425-02058 |             | 3°                 |                      | 4.20                      | 9°                      | 6                 | 70                    |
| ▲ ■ 01-00425-02064 |             | 1°                 | 26                   | 2.91                      | 9°                      | 4                 | 75                    |
| ▲ ■ 01-00425-02075 |             | 1°30′              | 31                   | 3.62                      | 1°30′                   | 4                 | 80                    |
| ▲ ■ 01-00425-02086 |             | 2°                 | 36                   | 4.51                      | 9°                      | 6                 | 85                    |
| ▲ ■ 01-00425-02088 |             | 3°                 |                      | 5.77                      | 3°                      | 6                 | 85                    |

| Work Material |             |               | Carbon Steels • Alloy Steels • Prehardened Steels<br>S50C • SKD • HPM • NAK                                                                                                    |                   |             |
|---------------|-------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|
| Cutting Speed |             |               | 40~70m/min                                                                                                                                                                     |                   |             |
| Dia.          | Taper Angle | Length of Cut | Depth of Cut                                                                                                                                                                   | Spindle Speed     | Feed        |
|               |             |               | mm                                                                                                                                                                             | min <sup>-1</sup> | mm/min      |
| 0.5           | 30′ ~ 1°    | 2 ~ 6         | 0.005 ~ 0.02                                                                                                                                                                   | 25,000 ~ 44,000   | 300 ~ 800   |
|               | 1°30′ ~ 3°  | 2 ~ 8         | 0.015 ~ 0.05                                                                                                                                                                   | 25,000 ~ 44,000   | 300 ~ 800   |
| 1             | 30′ ~ 1°    | 4 ~ 12        | 0.015 ~ 0.06                                                                                                                                                                   | 13,000 ~ 22,000   | 400 ~ 1,000 |
|               | 1°30′ ~ 3°  | 8 ~ 21        | 0.015 ~ 0.1                                                                                                                                                                    | 13,000 ~ 22,000   | 400 ~ 1,000 |
| 1.2           | 30′ ~ 1°    | 4 ~ 12        | 0.015 ~ 0.06                                                                                                                                                                   | 10,600 ~ 18,000   | 400 ~ 1,000 |
|               | 1°30′ ~ 3°  | 8 ~ 21        | 0.02 ~ 0.1                                                                                                                                                                     | 10,600 ~ 18,000   | 400 ~ 1,000 |
| 1.5           | 30′ ~ 1°    | 8 ~ 21        | 0.015 ~ 0.07                                                                                                                                                                   | 8,500 ~ 15,000    | 400 ~ 1,000 |
|               | 1°30′ ~ 3°  | 10 ~ 31       | 0.03 ~ 0.15                                                                                                                                                                    | 8,500 ~ 15,000    | 400 ~ 1,000 |
| 2             | 30′ ~ 1°    | 8 ~ 26        | 0.02 ~ 0.1                                                                                                                                                                     | 6,400 ~ 11,000    | 400 ~ 1,000 |
|               | 1°30′ ~ 3°  | 10 ~ 36       | 0.05 ~ 0.2                                                                                                                                                                     | 6,400 ~ 11,000    | 400 ~ 1,000 |
| Notes         |             |               | ※1 Water-insoluble fluid is recommended.<br>※2 Take a special care of the runout of the endmills.<br>※3 Use a rigid machine and holder.<br>※4 Recommend reciprocating cutting. |                   |             |



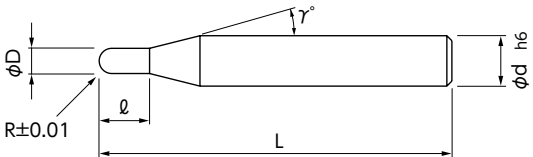
Tapered



Tapered

X COATING 2-Flute Miniature Ball End Mill

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

■ Specified distributor inventory

▲ Discontinued Products

Unit : mm

| Code No.           | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| ▲ ■ 01-00513-00200 | R0.2       | 0.8               | 0.4      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00250 | R0.25      | 1                 | 0.5      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00300 | R0.3       | 1.2               | 0.6      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00350 | R0.35      | 1.4               | 0.7      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00400 | R0.4       | 1.6               | 0.8      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00450 | R0.45      | 1.8               | 0.9      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00500 | R0.5       | 2                 | 1        | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00600 | R0.6       | 2.4               | 1.2      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00700 | R0.7       | 2.8               | 1.4      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00750 | R0.75      | 3                 | 1.5      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00800 | R0.8       | 3.2               | 1.6      | 9°                   | 3              | 35                 |
| ▲ ■ 01-00513-00900 | R0.9       | 3.6               | 1.8      | 9°                   | 3              | 35                 |

How to Order

When you order, indicate NCB-2X (R).

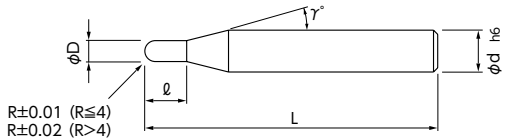
※ (γ) is reference value.

| Work Material               | Carbon Steels・Alloy Steels・Prehardened Steels<br>S50C・SCM・SKD・SUS・HPM・NAK        |        |
|-----------------------------|----------------------------------------------------------------------------------|--------|
| Cutting Speed               | 60~80m/min                                                                       |        |
| Radius                      | Spindle Speed                                                                    | Feed   |
|                             | min <sup>-1</sup>                                                                | mm/min |
| 0.2                         | 50,000                                                                           | 800    |
| 0.25                        | 50,000                                                                           | 800    |
| 0.3                         | 42,500                                                                           | 870    |
| 0.4                         | 32,000                                                                           | 930    |
| 0.5                         | 25,500                                                                           | 930    |
| 0.75                        | 17,000                                                                           | 930    |
| 0.8                         | 16,000                                                                           | 930    |
| Depth of Cut<br>(R: Radius) |                                                                                  |        |
| Notes                       | ※1 Use cutting fluid.<br>※2 Adjust both spindle speed and feed at the same rate. |        |



X COATING 2-Flute Ball End Mill

X COATING 2-Flute Ball End Mill



● : Semi-standard Products, please inquire for price and delivery.  
▲ : The sizes will no longer be on sale after the stock runs out.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.         | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| ▲ 01-00523-00100 | R1         | 3                 | 2        | 9°                   | 4              | 60                 |
| ▲ 01-00523-00105 | R1.05      | 3.5               | 2.1      | 9°                   | 4              | 60                 |
| ▲ 01-00523-00110 | R1.1       | 3.5               | 2.2      | 9°                   | 4              | 60                 |
| ▲ 01-00523-00115 | R1.15      | 3.5               | 2.3      | 9°                   | 4              | 60                 |
| ▲ 01-00523-00120 | R1.2       | 3.5               | 2.4      | 9°                   | 4              | 60                 |
| ▲ 01-00523-00125 | R1.25      | 3.5               | 2.5      | 9°                   | 4              | 60                 |
| ▲ 01-00523-00130 | R1.3       | 4                 | 2.6      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00135 | R1.35      | 4                 | 2.7      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00140 | R1.4       | 4                 | 2.8      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00145 | R1.45      | 4                 | 2.9      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00150 | R1.5       | 4                 | 3        | 9°                   | 6              | 60                 |
| ▲ 01-00523-00155 | R1.55      | 5                 | 3.1      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00160 | R1.6       | 5                 | 3.2      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00165 | R1.65      | 5                 | 3.3      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00170 | R1.7       | 5                 | 3.4      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00175 | R1.75      | 5                 | 3.5      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00180 | R1.8       | 6                 | 3.6      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00185 | R1.85      | 6                 | 3.7      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00190 | R1.9       | 6                 | 3.8      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00195 | R1.95      | 6                 | 3.9      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00200 | R2         | 6                 | 4        | 9°                   | 6              | 60                 |
| ▲ 01-00523-00205 | R2.05      | 8                 | 4.1      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00210 | R2.1       | 8                 | 4.2      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00215 | R2.15      | 8                 | 4.3      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00220 | R2.2       | 8                 | 4.4      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00225 | R2.25      | 8                 | 4.5      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00230 | R2.3       | 8                 | 4.6      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00235 | R2.35      | 8                 | 4.7      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00240 | R2.4       | 8                 | 4.8      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00245 | R2.45      | 8                 | 4.9      | 9°                   | 6              | 60                 |
| ▲ 01-00523-00250 | R2.5       | 8                 | 5        | 9°                   | 6              | 60                 |
| ▲ 01-00523-00255 | R2.55      | 10                | 5.1      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00260 | R2.6       | 10                | 5.2      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00265 | R2.65      | 10                | 5.3      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00270 | R2.7       | 10                | 5.4      | 9°                   | 6              | 80                 |

How to Order

When you order, indicate NSB-2X (R).

※ (γ) is reference value.

Unit : mm

| Code No.         | Radius (R) | Length of Cut (ℓ) | Dia. (D) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) |
|------------------|------------|-------------------|----------|----------------------|----------------|--------------------|
| ▲ 01-00523-00275 | R2.75      | 10                | 5.5      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00280 | R2.8       | 10                | 5.6      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00285 | R2.85      | 10                | 5.7      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00290 | R2.9       | 10                | 5.8      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00295 | R2.95      | 10                | 5.9      | 9°                   | 6              | 80                 |
| ▲ 01-00523-00300 | R3         | 10                | 6        | —                    | 6              | 80                 |
| ▲ 01-00523-00310 | R3.1       | 13                | 6.2      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00320 | R3.2       | 13                | 6.4      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00330 | R3.3       | 13                | 6.6      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00340 | R3.4       | 13                | 6.8      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00350 | R3.5       | 13                | 7        | 9°                   | 8              | 90                 |
| ▲ 01-00523-00360 | R3.6       | 13                | 7.2      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00370 | R3.7       | 13                | 7.4      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00380 | R3.8       | 13                | 7.6      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00390 | R3.9       | 13                | 7.8      | 9°                   | 8              | 90                 |
| ▲ 01-00523-00400 | R4         | 13                | 8        | —                    | 8              | 90                 |
| ▲ 01-00523-00410 | R4.1       | 15                | 8.2      | 9°                   | 10             | 100                |
| ▲ 01-00523-00420 | R4.2       | 15                | 8.4      | 9°                   | 10             | 100                |
| ▲ 01-00523-00430 | R4.3       | 15                | 8.6      | 9°                   | 10             | 100                |
| ▲ 01-00523-00440 | R4.4       | 15                | 8.8      | 9°                   | 10             | 100                |
| ▲ 01-00523-00450 | R4.5       | 15                | 9        | 9°                   | 10             | 100                |
| ▲ 01-00523-00460 | R4.6       | 15                | 9.2      | 9°                   | 10             | 100                |
| ▲ 01-00523-00470 | R4.7       | 15                | 9.4      | 9°                   | 10             | 100                |
| ▲ 01-00523-00480 | R4.8       | 15                | 9.6      | 9°                   | 10             | 100                |
| ▲ 01-00523-00490 | R4.9       | 15                | 9.8      | 9°                   | 10             | 100                |
| ▲ 01-00523-00500 | R5         | 15                | 10       | —                    | 10             | 100                |
| ▲ 01-00523-00510 | R5.1       | 15                | 10.2     | 9°                   | 12             | 110                |
| ▲ 01-00523-00520 | R5.2       | 15                | 10.4     | 9°                   | 12             | 110                |
| ▲ 01-00523-00530 | R5.3       | 15                | 10.6     | 9°                   | 12             | 110                |
| ▲ 01-00523-00540 | R5.4       | 15                | 10.8     | 9°                   | 12             | 110                |
| ▲ 01-00523-00550 | R5.5       | 15                | 11       | 9°                   | 12             | 110                |
| ▲ 01-00523-00560 | R5.6       | 15                | 11.2     | 9°                   | 12             | 110                |
| ▲ 01-00523-00570 | R5.7       | 15                | 11.4     | 9°                   | 12             | 110                |
| ▲ 01-00523-00580 | R5.8       | 15                | 11.6     | 9°                   | 12             | 110                |
| ▲ 01-00523-00590 | R5.9       | 15                | 11.8     | 9°                   | 12             | 110                |
| ▲ 01-00523-00600 | R6         | 15                | 12       | —                    | 12             | 110                |
| ▲ 01-00523-00650 | R6.5       | 20                | 13       | —                    | 12             | 110                |
| ▲ 01-00523-00700 | R7         | 20                | 14       | 9°                   | 16             | 160                |
| ▲ 01-00523-00750 | R7.5       | 20                | 15       | 9°                   | 16             | 160                |
| ▲ 01-00523-00800 | R8         | 20                | 16       | —                    | 16             | 160                |
| ▲ 01-00523-00850 | R8.5       | 25                | 17       | 9°                   | 20             | 170                |
| ▲ 01-00523-00900 | R9         | 25                | 18       | 9°                   | 20             | 170                |
| ▲ 01-00523-00950 | R9.5       | 25                | 19       | 9°                   | 20             | 170                |
| ▲ 01-00523-01000 | R10        | 25                | 20       | —                    | 20             | 170                |

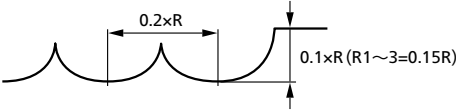


Coating  
Ball



Coating  
Ball

Recommended Milling Conditions

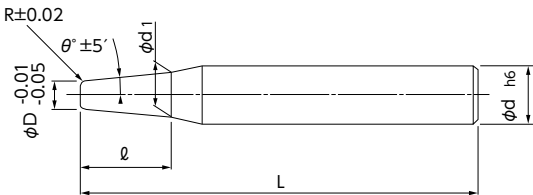
| Work Material                   | Carbon Steels<br>S50C                                                                                                                                                                                       |        | Alloy Steels<br>SCM・SKD・SUS |        | Prehardened Steels<br>HPM・NAK (～45HRC) |        |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------|--------|----------------------------------------|--------|
| Cutting Speed                   | 120m/min                                                                                                                                                                                                    |        | 100m/min                    |        | 80m/min                                |        |
| Radius                          | Spindle Speed                                                                                                                                                                                               | Feed   | Spindle Speed               | Feed   | Spindle Speed                          | Feed   |
|                                 | min <sup>-1</sup>                                                                                                                                                                                           | mm/min | min <sup>-1</sup>           | mm/min | min <sup>-1</sup>                      | mm/min |
| 1                               | 19,000                                                                                                                                                                                                      | 870    | 16,000                      | 760    | 12,700                                 | 520    |
| 1.5                             | 12,700                                                                                                                                                                                                      | 870    | 10,600                      | 760    | 8,450                                  | 520    |
| 2                               | 9,600                                                                                                                                                                                                       | 870    | 8,000                       | 760    | 6,400                                  | 520    |
| 2.5                             | 7,600                                                                                                                                                                                                       | 870    | 6,400                       | 760    | 5,100                                  | 520    |
| 3                               | 6,400                                                                                                                                                                                                       | 870    | 5,300                       | 760    | 4,250                                  | 520    |
| 4                               | 4,800                                                                                                                                                                                                       | 870    | 4,000                       | 760    | 3,200                                  | 520    |
| 5                               | 3,800                                                                                                                                                                                                       | 870    | 3,200                       | 760    | 2,550                                  | 520    |
| 6                               | 3,200                                                                                                                                                                                                       | 870    | 2,650                       | 760    | 2,150                                  | 520    |
| 8                               | 2,400                                                                                                                                                                                                       | 870    | 2,000                       | 760    | 1,600                                  | 520    |
| 10                              | 1,900                                                                                                                                                                                                       | 870    | 1,600                       | 760    | 1,300                                  | 520    |
| Depth of Cut<br><br>(R: Radius) |                                                                                                                         |        |                             |        |                                        |        |
| Notes                           | ※1 Use cutting fluid.<br>※2 This table shows milling conditions for flat surface. Adjust feed for inclined surface.<br>※3 Spindle speed and feed are changed according to overhang length and depth of cut. |        |                             |        |                                        |        |



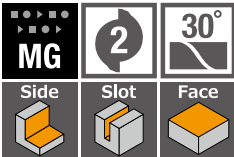


X COATING 2-Flute Taper Radius End Mill

X COATING 2-Flute Taper Radius End Mill



● : Semi-standard Products, please inquire for price and delivery.



Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.         | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Code No.                                      | Dia.<br>(D)      | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |                  |  |  |
|------------------|-------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|-----------------------------------------------|------------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|------------------|--|--|
| ▲ 01-00362-10102 | 1           | 30'                   | R0.2                    | 4                       | 1.07                         | 4                    | 45                       | ▲ 01-00362-15602                              | 1.5              | 4°                    | R0.2                    | 5                       | 2.20                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10103 |             |                       | R0.3                    | 4                       | 1.07                         | 4                    | 45                       | ▲ 01-00362-15603                              |                  |                       | R0.3                    | 5                       | 2.20                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10202 |             | 1°                    | R0.2                    | 4                       | 1.14                         | 4                    | 45                       | ▲ 01-00362-15605                              |                  |                       | R0.5                    | 5                       | 2.20                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10203 |             |                       | R0.3                    | 4                       | 1.14                         | 4                    | 45                       | ▲ 01-00362-15702                              |                  | 5°                    | R0.2                    | 5                       | 2.37                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10302 |             | 1°30'                 | R0.2                    | 4                       | 1.21                         | 4                    | 45                       | ▲ 01-00362-15703                              |                  |                       | R0.3                    | 5                       | 2.37                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10303 |             |                       | R0.3                    | 4                       | 1.21                         | 4                    | 45                       | ▲ 01-00362-15705                              |                  |                       | R0.5                    | 5                       | 2.37                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10402 |             | 2°                    | R0.2                    | 4                       | 1.28                         | 4                    | 45                       | ▲ 01-00362-15802                              |                  | 7°                    | R0.2                    | 5                       | 2.73                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10403 |             |                       | R0.3                    | 4                       | 1.28                         | 4                    | 45                       | ▲ 01-00362-15803                              |                  |                       | R0.3                    | 5                       | 2.73                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10502 |             | 3°                    | R0.2                    | 4                       | 1.42                         | 4                    | 45                       | ▲ 01-00362-15805                              |                  |                       | R0.5                    | 5                       | 2.73                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10503 |             |                       | R0.3                    | 4                       | 1.42                         | 4                    | 45                       | ▲ 01-00362-15902                              |                  | 10°                   | R0.2                    | 5                       | 3.26                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10602 |             | 4°                    | R0.2                    | 4                       | 1.56                         | 4                    | 45                       | ▲ 01-00362-15903                              |                  |                       | R0.3                    | 5                       | 3.26                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10603 |             |                       | R0.3                    | 4                       | 1.56                         | 4                    | 45                       | ▲ 01-00362-15905                              |                  |                       | R0.5                    | 5                       | 3.26                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10702 |             | 5°                    | R0.2                    | 4                       | 1.70                         | 4                    | 45                       | ▲ 01-00362-20102                              | 30'              | R0.2                  | 6                       | 2.10                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-10703 |             |                       | R0.3                    | 4                       | 1.70                         | 4                    | 45                       | ▲ 01-00362-20103                              |                  |                       | R0.3                    | 6                       | 2.10                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10802 |             | 7°                    | R0.2                    | 4                       | 1.98                         | 4                    | 45                       | ▲ 01-00362-20105                              |                  |                       | R0.5                    | 6                       | 2.10                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-10803 |             |                       | R0.3                    | 4                       | 1.98                         | 4                    | 45                       | ▲ 01-00362-20202                              | 1°               | R0.2                  | 6                       | 2.21                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-10902 |             | 10°                   | R0.2                    | 4                       | 2.41                         | 4                    | 45                       | ▲ 01-00362-20203                              |                  | R0.3                  | 6                       | 2.21                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-10903 |             |                       | R0.3                    | 4                       | 2.41                         | 4                    | 45                       | ▲ 01-00362-20205                              |                  | R0.5                  | 6                       | 2.21                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15102 |             | 1.5                   | 30'                     | R0.2                    | 5                            | 1.59                 | 4                        | 45                                            | ▲ 01-00362-20302 | 1°30'                 | R0.2                    | 6                       | 2.31                         | 4                    | 45                       |                  |  |  |
| ▲ 01-00362-15103 | R0.3        |                       |                         | 5                       | 1.59                         | 4                    | 45                       | ▲ 01-00362-20303                              | R0.3             |                       | 6                       | 2.31                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15105 | R0.5        |                       |                         | 5                       | 1.59                         | 4                    | 45                       | ▲ 01-00362-20305                              | R0.5             |                       | 6                       | 2.31                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15202 | 1°          |                       | R0.2                    | 5                       | 1.67                         | 4                    | 45                       | ▲ 01-00362-20402                              | 2°               | R0.2                  | 6                       | 2.42                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15203 |             |                       | R0.3                    | 5                       | 1.67                         | 4                    | 45                       | ▲ 01-00362-20403                              |                  | R0.3                  | 6                       | 2.42                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15205 |             |                       | R0.5                    | 5                       | 1.67                         | 4                    | 45                       | ▲ 01-00362-20405                              |                  | R0.5                  | 6                       | 2.42                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15302 | 1°30'       |                       | R0.2                    | 5                       | 1.76                         | 4                    | 45                       | ▲ 01-00362-20502                              | 3°               | R0.2                  | 6                       | 2.63                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15303 |             |                       | R0.3                    | 5                       | 1.76                         | 4                    | 45                       | ▲ 01-00362-20503                              |                  | R0.3                  | 6                       | 2.63                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15305 |             |                       | R0.5                    | 5                       | 1.76                         | 4                    | 45                       | ▲ 01-00362-20505                              |                  | R0.5                  | 6                       | 2.63                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15402 | 2°          |                       | R0.2                    | 5                       | 1.85                         | 4                    | 45                       | ▲ 01-00362-20602                              | 4°               | R0.2                  | 6                       | 2.84                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15403 |             |                       | R0.3                    | 5                       | 1.85                         | 4                    | 45                       | ▲ 01-00362-20603                              |                  | R0.3                  | 6                       | 2.84                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15405 |             |                       | R0.5                    | 5                       | 1.85                         | 4                    | 45                       | ▲ 01-00362-20605                              |                  | R0.5                  | 6                       | 2.84                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15502 | 3°          |                       | R0.2                    | 5                       | 2.02                         | 4                    | 45                       | ▲ 01-00362-20702                              | 5°               | R0.2                  | 6                       | 3.05                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15503 |             |                       | R0.3                    | 5                       | 2.02                         | 4                    | 45                       | ▲ 01-00362-20703                              |                  | R0.3                  | 6                       | 3.05                    | 4                            | 45                   |                          |                  |  |  |
| ▲ 01-00362-15505 |             |                       | R0.5                    | 5                       | 2.02                         | 4                    | 45                       | ▲ 01-00362-20705                              |                  | R0.5                  | 6                       | 3.05                    | 4                            | 45                   |                          |                  |  |  |
| How to Order     |             |                       |                         |                         |                              |                      |                          | When you order, indicate NTER-2X (D)×(θ)×(R). |                  |                       |                         |                         |                              |                      |                          | ▲ 01-00362-20802 |  |  |
|                  |             |                       |                         |                         |                              |                      |                          |                                               |                  |                       |                         |                         |                              |                      |                          | ▲ 01-00362-20803 |  |  |
|                  |             |                       |                         |                         |                              |                      |                          |                                               |                  |                       |                         |                         |                              |                      |                          | ▲ 01-00362-20805 |  |  |

How to Order

When you order, indicate NTER-2X (D)×(θ)×(R).

Unit : mm

| Code No.         | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Code No.         | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|------------------|-------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|------------------|-------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|
| ▲ 01-00362-20902 | 2           | 10°                   | R0.2                    | 6                       | 4.12                         | 6                    | 45                       | ▲ 01-00362-30202 | 3           | 1°                    | R0.2                    | 10                      | 3.35                         | 6                    | 50                       |
| ▲ 01-00362-20903 |             |                       | R0.3                    | 6                       | 4.12                         | 6                    | 45                       | ▲ 01-00362-30203 |             |                       | R0.3                    | 10                      | 3.35                         | 6                    | 50                       |
| ▲ 01-00362-20905 |             |                       | R0.5                    | 6                       | 4.12                         | 6                    | 45                       | ▲ 01-00362-30205 |             |                       | R0.5                    | 10                      | 3.35                         | 6                    | 50                       |
| ▲ 01-00362-25102 | 2.5         | 30′                   | R0.2                    | 8                       | 2.64                         | 4                    | 45                       | ▲ 01-00362-30210 |             | 1°30′                 | R1                      | 10                      | 3.35                         | 6                    | 50                       |
| ▲ 01-00362-25103 |             |                       | R0.3                    | 8                       | 2.64                         | 4                    | 45                       | ▲ 01-00362-30302 |             |                       | R0.2                    | 10                      | 3.52                         | 6                    | 50                       |
| ▲ 01-00362-25105 |             |                       | R0.5                    | 8                       | 2.64                         | 4                    | 45                       | ▲ 01-00362-30303 |             |                       | R0.3                    | 10                      | 3.52                         | 6                    | 50                       |
| ▲ 01-00362-25202 |             | 1°                    | R0.2                    | 8                       | 2.78                         | 4                    | 45                       | ▲ 01-00362-30305 |             |                       | R0.5                    | 10                      | 3.52                         | 6                    | 50                       |
| ▲ 01-00362-25203 |             |                       | R0.3                    | 8                       | 2.78                         | 4                    | 45                       | ▲ 01-00362-30310 |             | R1                    | 10                      | 3.52                    | 6                            | 50                   |                          |
| ▲ 01-00362-25205 |             |                       | R0.5                    | 8                       | 2.78                         | 4                    | 45                       | ▲ 01-00362-30402 |             | R0.2                  | 10                      | 3.70                    | 6                            | 50                   |                          |
| ▲ 01-00362-25302 |             | 1°30′                 | R0.2                    | 8                       | 2.92                         | 4                    | 45                       | ▲ 01-00362-30403 |             | 2°                    | R0.3                    | 10                      | 3.70                         | 6                    | 50                       |
| ▲ 01-00362-25303 |             |                       | R0.3                    | 8                       | 2.92                         | 4                    | 45                       | ▲ 01-00362-30405 |             |                       | R0.5                    | 10                      | 3.70                         | 6                    | 50                       |
| ▲ 01-00362-25305 |             |                       | R0.5                    | 8                       | 2.92                         | 4                    | 45                       | ▲ 01-00362-30410 |             |                       | R1                      | 10                      | 3.70                         | 6                    | 50                       |
| ▲ 01-00362-25402 |             | 2°                    | R0.2                    | 8                       | 3.06                         | 4                    | 45                       | ▲ 01-00362-30502 |             | 3°                    | R0.2                    | 10                      | 4.05                         | 6                    | 50                       |
| ▲ 01-00362-25403 |             |                       | R0.3                    | 8                       | 3.06                         | 4                    | 45                       | ▲ 01-00362-30503 |             |                       | R0.3                    | 10                      | 4.05                         | 6                    | 50                       |
| ▲ 01-00362-25405 |             |                       | R0.5                    | 8                       | 3.06                         | 4                    | 45                       | ▲ 01-00362-30505 |             |                       | R0.5                    | 10                      | 4.05                         | 6                    | 50                       |
| ▲ 01-00362-25502 | 3°          | R0.2                  | 8                       | 3.34                    | 4                            | 45                   | ▲ 01-00362-30510         | 4°               |             |                       | R1                      | 10                      | 4.05                         | 6                    | 50                       |
| ▲ 01-00362-25503 |             | R0.3                  | 8                       | 3.34                    | 4                            | 45                   | ▲ 01-00362-30602         |                  |             | R0.2                  | 10                      | 4.40                    | 6                            | 50                   |                          |
| ▲ 01-00362-25505 |             | R0.5                  | 8                       | 3.34                    | 4                            | 45                   | ▲ 01-00362-30603         |                  |             | R0.3                  | 10                      | 4.40                    | 6                            | 50                   |                          |
| ▲ 01-00362-25602 | 4°          | R0.2                  | 8                       | 3.62                    | 4                            | 45                   | ▲ 01-00362-30605         |                  |             | 5°                    | R0.5                    | 10                      | 4.40                         | 6                    | 50                       |
| ▲ 01-00362-25603 |             | R0.3                  | 8                       | 3.62                    | 4                            | 45                   | ▲ 01-00362-30610         | R1               |             |                       | 10                      | 4.40                    | 6                            | 50                   |                          |
| ▲ 01-00362-25605 |             | R0.5                  | 8                       | 3.62                    | 4                            | 45                   | ▲ 01-00362-30702         | R0.2             |             |                       | 10                      | 4.75                    | 6                            | 50                   |                          |
| ▲ 01-00362-25702 | 5°          | R0.2                  | 8                       | 3.90                    | 4                            | 45                   | ▲ 01-00362-30703         | 7°               |             |                       | R0.3                    | 10                      | 4.75                         | 6                    | 50                       |
| ▲ 01-00362-25703 |             | R0.3                  | 8                       | 3.90                    | 4                            | 45                   | ▲ 01-00362-30705         |                  |             | R0.5                  | 10                      | 4.75                    | 6                            | 50                   |                          |
| ▲ 01-00362-25705 |             | R0.5                  | 8                       | 3.90                    | 4                            | 45                   | ▲ 01-00362-30710         |                  |             | R1                    | 10                      | 4.75                    | 6                            | 50                   |                          |
| ▲ 01-00362-25802 | 7°          | R0.2                  | 8                       | 4.46                    | 6                            | 50                   | ▲ 01-00362-30802         |                  |             | 10°                   | R0.2                    | 10                      | 5.46                         | 6                    | 50                       |
| ▲ 01-00362-25803 |             | R0.3                  | 8                       | 4.46                    | 6                            | 50                   | ▲ 01-00362-30803         | R0.3             |             |                       | 10                      | 5.46                    | 6                            | 50                   |                          |
| ▲ 01-00362-25805 |             | R0.5                  | 8                       | 4.46                    | 6                            | 50                   | ▲ 01-00362-30805         | R0.5             |             |                       | 10                      | 5.46                    | 6                            | 50                   |                          |
| ▲ 01-00362-25902 | 10°         | R0.2                  | 8                       | 5.32                    | 6                            | 50                   | ▲ 01-00362-30810         | 4                | 30′         |                       | R1                      | 10                      | 5.46                         | 6                    | 50                       |
| ▲ 01-00362-25903 |             | R0.3                  | 8                       | 5.32                    | 6                            | 50                   | ▲ 01-00362-30902         |                  |             | R0.2                  | 10                      | 6.53                    | 6                            | 50                   |                          |
| ▲ 01-00362-25905 |             | R0.5                  | 8                       | 5.32                    | 6                            | 50                   | ▲ 01-00362-30903         |                  |             | R0.3                  | 10                      | 6.53                    | 6                            | 50                   |                          |
| ▲ 01-00362-30102 | 3           | 30′                   | R0.2                    | 10                      | 3.17                         | 6                    | 50                       |                  |             | ▲ 01-00362-30905      | R0.5                    | 10                      | 6.53                         | 6                    | 50                       |
| ▲ 01-00362-30103 |             |                       | R0.3                    | 10                      | 3.17                         | 6                    | 50                       | ▲ 01-00362-30910 | R1          | 10                    | 6.53                    | 6                       | 50                           |                      |                          |
| ▲ 01-00362-30105 |             |                       | R0.5                    | 10                      | 3.17                         | 6                    | 50                       | ▲ 01-00362-40102 | 4           | 30′                   | R0.2                    | 15                      | 4.26                         | 6                    | 50                       |
| ▲ 01-00362-30110 | R1          | 10                    | 3.17                    | 6                       | 50                           | ▲ 01-00362-40103     | R0.3                     | 15               |             |                       | 4.26                    | 6                       | 50                           |                      |                          |
|                  |             |                       |                         |                         |                              | ▲ 01-00362-40105     | R0.5                     | 15               |             |                       | 4.26                    | 6                       | 50                           |                      |                          |
|                  |             |                       |                         |                         |                              |                      | ▲ 01-00362-40110         |                  |             |                       |                         |                         |                              |                      |                          |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.                                      | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) | Code No.       | Dia.<br>(D)    | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |
|-----------------------------------------------|-------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|----------------|----------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|
| 01-00362-40202                                | 4           | 1°                    | R0.2                    | 15                      | 4.52                         | 6                    | 50                       | 01-00362-50102 | 5              | 30'                   | R0.2                    | 20                      | 5.35                         | 6                    | 55                       |
| 01-00362-40203                                |             |                       | R0.3                    | 15                      | 4.52                         | 6                    | 50                       | 01-00362-50103 |                |                       | R0.3                    | 20                      | 5.35                         | 6                    | 55                       |
| 01-00362-40205                                |             |                       | R0.5                    | 15                      | 4.52                         | 6                    | 50                       | 01-00362-50105 |                |                       | R0.5                    | 20                      | 5.35                         | 6                    | 55                       |
| 01-00362-40210                                |             |                       | R1                      | 15                      | 4.52                         | 6                    | 50                       | 01-00362-50110 |                |                       | R1                      | 20                      | 5.35                         | 6                    | 55                       |
| 01-00362-40302                                |             | 1°30'                 | R0.2                    | 15                      | 4.79                         | 6                    | 50                       | 01-00362-50115 |                | 1°                    | R1.5                    | 20                      | 5.35                         | 6                    | 55                       |
| 01-00362-40303                                |             |                       | R0.3                    | 15                      | 4.79                         | 6                    | 50                       | 01-00362-50202 |                |                       | R0.2                    | 20                      | 5.70                         | 6                    | 55                       |
| 01-00362-40305                                |             |                       | R0.5                    | 15                      | 4.79                         | 6                    | 50                       | 01-00362-50203 |                |                       | R0.3                    | 20                      | 5.70                         | 6                    | 55                       |
| 01-00362-40310                                |             | R1                    | 15                      | 4.79                    | 6                            | 50                   | 01-00362-50205           | R0.5           |                |                       | 20                      | 5.70                    | 6                            | 55                   |                          |
| 01-00362-40402                                |             | 2°                    | R0.2                    | 15                      | 5.05                         | 6                    | 50                       | 01-00362-50210 | R1             |                       | 20                      | 5.70                    | 6                            | 55                   |                          |
| 01-00362-40403                                |             |                       | R0.3                    | 15                      | 5.05                         | 6                    | 50                       | 01-00362-50215 | R1.5           |                       | 20                      | 5.70                    | 6                            | 55                   |                          |
| 01-00362-40405                                |             |                       | R0.5                    | 15                      | 5.05                         | 6                    | 50                       | 01-00362-50302 | R0.2           | 20                    | 6.05                    | 6                       | 55                           |                      |                          |
| 01-00362-40410                                |             | R1                    | 15                      | 5.05                    | 6                            | 50                   | 01-00362-50303           | 1°30'          | R0.3           | 20                    | 6.05                    | 6                       | 55                           |                      |                          |
| 01-00362-40502                                |             | 3°                    | R0.2                    | 15                      | 5.57                         | 6                    | 50                       |                | 01-00362-50305 | R0.5                  | 20                      | 6.05                    | 6                            | 55                   |                          |
| 01-00362-40503                                |             |                       | R0.3                    | 15                      | 5.57                         | 6                    | 50                       |                | 01-00362-50310 | R1                    | 20                      | 6.05                    | 6                            | 55                   |                          |
| 01-00362-40505                                |             |                       | R0.5                    | 15                      | 5.57                         | 6                    | 50                       |                | 01-00362-50315 | R1.5                  | 20                      | 6.05                    | 6                            | 55                   |                          |
| 01-00362-40510                                |             |                       | R1                      | 15                      | 5.57                         | 6                    | 50                       | 01-00362-50402 | 2°             | R0.2                  | 20                      | 6.40                    | 6                            | 55                   |                          |
| 01-00362-40602                                |             | 4°                    | R0.2                    | 15                      | 6.10                         | 6                    | 55                       | 01-00362-50403 |                | R0.3                  | 20                      | 6.40                    | 6                            | 55                   |                          |
| 01-00362-40603                                |             |                       | R0.3                    | 15                      | 6.10                         | 6                    | 55                       | 01-00362-50405 |                | R0.5                  | 20                      | 6.40                    | 6                            | 55                   |                          |
| 01-00362-40605                                |             |                       | R0.5                    | 15                      | 6.10                         | 6                    | 55                       | 01-00362-50410 |                | R1                    | 20                      | 6.40                    | 6                            | 55                   |                          |
| 01-00362-40610                                |             |                       | R1                      | 15                      | 6.10                         | 6                    | 55                       | 01-00362-50415 | R1.5           | 20                    | 6.40                    | 6                       | 55                           |                      |                          |
| 01-00362-40702                                |             | 5°                    | R0.2                    | 15                      | 6.62                         | 6                    | 55                       | 01-00362-50502 | 3°             | R0.2                  | 20                      | 7.10                    | 6                            | 55                   |                          |
| 01-00362-40703                                |             |                       | R0.3                    | 15                      | 6.62                         | 6                    | 55                       | 01-00362-50503 |                | R0.3                  | 20                      | 7.10                    | 6                            | 55                   |                          |
| 01-00362-40705                                |             |                       | R0.5                    | 15                      | 6.62                         | 6                    | 55                       | 01-00362-50505 |                | R0.5                  | 20                      | 7.10                    | 6                            | 55                   |                          |
| 01-00362-40710                                |             |                       | R1                      | 15                      | 6.62                         | 6                    | 55                       | 01-00362-50510 |                | R1                    | 20                      | 7.10                    | 6                            | 55                   |                          |
| 01-00362-40802                                |             | 7°                    | R0.2                    | 15                      | 7.68                         | 6                    | 55                       | 01-00362-50515 | 4°             | R1.5                  | 20                      | 7.10                    | 6                            | 55                   |                          |
| 01-00362-40803                                |             |                       | R0.3                    | 15                      | 7.68                         | 6                    | 55                       | 01-00362-50602 |                | R0.2                  | 20                      | 7.80                    | 6                            | 60                   |                          |
| 01-00362-40805                                |             |                       | R0.5                    | 15                      | 7.68                         | 6                    | 55                       | 01-00362-50603 |                | R0.3                  | 20                      | 7.80                    | 6                            | 60                   |                          |
| 01-00362-40810                                |             |                       | R1                      | 15                      | 7.68                         | 6                    | 55                       | 01-00362-50605 |                | R0.5                  | 20                      | 7.80                    | 6                            | 60                   |                          |
| 01-00362-40902                                | 10°         | 10°                   | R0.2                    | 15                      | 9.29                         | 8                    | 60                       | 01-00362-50610 | 5°             | 2°                    | R1                      | 20                      | 7.80                         | 6                    | 60                       |
| 01-00362-40903                                |             |                       | R0.3                    | 15                      | 9.29                         | 8                    | 60                       | 01-00362-50615 |                |                       | R1.5                    | 20                      | 7.80                         | 6                    | 60                       |
| 01-00362-40905                                |             |                       | R0.5                    | 15                      | 9.29                         | 8                    | 60                       | 01-00362-50702 |                |                       | R0.2                    | 20                      | 8.50                         | 8                    | 60                       |
| 01-00362-40910                                |             |                       | R1                      | 15                      | 9.29                         | 8                    | 60                       | 01-00362-50703 |                |                       | R0.3                    | 20                      | 8.50                         | 8                    | 60                       |
| How to Order                                  |             |                       |                         |                         |                              |                      |                          | 01-00362-50705 |                |                       | R0.5                    | 20                      | 8.50                         | 8                    | 60                       |
| When you order, indicate NTER-2X (D)×(θ)×(R). |             |                       |                         |                         |                              |                      |                          | 01-00362-50710 |                |                       | R1                      | 20                      | 8.50                         | 8                    | 60                       |
|                                               |             |                       |                         |                         |                              |                      |                          | 01-00362-50715 |                |                       | R1.5                    | 20                      | 8.50                         | 8                    | 60                       |
|                                               |             |                       |                         |                         |                              |                      |                          |                |                |                       |                         |                         |                              |                      |                          |

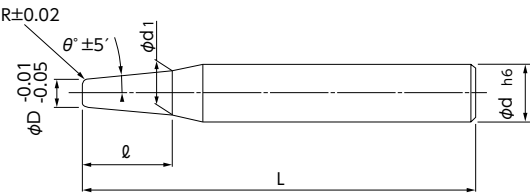
Unit : mm

| Code No.       | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |                | Code No.       | Dia.<br>(D) | Taper<br>Angle<br>(θ) | Corner<br>Radius<br>(R) | Length<br>of Cut<br>(ℓ) | Dia. at<br>Large End<br>(d1) | Shank<br>Dia.<br>(d) | Overall<br>Length<br>(L) |  |
|----------------|-------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|----------------|----------------|-------------|-----------------------|-------------------------|-------------------------|------------------------------|----------------------|--------------------------|--|
| 01-00362-50802 | 5           | 7°                    | R0.2                    | 20                      | 9.91                         | 8                    | 60                       | ▲              | 01-00362-60502 | 6           | 3°                    | R0.2                    | 20                      | 8.10                         | 8                    | 60                       |  |
| 01-00362-50803 |             |                       | R0.3                    | 20                      | 9.91                         | 8                    | 60                       | ▲              | 01-00362-60503 |             |                       | R0.3                    | 20                      | 8.10                         | 8                    | 60                       |  |
| 01-00362-50805 |             |                       | R0.5                    | 20                      | 9.91                         | 8                    | 60                       | ▲              | 01-00362-60505 |             |                       | R0.5                    | 20                      | 8.10                         | 8                    | 60                       |  |
| 01-00362-50810 |             |                       | R1                      | 20                      | 9.91                         | 8                    | 60                       | ▲              | 01-00362-60510 |             |                       | R1                      | 20                      | 8.10                         | 8                    | 60                       |  |
| 01-00362-50815 |             |                       | R1.5                    | 20                      | 9.91                         | 8                    | 60                       | ▲              | 01-00362-60515 |             |                       | R1.5                    | 20                      | 8.10                         | 8                    | 60                       |  |
| 01-00362-50902 |             | 10°                   | R0.2                    | 20                      | 12.05                        | 12                   | 70                       | ▲              | 01-00362-60520 |             | 4°                    | R0.2                    | 20                      | 8.80                         | 8                    | 65                       |  |
| 01-00362-50903 |             |                       | R0.3                    | 20                      | 12.05                        | 12                   | 70                       | ▲              | 01-00362-60602 |             |                       | R0.3                    | 20                      | 8.80                         | 8                    | 65                       |  |
| 01-00362-50905 |             |                       | R0.5                    | 20                      | 12.05                        | 12                   | 70                       | ▲              | 01-00362-60603 |             |                       | R0.5                    | 20                      | 8.80                         | 8                    | 65                       |  |
| 01-00362-50910 |             |                       | R1                      | 20                      | 12.05                        | 12                   | 70                       | ▲              | 01-00362-60605 |             |                       | R1                      | 20                      | 8.80                         | 8                    | 65                       |  |
| 01-00362-50915 |             |                       | R1.5                    | 20                      | 12.05                        | 12                   | 70                       | ▲              | 01-00362-60610 |             |                       | R1.5                    | 20                      | 8.80                         | 8                    | 65                       |  |
| 01-00362-60102 | 6           | 30'                   | R0.2                    | 20                      | 6.35                         | 6                    | 55                       | ▲              | 01-00362-60615 | 6           | 5°                    | R0.2                    | 20                      | 9.50                         | 8                    | 65                       |  |
| 01-00362-60103 |             |                       | R0.3                    | 20                      | 6.35                         | 6                    | 55                       | ▲              | 01-00362-60620 |             |                       | R0.3                    | 20                      | 9.50                         | 8                    | 65                       |  |
| 01-00362-60105 |             |                       | R0.5                    | 20                      | 6.35                         | 6                    | 55                       | ▲              | 01-00362-60702 |             |                       | R0.5                    | 20                      | 9.50                         | 8                    | 65                       |  |
| 01-00362-60110 |             |                       | R1                      | 20                      | 6.35                         | 6                    | 55                       | ▲              | 01-00362-60703 |             |                       | R1                      | 20                      | 9.50                         | 8                    | 65                       |  |
| 01-00362-60115 |             |                       | R1.5                    | 20                      | 6.35                         | 6                    | 55                       | ▲              | 01-00362-60705 |             |                       | R1.5                    | 20                      | 9.50                         | 8                    | 65                       |  |
| 01-00362-60120 |             |                       | R2                      | 20                      | 6.35                         | 6                    | 55                       | ▲              | 01-00362-60710 |             |                       | R2                      | 20                      | 9.50                         | 8                    | 65                       |  |
| 01-00362-60202 |             | 1°                    | R0.2                    | 20                      | 6.70                         | 6                    | 55                       | ▲              | 01-00362-60715 |             | 7°                    | R0.2                    | 20                      | 10.91                        | 10                   | 70                       |  |
| 01-00362-60203 |             |                       | R0.3                    | 20                      | 6.70                         | 6                    | 55                       | ▲              | 01-00362-60720 |             |                       | R0.3                    | 20                      | 10.91                        | 10                   | 70                       |  |
| 01-00362-60205 |             |                       | R0.5                    | 20                      | 6.70                         | 6                    | 55                       | ▲              | 01-00362-60802 |             |                       | R0.5                    | 20                      | 10.91                        | 10                   | 70                       |  |
| 01-00362-60210 |             |                       | R1                      | 20                      | 6.70                         | 6                    | 55                       | ▲              | 01-00362-60803 |             |                       | R1                      | 20                      | 10.91                        | 10                   | 70                       |  |
| 01-00362-60215 |             |                       | R1.5                    | 20                      | 6.70                         | 6                    | 55                       | ▲              | 01-00362-60805 |             |                       | R1.5                    | 20                      | 10.91                        | 10                   | 70                       |  |
| 01-00362-60220 |             |                       | R2                      | 20                      | 6.70                         | 6                    | 55                       | ▲              | 01-00362-60810 |             |                       | R2                      | 20                      | 10.91                        | 10                   | 70                       |  |
| 01-00362-60302 |             | 1°30'                 | R0.2                    | 20                      | 7.05                         | 6                    | 55                       | ▲              | 01-00362-60815 |             | 10°                   | R0.2                    | 20                      | 13.05                        | 12                   | 80                       |  |
| 01-00362-60303 |             |                       | R0.3                    | 20                      | 7.05                         | 6                    | 55                       | ▲              | 01-00362-60820 |             |                       | R0.3                    | 20                      | 13.05                        | 12                   | 80                       |  |
| 01-00362-60305 |             |                       | R0.5                    | 20                      | 7.05                         | 6                    | 55                       | ▲              | 01-00362-60902 |             |                       | R0.5                    | 20                      | 13.05                        | 12                   | 80                       |  |
| 01-00362-60310 |             |                       | R1                      | 20                      | 7.05                         | 6                    | 55                       | ▲              | 01-00362-60903 |             |                       | R1                      | 20                      | 13.05                        | 12                   | 80                       |  |
| 01-00362-60315 |             |                       | R1.5                    | 20                      | 7.05                         | 6                    | 55                       | ▲              | 01-00362-60905 |             |                       | R1.5                    | 20                      | 13.05                        | 12                   | 80                       |  |
| 01-00362-60320 |             |                       | R2                      | 20                      | 7.05                         | 6                    | 55                       | ▲              | 01-00362-60910 |             |                       | R2                      | 20                      | 13.05                        | 12                   | 80                       |  |
| 01-00362-60402 | 2°          | R0.2                  | 20                      | 7.40                    | 6                            | 55                   | ▲                        | 01-00362-60915 |                |             |                       |                         |                         |                              |                      |                          |  |
| 01-00362-60403 |             | R0.3                  | 20                      | 7.40                    | 6                            | 55                   | ▲                        | 01-00362-60920 |                |             |                       |                         |                         |                              |                      |                          |  |
| 01-00362-60405 |             | R0.5                  | 20                      | 7.40                    | 6                            | 55                   |                          |                |                |             |                       |                         |                         |                              |                      |                          |  |
| 01-00362-60410 |             | R1                    | 20                      | 7.40                    | 6                            | 55                   |                          |                |                |             |                       |                         |                         |                              |                      |                          |  |
| 01-00362-60415 |             | R1.5                  | 20                      | 7.40                    | 6                            | 55                   |                          |                |                |             |                       |                         |                         |                              |                      |                          |  |
| 01-00362-60420 |             | R2                    | 20                      | 7.40                    | 6                            | 55                   |                          |                |                |             |                       |                         |                         |                              |                      |                          |  |
|                |             |                       |                         |                         |                              |                      |                          |                |                |             |                       |                         |                         |                              |                      |                          |  |
|                |             |                       |                         |                         |                              |                      |                          |                |                |             |                       |                         |                         |                              |                      |                          |  |



X COATING 2-Flute Taper Radius End Mill for Runner

X COATING 2-Flute Taper Radius End Mill for Runner



● : Semi-standard Products, please inquire for price and delivery.

Work Material

| Carbon Steels | Alloy Steels<br>Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|---------------|-----------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
|               |                             |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ○             | ○                           | ○                  |                 |         | ○                |                | ○               | ○      | ○     |

Specified distributor inventory

Discontinued Products

Unit : mm

| Code No.       | Dia.<br>(D) | Taper Angle<br>(θ) | Corner Radius<br>(R) | Length of Cut<br>(ℓ) | Dia. at Large End<br>(d1) | Shank Dia.<br>(d) | Overall Length<br>(L) |  |
|----------------|-------------|--------------------|----------------------|----------------------|---------------------------|-------------------|-----------------------|--|
| 01-00732-20103 | 2           | 7°                 | R0.3                 | 5                    | 3.23                      | 4                 | 45                    |  |
| 01-00732-20105 |             |                    | R0.5                 | 5                    | 3.23                      | 4                 | 45                    |  |
| 01-00732-25103 | 2.5         |                    | R0.3                 | 6                    | 3.97                      | 4                 | 45                    |  |
| 01-00732-25105 |             |                    | R0.5                 | 6                    | 3.97                      | 4                 | 45                    |  |
| 01-00732-30103 | 3           |                    | R0.3                 | 7                    | 4.72                      | 6                 | 55                    |  |
| 01-00732-30105 |             |                    | R0.5                 | 7                    | 4.72                      | 6                 | 55                    |  |
| 01-00732-30110 | 3.5         |                    | R1                   | 7                    | 4.72                      | 6                 | 55                    |  |
| 01-00732-35103 |             |                    | R0.3                 | 7                    | 5.22                      | 6                 | 55                    |  |
| 01-00732-35105 | 4           |                    | R0.5                 | 7                    | 5.22                      | 6                 | 55                    |  |
| 01-00732-35110 |             |                    | R1                   | 7                    | 5.22                      | 6                 | 55                    |  |
| 01-00732-40103 | 4.5         |                    | R0.3                 | 8                    | 5.96                      | 6                 | 55                    |  |
| 01-00732-40105 |             |                    | R0.5                 | 8                    | 5.96                      | 6                 | 55                    |  |
| 01-00732-40110 | 5           |                    | R1                   | 8                    | 5.96                      | 6                 | 55                    |  |
| 01-00732-45103 |             |                    | R0.3                 | 9                    | 6.71                      | 8                 | 60                    |  |
| 01-00732-45105 | 6           |                    | R0.5                 | 9                    | 6.71                      | 8                 | 60                    |  |
| 01-00732-45110 |             |                    | R1                   | 9                    | 6.71                      | 8                 | 60                    |  |
| 01-00732-50103 | 6.5         |                    | R0.3                 | 10                   | 7.46                      | 8                 | 60                    |  |
| 01-00732-50105 |             |                    | R0.5                 | 10                   | 7.46                      | 8                 | 60                    |  |
| 01-00732-50110 | 7           |                    | R1                   | 10                   | 7.46                      | 8                 | 60                    |  |
| 01-00732-50115 |             |                    | R1.5                 | 10                   | 7.46                      | 8                 | 60                    |  |
| 01-00732-60103 | 7.5         |                    | R0.3                 | 12                   | 8.95                      | 10                | 70                    |  |
| 01-00732-60105 |             |                    | R0.5                 | 12                   | 8.95                      | 10                | 70                    |  |
| 01-00732-60110 | 8           |                    | R1                   | 12                   | 8.95                      | 10                | 70                    |  |
| 01-00732-60115 |             |                    | R1.5                 | 12                   | 8.95                      | 10                | 70                    |  |
| 01-00732-60120 | 8.5         |                    | R2                   | 12                   | 8.95                      | 10                | 70                    |  |
| 01-00732-20203 | 2           | 10°                | R0.3                 | 5                    | 3.76                      | 4                 | 45                    |  |
| 01-00732-20205 |             |                    | R0.5                 | 5                    | 3.76                      | 4                 | 45                    |  |
| 01-00732-25203 | 2.5         |                    | R0.3                 | 6                    | 4.62                      | 6                 | 55                    |  |
| 01-00732-25205 |             |                    | R0.5                 | 6                    | 4.62                      | 6                 | 55                    |  |
| 01-00732-30203 | 3           |                    | R0.3                 | 7                    | 5.47                      | 6                 | 55                    |  |
| 01-00732-30205 |             |                    | R0.5                 | 7                    | 5.47                      | 6                 | 55                    |  |
| 01-00732-30210 | 3.5         |                    | R1                   | 7                    | 5.47                      | 6                 | 55                    |  |
| 01-00732-35203 |             |                    | R0.3                 | 7                    | 5.97                      | 6                 | 55                    |  |
| 01-00732-35205 | 4           |                    | R0.5                 | 7                    | 5.97                      | 6                 | 55                    |  |
| 01-00732-35210 |             |                    | R1                   | 7                    | 5.97                      | 6                 | 55                    |  |
| 01-00732-40203 | 4.5         |                    | R0.3                 | 8                    | 6.82                      | 8                 | 60                    |  |
| 01-00732-40205 |             |                    | R0.5                 | 8                    | 6.82                      | 8                 | 60                    |  |
| 01-00732-40210 | 5           |                    | R1                   | 8                    | 6.82                      | 8                 | 60                    |  |
| 01-00732-45203 |             |                    | R0.3                 | 9                    | 7.67                      | 8                 | 60                    |  |
| 01-00732-45205 | 5.5         |                    | R0.5                 | 9                    | 7.67                      | 8                 | 60                    |  |
| 01-00732-45210 |             |                    | R1                   | 9                    | 7.67                      | 8                 | 60                    |  |

How to Order

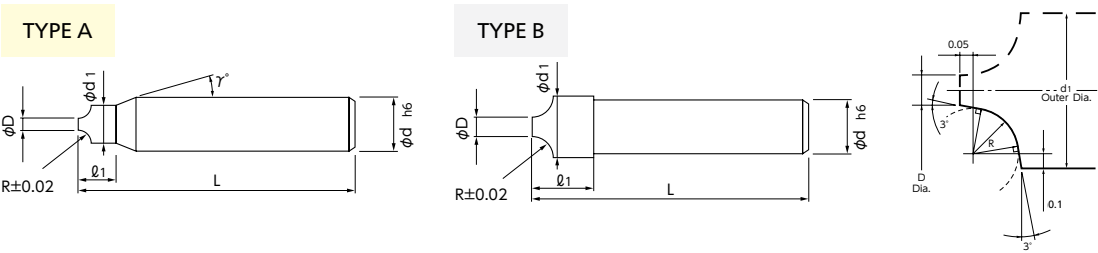
When you order, indicate NERR-2X (D)×(θ)×(R).

| Code No.       | Dia.<br>(D) | Taper Angle<br>(θ) | Corner Radius<br>(R) | Length of Cut<br>(ℓ) | Dia. at Large End<br>(d1) | Shank Dia.<br>(d) | Overall Length<br>(L) |
|----------------|-------------|--------------------|----------------------|----------------------|---------------------------|-------------------|-----------------------|
| 01-00732-50203 | 5           | 10°                | R0.3                 | 10                   | 8.53                      | 10                | 70                    |
| 01-00732-50205 |             |                    | R0.5                 | 10                   | 8.53                      | 10                | 70                    |
| 01-00732-50210 |             |                    | R1                   | 10                   | 8.53                      | 10                | 70                    |
| 01-00732-50215 |             |                    | R1.5                 | 10                   | 8.53                      | 10                | 70                    |
| 01-00732-60203 | 6           |                    | R0.3                 | 12                   | 10.23                     | 10                | 70                    |
| 01-00732-60205 |             |                    | R0.5                 | 12                   | 10.23                     | 10                | 70                    |
| 01-00732-60210 |             |                    | R1                   | 12                   | 10.23                     | 10                | 70                    |
| 01-00732-60215 |             |                    | R1.5                 | 12                   | 10.23                     | 10                | 70                    |
| 01-00732-60220 |             |                    | R2                   | 12                   | 10.23                     | 10                | 70                    |
| 01-00732-20303 | 2           |                    | R0.3                 | 5                    | 4.13                      | 4                 | 45                    |
| 01-00732-20305 |             |                    | R0.5                 | 5                    | 4.13                      | 4                 | 45                    |
| 01-00732-25303 | 2.5         |                    | R0.3                 | 6                    | 5.05                      | 6                 | 55                    |
| 01-00732-25305 |             | R0.5               | 6                    | 5.05                 | 6                         | 55                |                       |
| 01-00732-30303 | 3           | R0.3               | 7                    | 5.98                 | 6                         | 55                |                       |
| 01-00732-30305 |             | R0.5               | 7                    | 5.98                 | 6                         | 55                |                       |
| 01-00732-30310 |             | R1                 | 7                    | 5.98                 | 6                         | 55                |                       |
| 01-00732-35303 | 3.5         | R0.3               | 7                    | 6.48                 | 8                         | 60                |                       |
| 01-00732-35305 |             | R0.5               | 7                    | 6.48                 | 8                         | 60                |                       |
| 01-00732-35310 |             | R1                 | 7                    | 6.48                 | 8                         | 60                |                       |
| 01-00732-40303 | 4           | R0.3               | 8                    | 7.40                 | 8                         | 60                |                       |
| 01-00732-40305 |             | R0.5               | 8                    | 7.40                 | 8                         | 60                |                       |
| 01-00732-40310 |             | R1                 | 8                    | 7.40                 | 8                         | 60                |                       |
| 01-00732-45303 | 4.5         | R0.3               | 9                    | 8.33                 | 8                         | 60                |                       |
| 01-00732-45305 |             | R0.5               | 9                    | 8.33                 | 8                         | 60                |                       |
| 01-00732-45310 |             | R1                 | 9                    | 8.33                 | 8                         | 60                |                       |
| 01-00732-50303 | 5           | R0.3               | 10                   | 9.25                 | 10                        | 70                |                       |
| 01-00732-50305 |             | R0.5               | 10                   | 9.25                 | 10                        | 70                |                       |
| 01-00732-50310 |             | R1                 | 10                   | 9.25                 | 10                        | 70                |                       |
| 01-00732-50315 |             | R1.5               | 10                   | 9.25                 | 10                        | 70                |                       |
| 01-00732-60303 | 6           | R0.3               | 12                   | 11.10                | 10                        | 70                |                       |
| 01-00732-60305 |             | R0.5               | 12                   | 11.10                | 10                        | 70                |                       |
| 01-00732-60310 |             | R1                 | 12                   | 11.10                | 10                        | 70                |                       |
| 01-00732-60315 |             | R1.5               | 12                   | 11.10                | 10                        | 70                |                       |
| 01-00732-60320 |             | R2                 | 12                   | 11.10                | 10                        | 70                |                       |
| 01-00732-20403 | 2           | 15°                | R0.3                 | 5                    | 4.68                      | 6                 | 55                    |
| 01-00732-20405 |             |                    | R0.5                 | 5                    | 4.68                      | 6                 | 55                    |
| 01-00732-25403 | 2.5         |                    | R0.3                 | 6                    | 5.72                      | 6                 | 55                    |
| 01-00732-25405 |             |                    | R0.5                 | 6                    | 5.72                      | 6                 | 55                    |
| 01-00732-30403 | 3           |                    | R0.3                 | 7                    | 6.75                      | 6                 | 55                    |
| 01-00732-30405 |             |                    | R0.5                 | 7                    | 6.75                      | 6                 | 55                    |
| 01-00732-30410 |             |                    | R1                   | 7                    | 6.75                      | 6                 | 55                    |
| 01-00732-35403 | 3.5         |                    | R0.3                 | 7                    | 7.25                      | 8                 | 60                    |
| 01-00732-35405 |             |                    | R0.5                 | 7                    | 7.25                      | 8                 | 60                    |
| 01-00732-35410 |             |                    | R1                   | 7                    | 7.25                      | 8                 | 60                    |
| 01-00732-40403 | 4           |                    | R0.3                 | 8                    | 8.29                      | 8                 | 60                    |
| 01-00732-40405 |             |                    | R0.5                 | 8                    | 8.29                      | 8                 | 60                    |
| 01-00732-40410 |             |                    | R1                   | 8                    | 8.29                      | 8                 | 60                    |
| 01-00732-45403 | 4.5         |                    | R0.3                 | 9                    | 9.32                      | 10                | 70                    |
| 01-00732-45405 |             |                    | R0.5                 | 9                    | 9.32                      | 10                | 70                    |
| 01-00732-45410 |             |                    | R1                   | 9                    | 9.32                      | 10                | 70                    |
| 01-00732-50403 | 5           |                    | R0.3                 | 10                   | 10.36                     | 10                | 70                    |
| 01-00732-50405 |             |                    | R0.5                 | 10                   | 10.36                     | 10                | 70                    |
| 01-00732-50410 |             |                    | R1                   | 10                   | 10.36                     | 10                | 70                    |
| 01-00732-50415 |             |                    | R1.5                 | 10                   | 10.36                     | 10                | 70                    |
| 01-00732-60403 | 6           |                    | R0.3                 | 12                   | 12.43                     | 12                | 75                    |
| 01-00732-60405 |             |                    | R0.5                 | 12                   | 12.43                     | 12                | 75                    |
| 01-00732-60410 |             |                    | R1                   | 12                   | 12.43                     | 12                | 75                    |
| 01-00732-60415 |             |                    | R1.5                 | 12                   | 12.43                     | 12                | 75                    |
| 01-00732-60420 |             |                    | R2                   | 12                   | 12.43                     | 12                | 75                    |



X COATING 2-Flute Inner Radius Cutter

Recommended Milling Conditions



● ■ : Semi-standard Products, please inquire for price and delivery.

| Work Material |                          |                    |                 |         |                  |                |                 |        |       |
|---------------|--------------------------|--------------------|-----------------|---------|------------------|----------------|-----------------|--------|-------|
| Carbon Steels | Alloy Steels・Tool Steels | Prehardened Steels | Hardened Steels |         | Stainless Steels | Titanium Alloy | Aluminium Alloy | Copper | Resin |
|               |                          |                    | ~ 55HRC         | 55HRC ~ |                  |                |                 |        |       |
| ◎             | ◎                        | ◎                  |                 |         | ○                |                | ○               | ○      | ○     |

■ Specified distributor inventory

▲ Discontinued Products

Unit : mm

| Code No.           | Radius (R) | Dia. (D) | Outer Dia. (d1) | Outer Dia. Length (ℓ1) | Neck Taper Angle (γ) | Type | Shank Dia. (d) | Overall Length (L) |
|--------------------|------------|----------|-----------------|------------------------|----------------------|------|----------------|--------------------|
| ▲ ■ 01-00913-00500 | R0.5       | 1.5      | 2.7             | 4                      | 9°                   | A    | 4              | 45                 |
| ▲ ■ 01-00913-00750 | R0.75      | 1.5      | 3.2             | 4                      | 9°                   |      | 4              | 45                 |
| ▲ ■ 01-00913-01000 | R1         | 1.5      | 3.7             | 4                      | 9°                   |      | 4              | 45                 |
| ▲ ■ 01-00913-01250 | R1.25      | 1.5      | 4.2             | 4                      | —                    | B    | 4              | 45                 |
| ▲ ■ 01-00913-01500 | R1.5       | 1.5      | 4.7             | 4                      | 9°                   | A    | 6              | 45                 |
| ▲ ■ 01-00913-01750 | R1.75      | 1.5      | 5.2             | 4                      | 9°                   |      | 6              | 45                 |
| ▲ ■ 01-00913-02000 | R2         | 1.5      | 5.7             | 4                      | 9°                   |      | 6              | 45                 |
| ▲ ■ 01-00913-02500 | R2.5       | 1.5      | 6.7             | 6                      | —                    | B    | 6              | 50                 |
| ▲ ■ 01-00913-03000 | R3         | 1.5      | 7.7             | 6                      | 9°                   | A    | 8              | 50                 |

How to Order

When you order, indicate NCR-2X (R). ※ (γ) is reference value.

| Work Material           | Carbon Steels S50C                                                         |          |           | Alloy Steels SCM・SKD・SUS |          |           | Prehardened Steels HPM・NAK |          |           |
|-------------------------|----------------------------------------------------------------------------|----------|-----------|--------------------------|----------|-----------|----------------------------|----------|-----------|
| Cutting Speed           | 25~35m/min                                                                 |          |           | 20~30m/min               |          |           | 15~25m/min                 |          |           |
| R                       | Spindle Speed                                                              | Feed     |           | Spindle Speed            | Feed     |           | Spindle Speed              | Feed     |           |
|                         | min <sup>-1</sup>                                                          | mm/min   |           | min <sup>-1</sup>        | mm/min   |           | min <sup>-1</sup>          | mm/min   |           |
|                         |                                                                            | Roughing | Finishing |                          | Roughing | Finishing |                            | Roughing | Finishing |
| 0.5                     | 4,800                                                                      | 55       | 80        | 4,000                    | 40       | 60        | 3,200                      | 30       | 45        |
| 0.75                    | 4,250                                                                      | 55       | 80        | 3,500                    | 40       | 60        | 2,800                      | 30       | 45        |
| 1                       | 3,800                                                                      | 55       | 80        | 3,200                    | 40       | 60        | 2,550                      | 30       | 45        |
| 1.25                    | 3,500                                                                      | 55       | 80        | 2,900                    | 40       | 60        | 2,300                      | 30       | 45        |
| 1.5                     | 3,200                                                                      | 55       | 80        | 2,650                    | 40       | 60        | 2,100                      | 30       | 45        |
| 1.75                    | 2,950                                                                      | 55       | 80        | 2,450                    | 40       | 60        | 1,950                      | 30       | 45        |
| 2                       | 2,700                                                                      | 55       | 80        | 2,300                    | 40       | 60        | 1,800                      | 30       | 45        |
| 2.5                     | 2,400                                                                      | 55       | 80        | 2,000                    | 40       | 60        | 1,600                      | 30       | 45        |
| 3                       | 2,100                                                                      | 55       | 80        | 1,750                    | 40       | 60        | 1,400                      | 30       | 45        |
| Depth of Cut (R:Radius) |                                                                            |          |           |                          |          |           |                            |          |           |
| Notes                   | ※ 1 Use cutting fluid.<br>※ 2 Divide the cutting depth into several paths. |          |           |                          |          |           |                            |          |           |

5

## Features of NS TOOL

Features of NS TOOL

PAGE

V-002

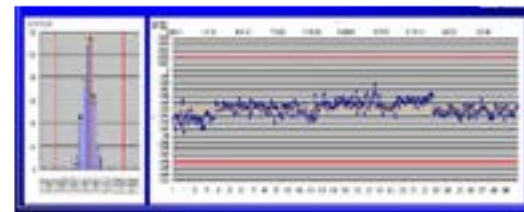


## Being particular manufacturing that continues to maintain stable accuracy and quality

What is important in NS TOOL's product manufacturing is not only the high quality, but also the absolute quality of always maintaining the high quality and continuing to deliver the same high-precision products.



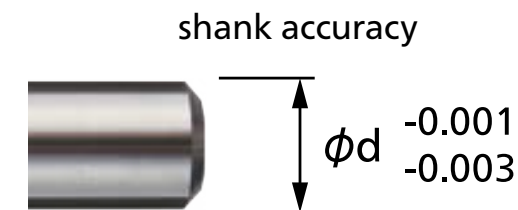
In- house development tool grinder TGM



Realize stable production accuracy

## Uncompromising on shank accuracy as the basis of the tools

The end mill shank is the part that is attached to the machine tool both when using the end mill and when manufacturing the end mill. The shank is the standard for end mills and is a very important part of the basis of high precision. NS TOOL is particular about the accuracy of the shank, which is the standard, and manufactures it in the 2  $\mu$ m range of "-0.001 mm to -0.003 mm". (Excludes some products.)



## Inspections in each process

### Support micro precision machining with NS TOOL accuracy and quality

NS TOOL inspects end mills in each process to ensure high quality, and find out any occurred abnormalities at early process by inspective system



## Responsibility for stable supply

End mills have become indispensable for cutting, and we are working on various earthquake countermeasures so that supply will not be interrupted. In addition to the measures for buildings mentioned above, we also take thorough measures to prevent falls, prevent glass from scattering, and protect measuring instruments and production equipment. As one of them, we also develop our own seismic detector device. We aim to be the most disaster-resistant factory in the world without stopping the production of our customers.



## Strengths for small diameter sizes under 6mm

### The accuracy and quality of NS TOOL's end mills support micro and precision machining

NS TOOL, which delivers small-diameter end mills to customers, is responsible for product stability. The in-house developed tool grinding machine TGM, which was developed to realize that desire, has made it possible to suppress product variations and deliver products with stable accuracy and quality to customers every time.

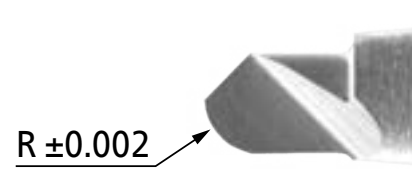


Dia. tolerance



NSME230  $\phi 0.03$  mm

R tolerance



NSMB100 R0.005 mm

## R&D center with the most advanced environment and equipment

Development of new products and technologies that embody customer needs by adopting "all-round seismic isolation" that combines micro-vibration dampers with seismic isolation devices, which are devices that dampen micro-vibrations that hinder microfabrication. We are accelerating. In addition, we have set up a seminar room that can accommodate 150 people, and actively hold seminars by inviting customers, aiming to be a base for disseminating information on precision and microfabrication technology.



### Be aware of the technology to "use" as well as "make"

At our company, we are always conscious of the user's perspective on how it will be used by our customers, and we are working on technological development not only for "making" but also for "using".



We are conscious of developing things not yet in the world from the perspective of being used.

We will keep to continue to be bold with any challenge for development while looking a little ahead of the customer's perspective.

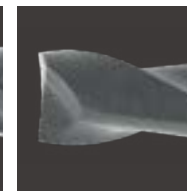


### Tool development realizes micro and precision machining

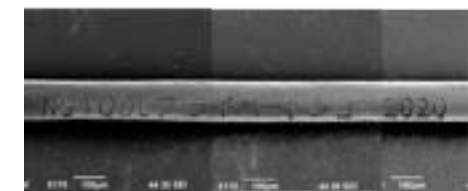
NS TOOL's great strength is that other companies cannot imitate the manufacturing technology for small diameter sizes, such as standardizing end mills that are thinner than hair and have an outer diameter of 0.01 mm. In particular, the requirements for tolerances have become even more stringent when the diameter is small, and we are currently achieving a tolerance range of 0.004 mm for non-coated products with an outer diameter, ball radius, and corner radius.



NSME100  $\phi$ 0.01 mm



NSME230  $\phi$ 0.03 mm



Milling on hair



CBN end mill series



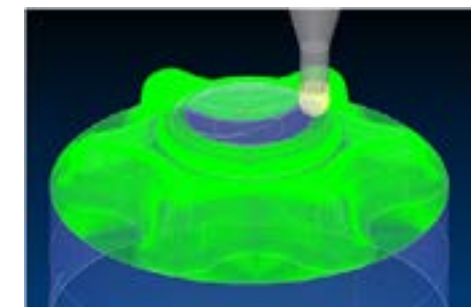
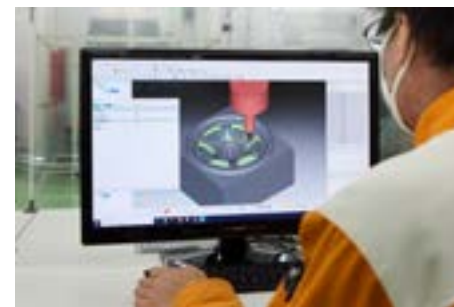
PCD end mill series



Long neck end mill series

### Development of CAD / CAM specialized for fine and precision machining

Tool paths are a very important factor in researching precision and micro fabrication technology. While researching a tool path that allows end mills with a small diameter to fully demonstrate their capabilities, we have also developed a CAD / CAM "NS-Micro CAM".



## NS TOOL Tool Material Introduction

### ■ CBN End Mill

CBN(Cubic Boron Nitride) sintered alloy is 3 times harder than Tungsten carbide, second hardest material next to diamond, moreover strong heat-resistant and high thermal conductivity. However less tough characteristic of CBN often causes chipping of tool edge easily. Accordingly, CBN is recommended for finishing of hard materials with less cutting load on the tool edge, which guarantees extra long tool life.

### ■ PCD End Mill

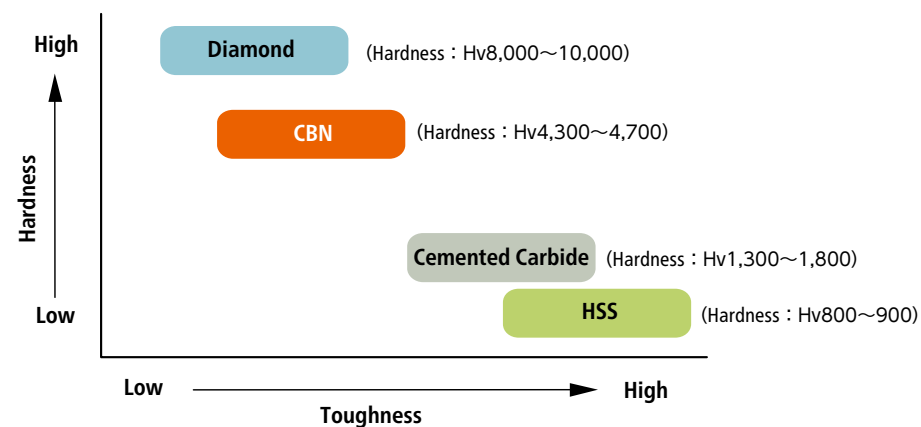
PCD consists micron-size artificial diamond powders sintered with binding materials such as Co and etc. at high pressure and temperature. PCD is as hard as Monocrystalline Diamond featuring strong wear-resistance. However the use is limited as being fragile against heat. It is mostly used for the machining of brittle materials.

### ■ Cemented Carbide End Mill

Cemented Carbide End Mill is made by WC (Tungsten carbide) -based sintered metal composed with power materials of Co (Cobalt) and etc. Its hardness higher than HSS (High speed steel) takes advantage on wear-resistance. It is widely used for the machining of various materials from Roughing to Finishing.

### ■ Monocrystalline Diamond End Mill

Monocrystalline Diamond End Mill by the hardest material on earth is made by a single crystal on flute unlike PCD consisting various binding materials. Its perfect sharp edge allows milling stress at minimum, while its application range may be limited due to behavior gap of flute wearing against material types. It is mostly used for the machining of brittle materials and non-ferrous metals.



### MUGEN COATING PREMIUM Plus

MUGEN COATING PREMIUM Plus realizes machining on high hardened steels up to 70HRC. Three layers, oxidation resistant layer, hard coating layer (ultra micro crystal structure), and high adhesion coating layer (micro crystal structure), support excellent tool life.



### MUGEN COATING PREMIUM

MUGEN COATING PREMIUM supports the tool life when directly milling on high hardened steels. Suitable for machining on high hardened materials from 48HRC to 65HRC.



### MUGEN COATING

MUGEN COATING is a TiAlN (titanium aluminide) based coating, but it also has strong wear resistance and lubricity against hardened steel, heat-treated steel, raw materials, and copper.



### DLC COATING

DLC (diamond-like carbon) COATING is a carbon film with diamond-like properties and is an amorphous (non-crystalline) structure coating that has both diamond and graphite. The hardness is high, the coefficient of friction is low, and the surface roughness of the film is Ra 0.02 μm, which is extremely smooth. In addition, it has excellent welding resistance, so it is possible to maintain a good finished surface by processing aluminium alloys.



### DIAMOND COATING

High stability is achieved by excellent wear resistance and high adhesion technology made of high-purity diamond that does not contain binders and impurities.



### MUGEN MICRO COATING

This is a TiAlN (titanium aluminide) -based coating developed as a special coating for ultra-small diameter sizes with an outer diameter of 0.1 mm or less, which NS TOOL specializes in.



### X COATING \*Distributor Stock Only

X COATING is based on TiCN (Titanium Carbon Nitride) with high hardness and strong adhesion. It has good performance in general cutting (cutting speed 100 m / min or less) by wet coolant.

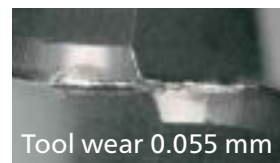




## MUGEN COATING PREMIUM Plus

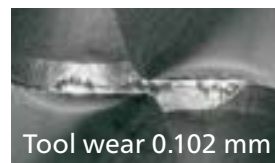
New developed coating with high oxidation resistance and abrasion resistance realizes machining on high hardened steels up to 70HRC. Three layers, Oxidation resistant layer, Hard coating layer (Ultra micro crystal structure), and High adhesion coating layer (micro crystal structure), support excellent tool life.

### HAP72 70HRC Powder HSS



Tool wear 0.055 mm

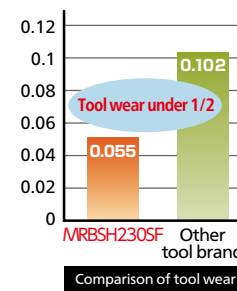
MRBSH230SF R1 × 6



Tool wear 0.102 mm

Other tool brand

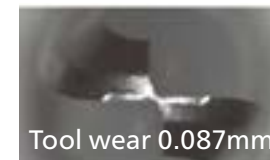
n : 16,000 min<sup>-1</sup> vf : 1,200 mm/min ap 0.1 mm × ae 0.3 mm  
Oil mist Machining time : 80 min



## MUGEN COATING

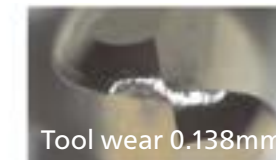
MUGEN COATING based on TiAlN (Titanium Aluminium Nitride), is recommended for hardened steels, pre-hardened steel, raw materials, and copper machining. In addition, the coating supports various type of coolant, such as water soluble fluid, water insoluble fluid, air blow, and oil mist.

### STAVAX 52HRC (SUS420J2)



Tool wear 0.087mm

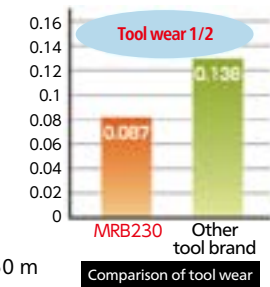
MRB230 R1 × 10



Tool wear 0.138mm

Other tool brand

n : 10,000min<sup>-1</sup> vf : 1,500 mm/min ap 0.1 mm × ae 0.2 mm  
Water soluble fluid Machining time : 132 min Cutting length : 150 m



## MUGEN COATING PREMIUM

MUGEN COATING PREMIUM, improved from MUGEN COATING, supports the extended tool life for direct milling on high hardened steels. Suitable for machining on high hard materials from 48HRC to 65HRC.

### HAP40 65HRC Powder HSS



Tool wear 0.029 mm

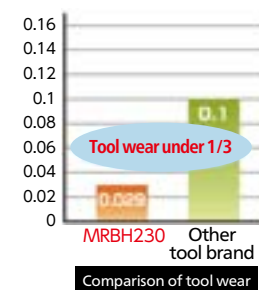
MRBH230 R1 × 6



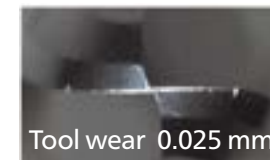
Tool wear 0.1 mm

Other tool brand

n : 20,000 min<sup>-1</sup> vf : 1,600 mm/min ap 0.15 mm × ae 0.3 mm  
Oil mist Machining time : 18 min Cutting length : 25 m



### Copper



Tool wear 0.025 mm

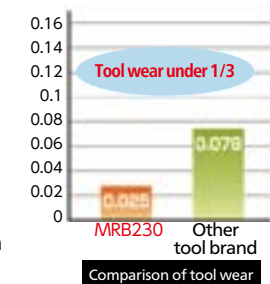
MRB230 R1 × 20



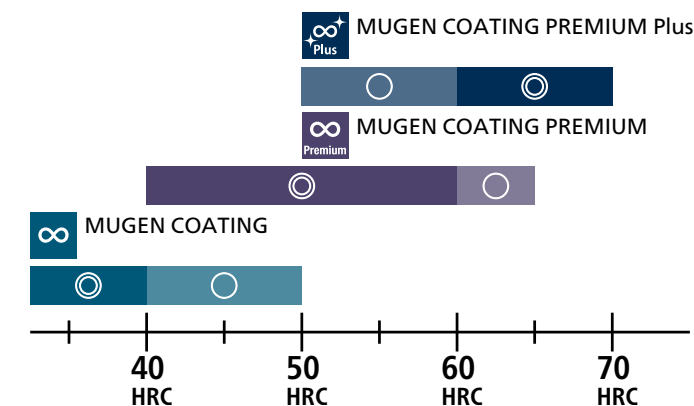
Tool wear 0.078 mm

Other tool brand

Roughing n : 12,000 min<sup>-1</sup> vf : 1,200 mm/min ap 0.2 mm × ae 0.3 mm  
Finishing n : 5,000 min<sup>-1</sup> vf : 700 mm/min ap 0.05 mm × ae 0.03 mm  
Water soluble fluid Machining time : 8 hr 54 min



## Range of NS TOOL original coating by work material hardness



6

NS TOOL  
Machining Case

Machining Case

PAGE  
W-002



Narrow pitch connector

Work Material HAP40  
Hardness 64HRC

CBN Square End Mill

Page ➡ B-008



**SSE600**

φ 0.2 ~ φ 1 Total 14 sizes



Possible to high-precision machining with reduced wear even for requiring corner edges with high hardened steels of 60HRC or higher



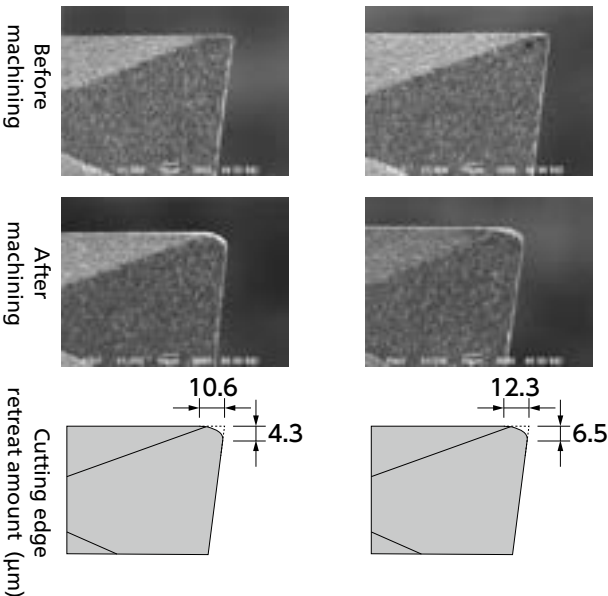
Work size 15 × 15 mm  
(Cutting depth 2mm)

Work material HAP40(64HRC)

Coolant Oil mist

Total machining time 13 hr 32 min

Bottom cutting edge 1 Bottom cutting edge 2



| Process                            | Roughing                  | Contour line semi-finishing | Scanning line semi-finishing | Contour line finishing | Scanning line finishing |
|------------------------------------|---------------------------|-----------------------------|------------------------------|------------------------|-------------------------|
| Tool                               | SSR200<br>φ 0.5×R0.05×2.5 | SSR200<br>φ 0.5×R0.05×2.5   |                              | SSE600<br>φ 0.5×2.5    |                         |
| Spindle speed [min <sup>-1</sup> ] | 30,000                    | 30,000                      |                              | 30,000                 |                         |
| Feed [mm/min]                      | 500                       | 500                         | 300                          | 400                    | 300                     |
| Feed apxae [mm]                    | 0.005×0.2                 | 0.005×0.01                  | 0.01×0.01                    | 0.005×0.002            | 0.002×0.01              |
| Machining time                     | 7 hr 20 min               | 2 hr 52 min                 |                              | 3 hr 20 min            |                         |

" N " letter engraving

Work Material PD613  
Hardness 60HRC

CBN Ball End Mill for precision machining "CBN Micro Ball"

Page ➡ B-010



**SMB120**

R0.01 ~ R0.05 Total 7 sizes



Micro manufacturing cutting into high hardened steels  
Long tool life CBN enables making of highly accurate corners even with a small diameter



Work size 0.31 × 0.28 mm  
(Cutting depth 0.01 mm)

Work material PD613 (60HRC)

Coolant Oil mist

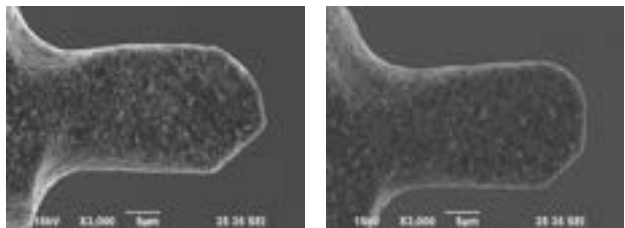
Total machining time 3 hr 10 min



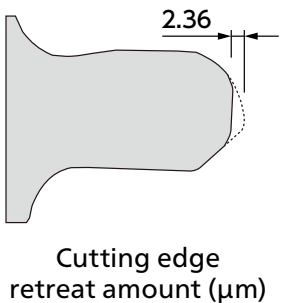
Bottom surface roughness  
Rz 0.80 μm

Before machining

After machining



|                                    |                 |
|------------------------------------|-----------------|
| Tool                               | SMB120<br>R0.01 |
| Spindle speed [min <sup>-1</sup> ] | 80,000          |
| Feed [mm/min]                      | 5               |
| Depth of cut apxae [mm]            | 0.0005×0.001    |
| Machining time                     | 3 hr 10 min     |



Machining  
Case  
CBN  
Core Line

Machining  
Case  
CBN  
Core Line

CBN Super Spiral Ball End Mill

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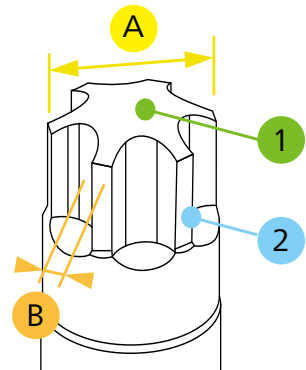
**SSPB220** R0.1 ~ R3 Total 30 sizes



The spiral ball shape is ideal for finishing process. It provides stable, excellent surface roughness and machining accuracy



|                      |                               |                                    |                    |
|----------------------|-------------------------------|------------------------------------|--------------------|
| Work size            | φ 25<br>(Cutting depth 30 mm) | Process                            | Finishing          |
| Work material        | HAP40(65HRC)                  | Tool                               | SSPB220<br>R3 × 18 |
| Coolant              | Oil mist                      | Spindle speed [min <sup>-1</sup> ] | 6,000              |
| Total machining time | 4 hr 36 min                   | Feed [mm/min]                      | 600                |
|                      |                               | Depth of cut apxae [mm]            | 0.05 × 0.05        |
|                      |                               | Machining time                     | 1 hr 58 min        |



| Machining accuracy [mm] |        |        |        |
|-------------------------|--------|--------|--------|
|                         | pcs    | 1 pc   | 6 pc   |
| A                       | Actual | 23.006 | 23.008 |
|                         | Error  | +0.006 | +0.008 |
| B                       | Actual | 3.005  | 3.008  |
|                         | Error  | +0.005 | +0.008 |

| Machining accuracy [μm] |     |       |       |
|-------------------------|-----|-------|-------|
|                         | pcs | 1 pc  | 6 pc  |
| 1                       | Ra  | 0.145 | 0.162 |
|                         | Rz  | 1.054 | 1.122 |
| 2                       | Ra  | 0.167 | 0.185 |
|                         | Rz  | 1.355 | 1.355 |

CBN Super Speed Ball End Mill

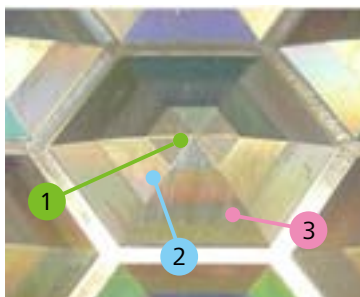
Page ➡ B-016



**SSB200** R0.1 ~ R1 Total 15 sizes



Suitable for long finishing operation in high-hardened steel



|                      |                                       |                         |             |             |
|----------------------|---------------------------------------|-------------------------|-------------|-------------|
| Work size            | 15 × 15 mm<br>(Cutting depth 0.35 mm) | Surface roughness [μ m] |             |             |
| Work material        | ELMAX(60HRC)                          | 1                       | 2           | 3           |
| Coolant              | Oil mist                              |                         |             |             |
| Total machining time | 9 hr 34 min                           | Rz 0.87 μ m             | Rz 0.89 μ m | Rz 0.57 μ m |

| Process                            | Roughing            | Slot                      | Semi-finishing      | Finishing            |
|------------------------------------|---------------------|---------------------------|---------------------|----------------------|
| Tool                               | MRBH230<br>R0.5 × 2 | MHRH230R<br>φ 0.4×R0.05×1 | MRBH230<br>R0.5 × 2 | SSB200<br>R0.5 × 2.5 |
| Spindle speed [min <sup>-1</sup> ] | 40,000              | 30,000                    | 40,000              | 40,000               |
| Feed [mm/min]                      | 800                 | 125                       | 800                 | 400                  |
| Depth of cut apxae [mm]            | 0.02 × 0.1          | ap 0.003                  | 0.02 × 0.08         | 0.004 × 0.004        |
| Machining time                     | 52 min              | 38 min                    | 1 hr 45 min         | 6 hr 19 min          |

CBN Super Speed Radius End Mill

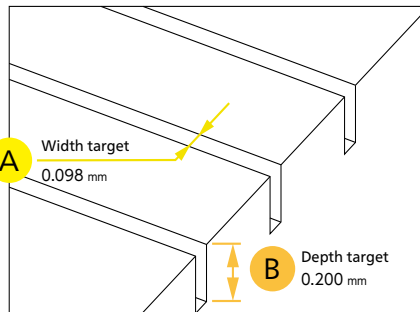
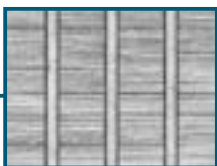
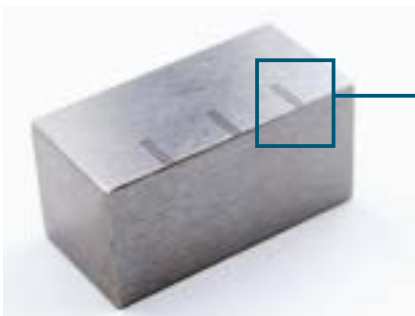
Page ➡ B-026

**SSR200**

$\phi 0.1 \times R0.02 \sim \phi 2 \times R0.5$  Total 172 sizes



High-precision machining to YXR7 (63HRC) is possible even with an ultra-fine diameter of 0.1 mm



Work size 30 x 15 mm  
(Cutting depth 0.2 mm)

Work material YXR7(63HRC)

Coolant Oil mist

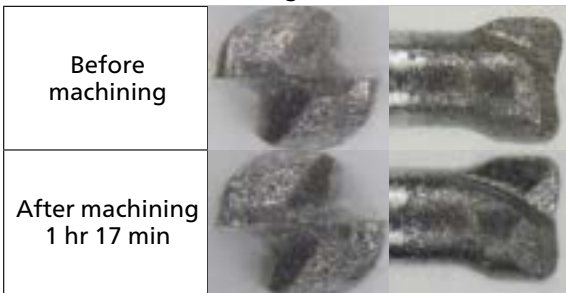
Total machining time 3 hr 51 min

※Actual tool diameter  $\phi 0.098$ .

|                     | Target    | Actual   |
|---------------------|-----------|----------|
| <b>A</b> Slot width | 0.098 mm* | 0.099 mm |
| <b>B</b> Depth      | 0.2 mm    | 0.198 mm |

|                                     |                                              |
|-------------------------------------|----------------------------------------------|
| Tool                                | SSR200<br>$\phi 0.1 \times R0.02 \times 0.2$ |
| Spindle speed [ $\text{min}^{-1}$ ] | 31,000                                       |
| Feed [mm/min]                       | 50                                           |
| Depth of cut [mm]                   | ap 0.001                                     |

Tool ware after machining



Three slots machined by one tool

CBN Super Speed Radius End Mill

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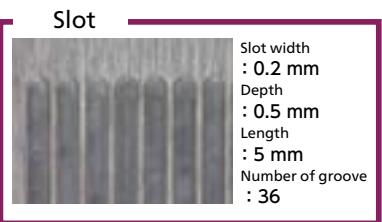


**SSR200**

$\phi 0.1 \times R0.02 \sim \phi 2 \times R0.5$  Total 172 sizes



CBN End Mill ensures high quality surface and accuracy for a long time machining to high-hardened steel (60HRC) even with 0.2mm cutter diameter



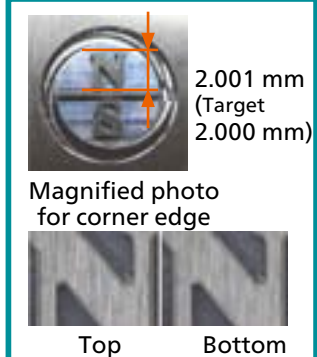
Work size 30 x 30 mm

Work material PD613(60HRC)

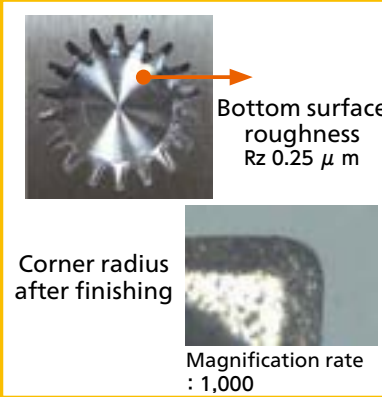
Coolant Oil mist

Total machining time 14 hr 47 min

NS Logo



Gear (Gear dia. 8 mm)



|                                    |                                                                                            |                        |                                                                                               |                       |                                                                                            |                       |
|------------------------------------|--------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------|-----------------------|
| Cutting Part                       |  Slot |                        |  NS Logo |                       |  Gear |                       |
| Process                            | Slotting<br>(to Z-0.03)                                                                    | Slotting<br>(to Z-0.5) | Finishing<br>(Side)                                                                           | Finishing<br>(Bottom) | Finishing<br>(Side)                                                                        | Finishing<br>(Bottom) |
| Tool                               | SSR200<br>ϕ 0.2×R0.02×0.5                                                                  |                        |                                                                                               |                       | SSR200<br>ϕ 0.2×R0.02×1                                                                    |                       |
| Spindle speed [min <sup>-1</sup> ] | 40,000                                                                                     |                        |                                                                                               |                       |                                                                                            |                       |
| Feed [mm/min]                      | 100                                                                                        | 300                    | 300                                                                                           |                       | 200                                                                                        |                       |
| Depth of cut apxae<br>[mm]         | ap 0.001                                                                                   | ap 0.003               | 0.001×<br>0.005                                                                               | 0.005×<br>0.005       | 0.003×<br>0.005                                                                            | 0.005×<br>0.005       |
| Machining time                     | 1 hr 8 min                                                                                 | 2 hr 19 min            | 1 hr 55 min                                                                                   | 20 min                | 1 hr 45 min                                                                                | 30 min                |

Micro needle

Work Material STAVAX  
Hardness 52HRC

CBN Super High Precision Radius End Mill

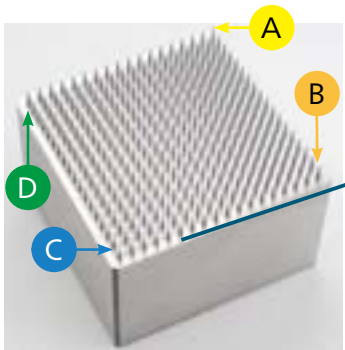
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**SHPR400**

$\phi 0.1 \times R0.01 \sim \phi 3 \times R0.2$  Total 142 sizes

Achieves long tool life machining with 4-flutes CBN edge despite its small diameter of  $\phi 0.3$

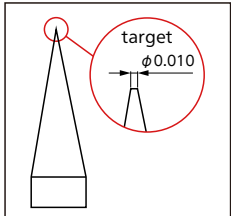
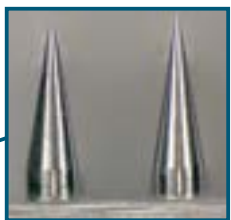


Work size 15 × 15 mm  
(Cutting depth 1.2mm)

Work material STAVAX(52HRC)

Coolant Oil mist

Total machining time 24 hr 53 min



| Measuring position | Tip diameter [mm] |        |
|--------------------|-------------------|--------|
|                    | Target            | Actual |
| A                  | 0.010             | 0.009  |
| B                  |                   | 0.013  |
| C                  |                   | 0.013  |
| D                  |                   | 0.013  |

|                                     |                                               |
|-------------------------------------|-----------------------------------------------|
| Process                             | Finishing                                     |
| Tool                                | SHPR400<br>$\phi 0.3 \times R0.02 \times 1.5$ |
| Spindle speed [ $\text{min}^{-1}$ ] | 40,000                                        |
| Feed [mm/min]                       | 25 ~ 300                                      |
| Depth of cut apxae [mm]             | 0.003 × 0.04                                  |
| Stock [mm]                          | —                                             |
| Machining time                      | 14 hr 50 min                                  |

※ 2 end mills used for finishing

Micro flow channel

Work Material Cemented Carbide  
Hardness 92.5HRA

PCD Square End Mill

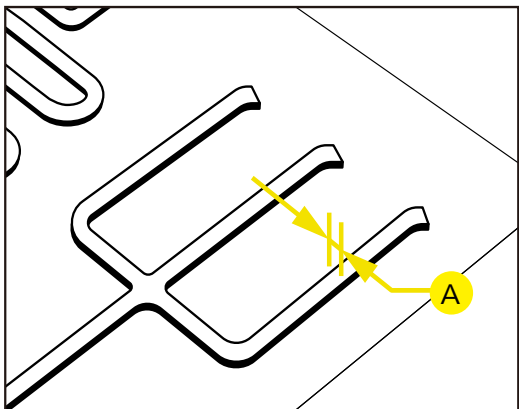
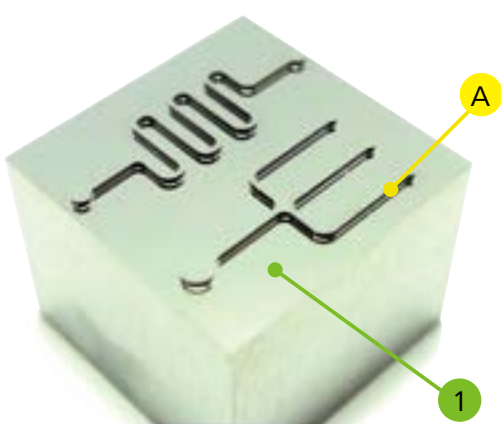
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**PCDSE**

$\phi 0.1 \sim \phi 1$  Total 8 sizes

Realizes stable machined surface in milling of cemented carbides. Possible to achieve the nano-level surface roughness required in ultra-precision machining



Work size 10 × 10 mm  
(Cutting depth 0.25 mm)

Work material Cemented carbide(92.5HRA)  
Coolant Water-insoluble fluid

Total machining time 12 hr 50 min

| 1  | Bottom surface roughness |
|----|--------------------------|
| Ra | 0.002 $\mu\text{m}$      |
| Rz | 0.038 $\mu\text{m}$      |

| A      | Passage width |
|--------|---------------|
| Target | 0.180 mm      |
| Actual | 0.182 mm      |
| Error  | +0.002 mm     |

| Cutting Part                        | Contour line finishing | Scanning line finishing |
|-------------------------------------|------------------------|-------------------------|
| Tool                                | PCDSE<br>$\phi 0.5$    | PCDSE<br>$\phi 0.5$     |
| Spindle speed [ $\text{min}^{-1}$ ] | 56,000                 | 56,000                  |
| Feed [mm/min]                       | 70                     | 50                      |
| Depth of cut apxae [mm]             | 0.001 × 0.002          | 0.001 × 0.01            |
| Machining time                      | 5 hr                   | 7 hr 50 min             |

Machining Case  
CBN  
Core Line

Machining Case  
PCD  
Core Line



## Tail lamp mold

Work Material STAVAX  
Hardness 52HRC

### PCD Ball End Mill

Page ➡ C-006



Finished surface looks “smooth, even and shiny”  
such as the mirror surface  
Realized the roughness : Ra 30nm



Work size 200 × 100 mm  
(Cutting depth 38.02 mm)

Work material STAVAX(52HRC)

Coolant Water-insoluble fluid

Total machining time 158 hr 8 min

| Measuring position  | Ra [μm] |
|---------------------|---------|
| 1 Parting face      | 0.028   |
| 2 Main part surface | 0.026   |

| Process                            | Roughing     |              | Semi-finishing | Finishing     |
|------------------------------------|--------------|--------------|----------------|---------------|
| Tool                               | MRBH230 R2×8 | MRBH230 R1×6 | SSPB200 R1×5   | PCDRB R1×5    |
| Spindle speed [min <sup>-1</sup> ] | 20,000       | 20,000       | 40,000         | 40,000        |
| Feed [mm/min]                      | 2,000        | 1,500        | 1,000          | 1,000         |
| Depth of cut apxae [mm]            | 0.2×1.5      | 0.05×0.05    | 0.02×0.02      | 0.005 × 0.005 |
| Stock                              | 0.05         | 0.02         | 0.005          | -             |
| Machining time                     | 9 hr 49 min  | 6 hr 33 min  | 26 hr 57 min   | 114 hr 49 min |

## Punch pin

Work Material HAP40  
Hardness 64HRC

### MUGEN COATING PREMIUM Plus 3-Flute Ball End Mill for 5-axis machining

Page ➡ E-004

#### MSBSH330-5X R0.1 ~ R1 Total 8 sizes



Realize high precision deep milling by the tool design  
that conforms the advantage of the features of a 5-axis  
machine



Work size φ25 × 80 mm  
(Cutting depth 35mm)

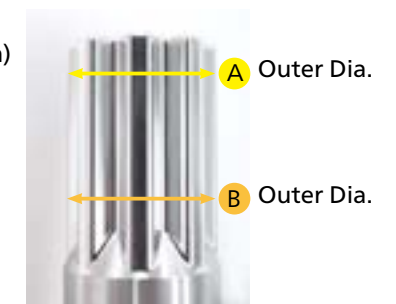
Work material HAP40(64HRC)

Coolant Oil mist

Total machining time 5 hr 52 min

| Surface roughness | 1    | 2    | 3    |
|-------------------|------|------|------|
| Ra[μm]            | 0.07 | 0.13 | 0.09 |

| Machining Accuracy | A      | B      |
|--------------------|--------|--------|
| Target [mm]        | 24.000 |        |
| Actual [mm]        | 24.001 | 24.006 |



| Process                            | Roughing       |                | Semi-finishing | Finishing      | Engraving        |
|------------------------------------|----------------|----------------|----------------|----------------|------------------|
| Tool                               | MSBSH330-5X R1 | MSBSH330-5X R1 | MSBSH330-5X R1 | MSBSH330-5X R1 | MSBSH330-5X R0.1 |
| Spindle speed [min <sup>-1</sup> ] | 20,000         | 20,000         | 20,000         | 20,000         | 40,000           |
| Feed [mm/min]                      | 3,000          | 1,500          | 1,500          | 1,200          | 200              |
| Depth of cut apxae [mm]            | 0.08×0.3       | 0.09×0.09      | 0.06×0.06      | 0.03×0.03      | 0.005×0.005      |
| Stock                              | 0.07           | 0.04           | 0.02           | -              | -                |
| Ting angle                         | 20° ~ 90°      | 30° ~ 90°      | 30° ~ 65°      | 30° ~ 65°      | 90°              |
| Machining time                     | 2 hr           | 38 min         | 55 min         | 2 hr 13 min    | 6 min            |



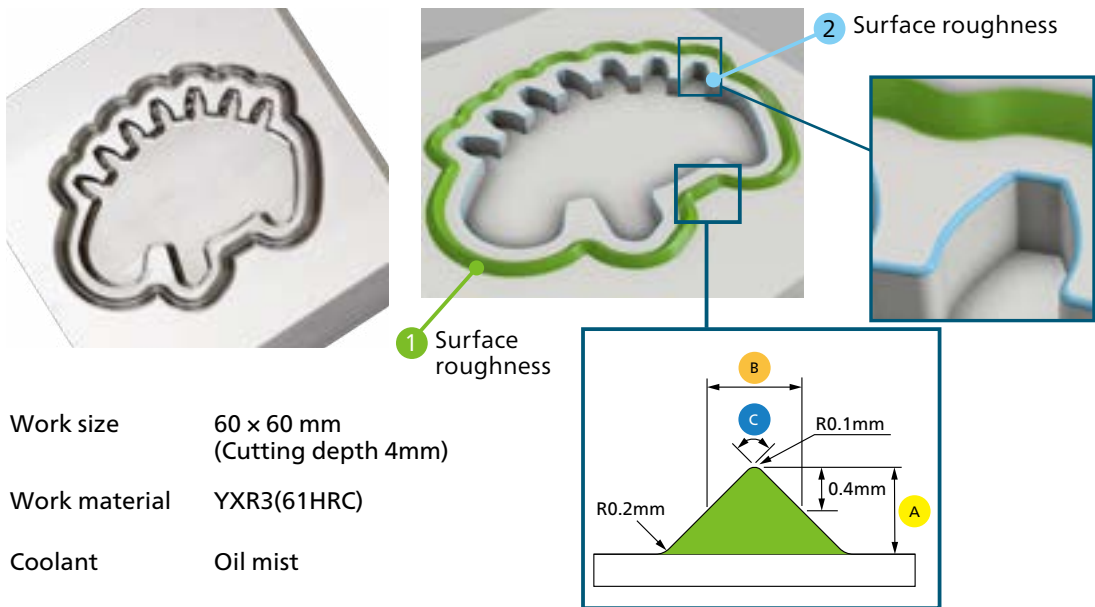
MUGEN COATING PREMIUM Plus  
2-Flute Long Neck Ball End Mill for Hardened steel and High accuracy cutting

MRBSH230SF R 0.05 ~ R 3 Total 83 sizes



Achieves long tool life and high precision cutting even in  
60 to 70HRC high-hardened steel

Page ➡ E-006



Work size 60 × 60 mm  
(Cutting depth 4mm)

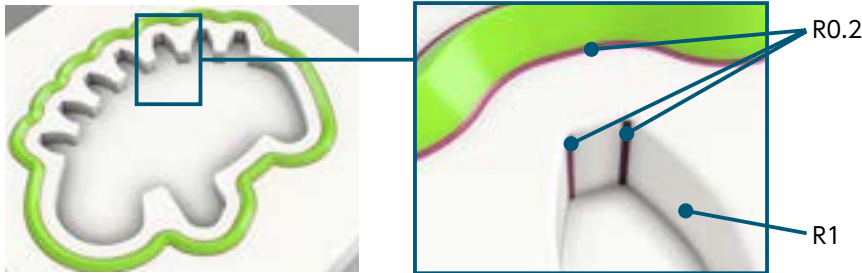
Work material YXR3(61HRC)

Coolant Oil mist

Total machining time 7 hr 27 min

| Surface roughness | 1     | 2     |
|-------------------|-------|-------|
| Ra                | 0.145 | 0.080 |
| Rz                | 1.192 | 0.521 |

|        | A        | B         | C         |
|--------|----------|-----------|-----------|
| Target | 0.958 mm | 0.883 mm  | 90°0'00"  |
| Actual | 0.958 mm | 0.888 mm  | 90°15'10" |
| Error  | 0.000 mm | +0.005 mm | 0°15'10"  |



| Process                            | Blank holder | Roughing        | Semi-finishing  | Finishing  | Stock removal     | Finishing                    | Stock removal        | Stock removal     |
|------------------------------------|--------------|-----------------|-----------------|------------|-------------------|------------------------------|----------------------|-------------------|
| Tool                               |              | MRBSH230SF R1x4 | MRBSH230SF R1x4 |            | MRBSH230SF R0.5x2 |                              | MRBSH230SF R0.25x1.5 | MRBSH230SF R0.2x1 |
| Spindle speed [min <sup>-1</sup> ] |              | 25,000          |                 |            | 30,000            |                              |                      |                   |
| Feed [mm/min]                      |              | 2,500           |                 |            | 1,000             |                              | 540                  | 540               |
| Depth of cut apxae [mm]            |              | 0.2 × 0.5       | pf : 0.05       | pf : 0.08  | pf : 0.05         | pf : 0.03                    | pf : 0.03            | pf : 0.02         |
| Stock                              |              | 0.03            | 0.01            | -          | 0.01              | -<br>(Only corner part0.005) |                      | -                 |
| Machining time                     |              | 39 min          | 40 min          | 1 hr 6 min | 1 hr 3 min        |                              | 47 min               | 1 hr 26 min       |

※ pf : Pick feed

| Process                            | Roughing             |  | Finishing         |
|------------------------------------|----------------------|--|-------------------|
| Tool                               | MRBSH230SF R0.25×1.5 |  | MRBSH230SF R0.2×1 |
| Spindle speed [min <sup>-1</sup> ] | 30,000               |  |                   |
| Feed [mm/min]                      | 540                  |  |                   |
| Depth of cut apxae [mm]            | 0.01 × 0.03          |  | pf : 0.01         |
| Stock                              | 0.003                |  | -                 |
| Machining time                     | 1 hr 11 min          |  | 35 min            |

※ pf : Pick feed

Machining Case  
Regular Line  
MUGEN PREMIUM Plus

Machining Case  
Regular Line  
MUGEN PREMIUM Plus

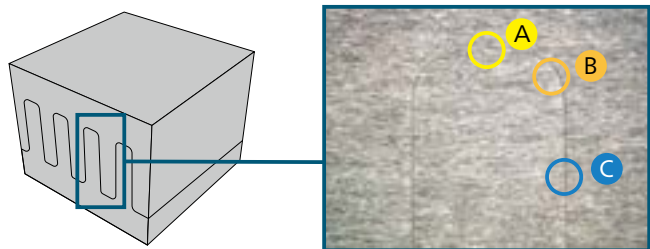
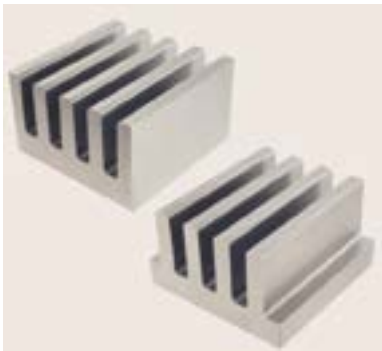
MUGEN COATING PREMIUM  
2-Flute Long Taper Neck Ball End Mill

Page ➡ G-028

**MRBTNH230** R 0.05 × Neck Taper Angle 3° ~ R 2 × Neck Taper Angle 1° Total 209 sizes



The tapered neck shape with high rigidity enables highly accurate and stable machining even in deep milling



|   | Stock removal |
|---|---------------|
| A | 0.002 mm      |
| B | 0.014 mm      |
| C | 0.007 mm      |

Work size 50 × 50 mm  
(Cutting depth 20 mm)

Work material STAVAX(52HRC)

Coolant Oil mist

Machining time Concave 24 hr 11 min  
Convex 25 hr 13 min

Total machining time 49 hr 24 min

| Process                            | Roughing         | Semi-finishing   | Stock removal          | Finishing              |
|------------------------------------|------------------|------------------|------------------------|------------------------|
| Tool                               | MRBH230<br>R2×20 | MRBH230<br>R2×20 | MRBTNH230<br>R1×30'×20 | MRBTNH230<br>R1×30'×20 |
| Spindle speed [min <sup>-1</sup> ] | 16,000           | 8,000            | 8,000                  | 5,000                  |
| Feed [mm/min]                      | 2,400            | 800              | 700                    | 400                    |
| Depth of cut apxae [mm]            | 0.2 × 1.0        | 0.1 × 0.02       | 0.05 × 0.1             | 0.03 × 0.01            |
| Stock                              | 0.03             | 0.01             | 0.01                   | -                      |
| Concave Machining time             | 1 hr 24 min      | 2 hr 16 min      | 1 hr 15 min            | 19 hr 16 min           |
| Convex Machining time              | 1 hr 43 min      | 2 hr 42 min      | 58 min                 | 19 hr 50 min           |

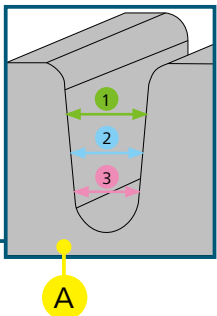
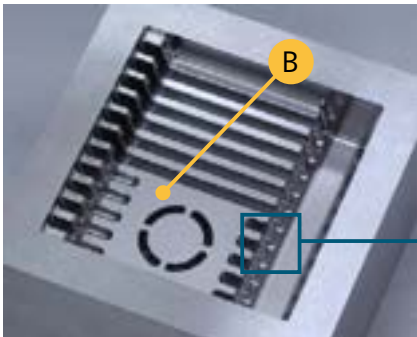
MUGEN COATING PREMIUM  
3-Flute Long Taper Neck Ball End Mill

Page ➡ G-036

**MRBTNH345** R0.5 × Neck Taper Angle 30' ~ R2 × Neck Taper Angle 1° Total 69 sizes



The tapered neck shape with high rigidity enables highly accurate and stable machining even in deep milling



Unit : mm

| Width | Target | Actual |
|-------|--------|--------|
| 1     | 2.479  | 2.465  |
| 2     | 2.339  | 2.319  |
| 3     | 2.199  | 2.168  |

Work size 80 × 80 mm

Work material DH31-S(48HRC)

Coolant Oil mist

Total machining time 13 hr 35 min

|        | Surface Roughness        |
|--------|--------------------------|
| A Side | Ra : 0.187<br>Rz : 1.092 |
| B Top  | Ra : 0.577<br>Rz : 2.643 |

| Cutting Part                       | R1 slotting           |                |                       | R0.5 slotting           |                |                         |
|------------------------------------|-----------------------|----------------|-----------------------|-------------------------|----------------|-------------------------|
| Process                            | Slotting              | Semi-Finishing | Finishing             | Slotting                | Semi-Finishing | Finishing               |
| Tool                               | MRBTNH345<br>R1×2°×20 |                | MRBTNH345<br>R1×2°×20 | MRBTNH230<br>R0.5×2°×10 |                | MRBTNH230<br>R0.5×2°×10 |
| Spindle speed [min <sup>-1</sup> ] | 10,000                |                |                       | 20,000                  |                |                         |
| Feed [mm/min]                      | 600                   | 1,200          | 800                   | 400                     | 800            | 600                     |
| Depth of cut apxae [mm]            | ap 0.05               | 0.1 × 0.7      | ap 0.05               | ap 0.02                 | 0.04× 0.5      | ap 0.02                 |
| Stock                              | 0.05                  |                | -                     | 0.03                    |                | -                       |
| Machining time                     | 3 hr 14 min           |                | 5 hr 31 min           | 1 hr 9 min              |                | 1 hr 3 min              |

Machining Case  
Regular Line  
MUGEN PREMIUM  
Long Neck Type

Machining Case  
Regular Line  
MUGEN PREMIUM  
Long Neck Type

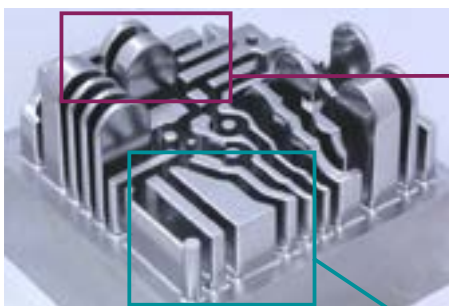
**MUGEN COATING PREMIUM**  
**3-Flute Long Neck Ball End Mill**

Page ➡ G-036

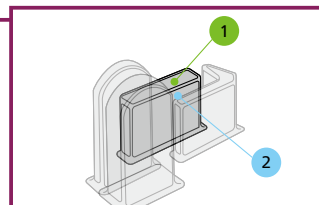
**MRBTNH345** R 0.5 × Neck Taper Angle 30° ~ R 2 × Neck Taper Angle 1° Total 69 sizes



The tapered neck shape with high rigidity enables highly accurate and stable machining even in deep milling

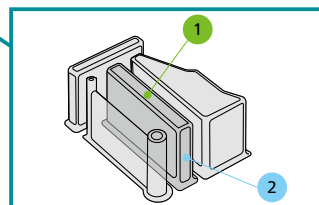


At the beginning of machining



| Surface roughness [μm] |            |            |
|------------------------|------------|------------|
| 1 Top                  | Ra : 0.340 | Rz : 2.015 |
| 2 Side                 | Ra : 0.168 | Rz : 1.271 |

At the end of machining



| Surface roughness [μm] |            |            |
|------------------------|------------|------------|
| 1 Top                  | Ra : 0.343 | Rz : 2.081 |
| 2 Side                 | Ra : 0.194 | Rz : 1.375 |

Work size 80 × 80 mm  
Work material DAC-S(44HRC)  
Coolant Oil mist  
Total machining time 35 hr 37 min

| Process                            | Roughing ①              | Roughin ②-1           |            | Roughing ②-2          |            | Roughin ②-3           |            | Finishing             |        |
|------------------------------------|-------------------------|-----------------------|------------|-----------------------|------------|-----------------------|------------|-----------------------|--------|
| Tool                               | MRBTNH345<br>R1.5×1°×30 | MRBTNH345<br>R1×1°×20 |            | MRBTNH345<br>R1×1°×25 |            | MRBTNH345<br>R1×1°×30 |            | MRBTNH345<br>R1×1°×30 |        |
| Spindle speed [min <sup>-1</sup> ] | 10,000                  |                       |            |                       |            | 8,000                 |            |                       |        |
| Feed [mm/min]                      | 1,600                   | 1,000                 | 2,000      | 800                   | 1,600      | 600                   | 1,200      | 800                   |        |
| Depth of cut apxae [mm]            | 0.1 × 0.2               | ap<br>0.04            | ap<br>0.08 | ap<br>0.04            | ap<br>0.08 | ap<br>0.035           | ap<br>0.07 | ap<br>0.15            | ae 0.1 |
| Stock                              | Side:0.2<br>Bottom:0.1  | 0.05                  |            |                       |            |                       | -          |                       |        |
| Machining time                     | 1 hr 38 min             | 7 hr 45 min           |            | 6 hr                  |            | 9 hr 20 min           |            | 6 hr 26 min           |        |

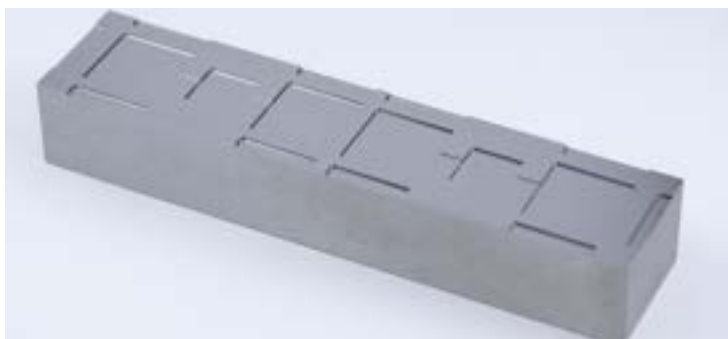
**MUGEN COATING PREMIUM**  
**4-flute Long Neck Radius End Mill for Hardend Steel**

Page ➡ G-044

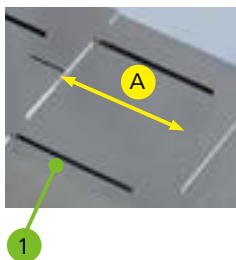
**MHRH430R** φ 0.1 × R 0.01 ~ φ 6 × R 1 Total 336 sizes



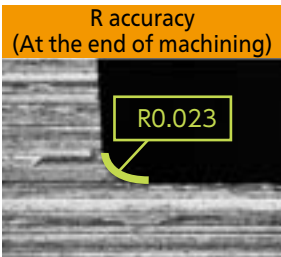
High-precision milling with minimal tool wear even after long hours of machining on high-hardened steel of 60 HRC or higher



Work size 90 × 20 mm  
(Cutting depth 0.35mm)  
Work material HPM31(60HRC)  
Coolant Oil mist  
Total machining time 3 hr 59 min



|                     | Target                     | Actual    |
|---------------------|----------------------------|-----------|
| A Width             | 12.000 mm                  | 11.998 mm |
| 1 Surface roughness | Ra 0.046 μm<br>Rz 0.247 μm |           |



| Cutting Part                       | Roughing             | Semi-finishing         | Finishing (Side・Corner) | Finishing(Bottom)     |
|------------------------------------|----------------------|------------------------|-------------------------|-----------------------|
| Tool                               | MHRH430R φ 1×R0.05×2 | MHRH430R φ 0.8×R0.02×2 | MHRH430R φ 0.8×R0.02×2  | MHRH430R φ 0.8×R0.1×2 |
| Spindle speed [min <sup>-1</sup> ] | 21,000               | 21,000                 | 31,000                  | 31,000                |
| Feed [mm/min]                      | 2,000                | 1,800                  | 1,200                   | 1,200                 |
| Depth of cut apxae [mm]            | 0.04 × 0.25          | 0.015 × 0.1            | ap 0.01                 | ae 0.01               |
| Stock                              | 0.02                 | 0.01                   | -                       | -                     |
| Machining time                     | 1 hr 16 min          | 25 min                 | 39 min                  | 1hr 39min             |

Machining Case  
Regular Line  
MUGEN PREMIUM  
Long Neck Type

MUGEN COATING PREMIUM  
4-Flute High Efficient "Z" End Mill for Stainless Steels

Page ➡ K-004

**MSUSZ440**       $\phi 1 \sim \phi 6$  Total 62 sizes

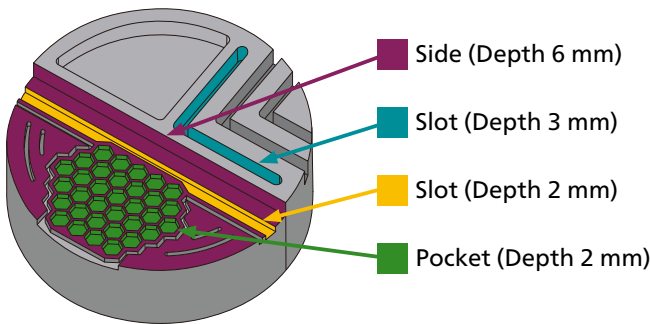


Unequal flute spacing / unequal helix angle to minimize chatter  
Specializing in high-efficiency machining of titanium alloy



Work size     $\phi 80$

Work material    Titanium alloy Ti-6Al-4V  
Coolant    Water-soluble fluid



Machining time     $\phi 1$  : 27 min  
                          $\phi 3$  : 9 min 30 sec

| Cutting Part                       | Side (Depth 6 mm)          |           | Slot (Depth 3 mm) |          |           | Slot (Depth 2 mm)          |           | Pocket (Depth 2 mm) |           |                                    |
|------------------------------------|----------------------------|-----------|-------------------|----------|-----------|----------------------------|-----------|---------------------|-----------|------------------------------------|
| Process                            | Roughing                   | Finishing | Plunging          | Slotting | Finishing | Trochoidal                 | Finishing | Plunging&Contouring | Roughing  | Finishing                          |
| Tool                               | MSUSZ440 $\phi 3 \times 6$ |           |                   |          |           | MSUSZ440 $\phi 1 \times 2$ |           |                     |           |                                    |
| Spindle speed [min <sup>-1</sup> ] | 6,700                      |           | 6,200             |          |           | 16,800                     |           | 13,500              |           |                                    |
| Feed [mm/min]                      | 1,100                      | 800       | 50                | 300      | 800       | 600                        | 400       | 50 & 200            | 600       | 400                                |
| Depth of cut apxae [mm]            | 6x0.6                      | 6x0.1     | ap 0.75           |          | 3x0.1     | 2x0.2                      | 2x0.05    | 0.25x0.5            | 1.97x0.12 | 2x0.05 (Side)<br>0.03x0.5 (Bottom) |
| Machining time                     | 4 min 30 sec               |           | 1 min             |          |           | 4 min 30 sec               |           | 18 min 30 sec       |           |                                    |

MUGEN COATING  
4-Flute High Efficient "Z" End Mill for Carbon Steels

Page ➡ K-006

**MSCZ440**       $\phi 1 \sim \phi 6$  Total 62 sizes

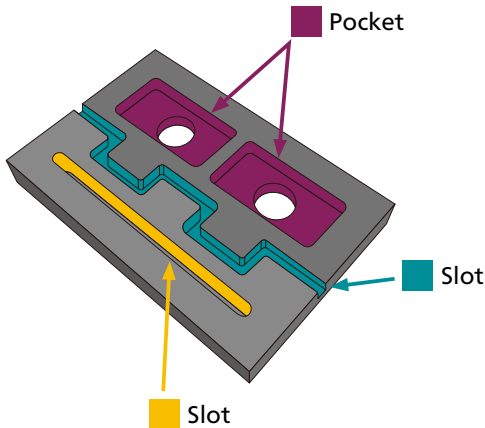


Unequal flute spacing / unequal helix angle to minimize chatter  
For carbon steel to pre-hardened steel, possible continuous machining from plunging to grooving



Work size    150x100mm  
                  (Cutting depth 15 mm)

Work material    SCM415  
Coolant    Air blow



Total machining time    8 min 30 sec

| Cutting Part                       | Pocket                     |          |           | Slot     |           | Slot                       |           |
|------------------------------------|----------------------------|----------|-----------|----------|-----------|----------------------------|-----------|
| Process                            | Roughing                   | Roughing | Finishing | Roughing | Finishing | Roughing                   | Finishing |
| Tool                               | MSCZ440 $\phi 5 \times 10$ |          |           |          |           | MSCZ440 $\phi 6 \times 18$ |           |
| Spindle speed [min <sup>-1</sup> ] | 4,200                      |          |           |          |           | 3,500                      |           |
| Feed [mm/min]                      | Plunging:200<br>Slot:880   | 1,600    | 800       | 880      | 800       | Plunging:150<br>Slot:650   | 780       |
| Depth of cut apxae [mm]            | ap 2.5                     | 7.5x1    | 7.5x0.2   | ap 5     | ap 5      | ap 3                       | ap 15     |
| Stock                              | -                          | 0.2      | -         | 0.4      | -         | 0.3                        | -         |
| Machining time                     | 1 min 30 sec               | 3 min    | 1 min     | 30 sec   | 30 sec    | 1 min 30 sec               | 30 sec    |



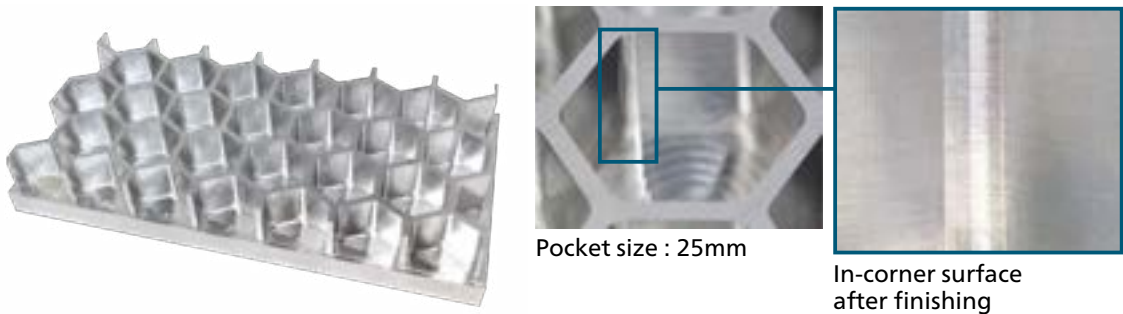
High Efficient 3-Flute End Mill for Aluminium L/D=3

Page ➡ K-012  
L-020

AL3D-345  $\phi 1 \sim \phi 12$  Total 9 sizes



3-flute strong twist type for aluminium processing  
Continuous machining from plunge to grooving is possible



Work size 200 × 100 mm  
(Cutting depth 18 mm)  
Work material A6061  
Coolant Water-soluble fluid  
Total machining time 18 min



| Cutting Part                       | Peripheral part   |           | Honeycomb pocket                                        |          |           |
|------------------------------------|-------------------|-----------|---------------------------------------------------------|----------|-----------|
| Process                            | Roughing          | Finishing | Helical approach                                        | Roughing | Finishing |
| Tool                               | AL3D-345 $\phi 6$ |           |                                                         |          |           |
| Spindle speed [min <sup>-1</sup> ] | 17,500            |           |                                                         |          |           |
| Feed [mm/min]                      | 3,000             |           | 1,000                                                   | 3,000    |           |
| Depth of cut apxae [mm]            | 18 × 1.8          | 18 × 0.1  | ap 0.14 (1circle)<br>(Helical R = 2.0 mm<br>Angle = 4°) | 18 × 1.8 | 18 × 0.1  |

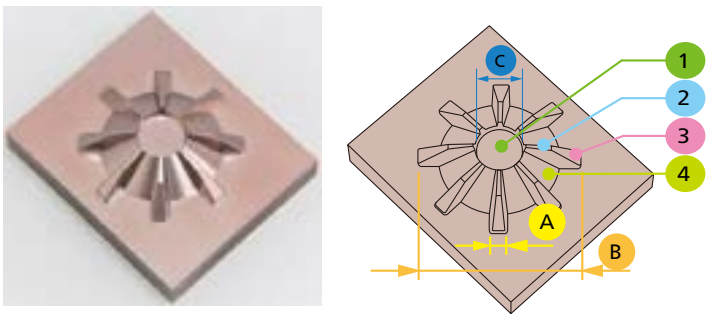
Long Neck Ball End Mill for Copper Electrode

Page ➡ M-008

DRB230 R 0.05 ~ R 3 Total 94 sizes



Realizes long time machining and achieves stable high precision machining surface even on tough material of copper tungsten



|                         | Surface Roughness        |
|-------------------------|--------------------------|
| 1 Flat surface          | Ra : 0.129<br>Rz : 1.224 |
| 2 Inclined angle 12°    | Ra : 0.174<br>Rz : 1.709 |
| 3 Inclined angle 34.07° | Ra : 0.199<br>Rz : 1.471 |
| 4 Inclined angle 35°    | Ra : 0.296<br>Rz : 2.050 |

Work size 30 × 36 mm  
(Cutting depth 5 mm)  
Work material Copper tungsten (W70% - Cu30%)  
Coolant Water-insoluble fluid  
Total machining time 4 hr 20 min

|   | Width  |        |
|---|--------|--------|
|   | Target | Actual |
| A | 2.500  | 2.504  |
| B | 25.000 | 25.002 |
| C | 8.203  | 8.202  |

| Process                            | Roughing      | Semi-finishing |             | Stock removal | Finishing     |             |                        |
|------------------------------------|---------------|----------------|-------------|---------------|---------------|-------------|------------------------|
|                                    |               | Side · Curved  | Top · Flat  |               | Side · Curved | Top         | Flat · Contour         |
| Tool                               | DRB230 R0.4x3 | DRB230 R0.4x3  |             | DRB230 R0.2x1 |               |             |                        |
| Spindle speed [min <sup>-1</sup> ] | 30,000        |                |             |               |               |             |                        |
| Feed [mm/min]                      | 1,400         |                |             | 500           |               |             |                        |
| Depth of cut apxae [mm]            | 0.15 × 0.3    | 0.05×0.01      | 0.01 × 0.05 | 0.01 × 0.02   | 0.03×0.01     | 0.01 × 0.03 | ap0.01<br>ae 0.03·0.02 |
| Stock                              | 0.02          | 0.01           |             | 0.01          | -             |             |                        |
| Machining time                     | 1 hr 20 min   | 25 min         | 23 min      | 47 min        | 1 hr 25 min   |             |                        |



Long Neck Square End Mill for Copper Electrode

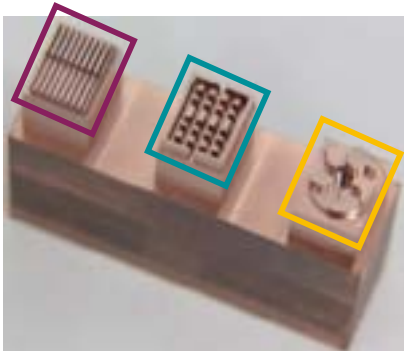
Page ➡ M-004

**DHR237**

φ 0.1 ~ φ 6 Total 74 sizes



Realizes long time machining and achieves stable high precision machining surface even on tough material of copper tungsten

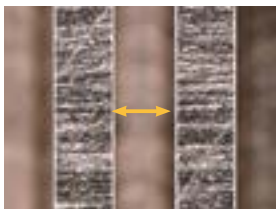
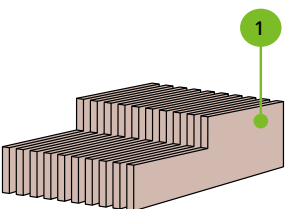


Work size 10 × 30 mm  
(Cutting depth 3 mm)

Work material Copper tungsten (W70% - Cu30%)

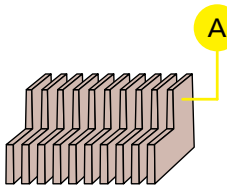
Coolant Water-insoluble fluid

Total machining time 1 hr 40 min



| Slot width [mm] |        |        |
|-----------------|--------|--------|
| B               | Target | Actual |
|                 | 0.310  | 0.307  |

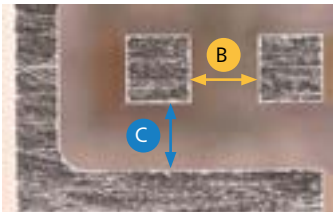
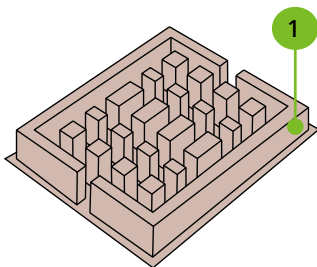
| Side surface roughness [μm] |
|-----------------------------|
| 1 Ra : 0.101                |



| A Deflection [mm] |
|-------------------|
| 0.001             |

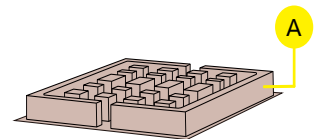
| Shape                              | Micro slit shape      |                          |
|------------------------------------|-----------------------|--------------------------|
| Process                            | Roughing (Slotting)   | Finishing (Side milling) |
| Tool                               | DHR237 φ 0.3×1        | DHR237 φ 0.3×2           |
| Spindle speed [min <sup>-1</sup> ] | 25,000                |                          |
| Feed [mm/min]                      | 200<br>100 ※          | 150                      |
| Depth of cut apxae [mm]            | ap 0.01<br>ap 0.005 ※ | 0.1×0.005                |
| Stock                              | 0.005                 | -                        |
| Machining time                     | 42 min                | 12 min                   |

※Guide part machining from the upper surface to -0.05mm.



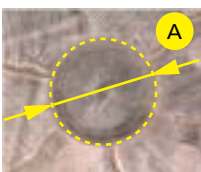
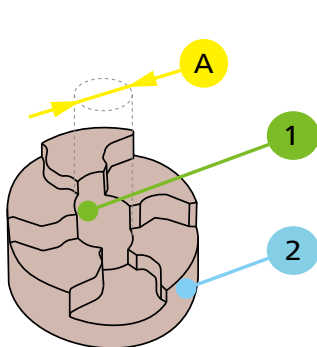
| Slot width [mm] |        |        |
|-----------------|--------|--------|
| B               | Target | Actual |
|                 | 0.600  | 0.601  |
| C               | 0.600  | 0.599  |

| 1 Side surface roughness [μm] |
|-------------------------------|
| Ra : 0.197                    |



| A Deflection [mm] |
|-------------------|
| 0.001             |

| Shape                              | Fine prism profile  |                          |                          |
|------------------------------------|---------------------|--------------------------|--------------------------|
| Process                            | Roughing (Slotting) | Finishing (Side milling) | Finishing (Side milling) |
| Tool                               | DHR237 φ 0.5×1.5    |                          |                          |
| Spindle speed [min <sup>-1</sup> ] | 26,000              |                          |                          |
| Feed [mm/min]                      | 500                 | 550                      |                          |
| Depth of cut apxae [mm]            | ap 0.07             | 0.3 × 0.02               | 0.3 × 0.005              |
| Stock                              | 0.05                | 0.005                    | -                        |
| Machining time                     | 13 min              |                          |                          |



| Width [mm] |        |        |
|------------|--------|--------|
| A          | Target | Actual |
|            | 1.800  | 1.797  |

| Surface roughness [μm] |          |
|------------------------|----------|
| 1                      | Ra 0.182 |
| 2                      | Ra 0.176 |

| Shape                              | Cylindrical stage profile     |                          |                          |
|------------------------------------|-------------------------------|--------------------------|--------------------------|
| Process                            | Roughing (Helical milling)    | Finishing (Side milling) | Finishing (Side milling) |
| Tool                               | DHR237 φ 0.8×3                |                          |                          |
| Spindle speed [min <sup>-1</sup> ] | 12,000                        |                          |                          |
| Feed [mm/min]                      | 500                           |                          |                          |
| Depth of cut apxae [mm]            | ap 0.02<br>(Helical R = 0.25) | 0.5 × 0.02               | 0.5 × 0.005              |
| Stock                              | 0.25                          | 0.005                    | -                        |
| Machining time                     | 33 min                        |                          |                          |

Machining Case  
Copper Electrode  
Milling

Machining Case  
Copper Electrode  
Milling

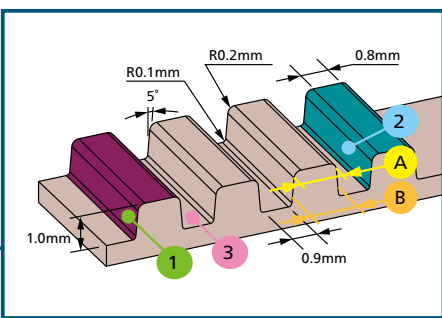
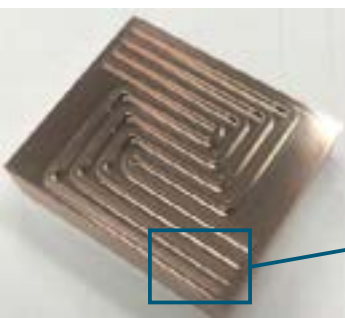
Long Neck Radius End Mill for Copper Electrode

Page ➡ M-014

**DHR237R**  $\phi 0.2 \times R0.02 \sim \phi 6 \times R1$  Total 153 sizes



Realizes long time machining and achieves stable high precision machining surface even on tough material of copper tungsten



| Surface roughness [ $\mu m$ ] |   |                          |
|-------------------------------|---|--------------------------|
| Side                          | 1 | Ra : 0.159<br>Rz : 1.403 |
|                               | 2 | Ra : 0.139<br>Rz : 1.018 |
| Bottom                        | 3 | Ra : 0.055<br>Rz : 0.516 |

Work size 30 × 35 mm  
(Cutting depth 1.0 mm)

Work material Copper tungsten (W70% - Cu30%)

Coolant Water-soluble fluid

Total machining time 2 hr 5 min

|        | A                     | B                     |
|--------|-----------------------|-----------------------|
| Width  | Depth from top 0.2 mm | Depth from top 0.8 mm |
| Target | 1.202 mm              | 1.307 mm              |
| Shape  | 1.203 mm              | 1.311 mm              |
| Shape  | 1.207 mm              | 1.314 mm              |

| Process                            | Roughing              |          | Semi-finishing |         | Finishing             |         |
|------------------------------------|-----------------------|----------|----------------|---------|-----------------------|---------|
|                                    | Contour               | Slot     | Flat surface   | Side    | Flat surface          | Side    |
| Tool                               | DHR237R<br>ϕ 1×R0.1×3 |          |                |         | DHR237R<br>ϕ 1×R0.1×3 |         |
| Spindle speed [min <sup>-1</sup> ] | 23,000                |          |                |         |                       |         |
| Feed [mm/min]                      | 2,200                 | 1,000    | 2,200          |         | 1,100                 |         |
| Depth of cut apxae [mm]            | 0.054 × 0.55          | ap 0.027 | ae 0.05        | ap 0.03 | ae 0.05               | ap 0.02 |
| Stock                              | 0.05                  |          | 0.03           |         | -                     |         |
| Machining time                     | 23 min                |          | 30 min         |         | 1 hr 12 min           |         |

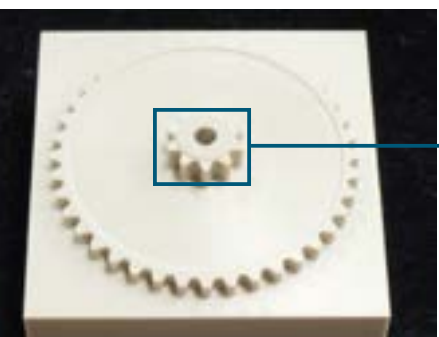
Short Flute End Mill for Resin

Page ➡ N-004

**RSES230**  $\phi 0.1 \sim \phi 6$  Total 155 sizes



Short flute on the long neck RSES230 type suppress chattering to obtain excellent surface even at corners



Work size 45 × 45 mm  
(Cutting depth 6.5 mm)

Work material PEEK resin

Coolant Water-soluble fluid

Total machining time 1 hr 40 min

Excellent surface even at corners

| Process                             | Roughing                     | Semi-finishing                          | Finishing                                                  |
|-------------------------------------|------------------------------|-----------------------------------------|------------------------------------------------------------|
| Tool                                | RSES230<br>$\phi 6 \times 9$ | RSES230<br>$\phi 1 \times 1.5 \times 4$ | RSES230<br>$\phi 1 \times 1.5 \times 4$                    |
| Spindle speed [ $\text{min}^{-1}$ ] | 3,000                        | 20,000                                  | 20,000                                                     |
| Feed [mm/min]                       | 1,250                        | 800                                     | 400                                                        |
| Depth of cut apxae [mm]             | $6.47 \times 1$              | $0.3 \times 0.5$                        | Side: $0.3 \times 0.03$<br>Flat surface: $0.03 \times 0.3$ |
| Stock                               | 0.03                         | 0.03                                    | -                                                          |
| Machining time                      | 4 min 30 sec                 | 7 min                                   | 1 hr 28 min 30 sec                                         |

Machining Case  
Copper  
Electrode  
Milling

Machining Case  
Resin Milling

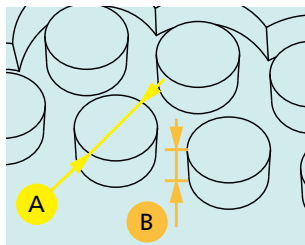
End Mill for Hard Brittle Materials

Page ➡ O-004

**DCMS**       $\phi$  0.3 ~  $\phi$  2 Total 14 sizes



Machinable on hard brittle materials such as glass and cemented carbide  
High adhered DIAMOND COATING makes tool life longer



Work size      20 × 20 mm  
                    (Cutting depth 1 mm)

Work material    Heat-resistant glass

Coolant          Water-soluble fluid

Total machining time    20 hr 30 min

|        | A | Cylinder diameter | B | Cutting Depth |
|--------|---|-------------------|---|---------------|
| Target |   | 1.260             |   | 1.000         |
| Actual |   | 1.259             |   | 0.999         |

|                                    |                      |
|------------------------------------|----------------------|
| Process                            | Contour              |
| Tool                               | DCMS<br>$\phi$ 0.5×1 |
| Spindle speed [min <sup>-1</sup> ] | 20,000               |
| Feed [mm/min]                      | 120                  |
| Depth of cut apxae [mm]            | 0.002 × 0.3          |
| Machining time                     | 20 hr 30 min         |

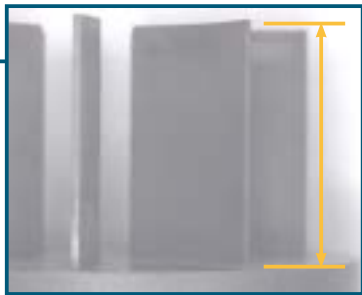
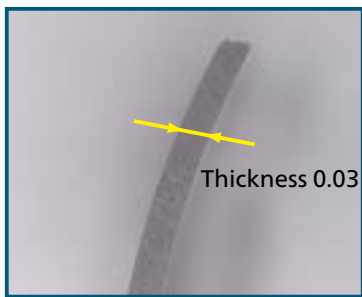
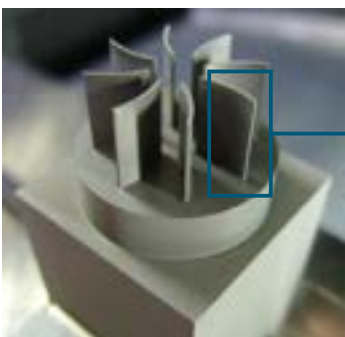
DIAMOND COATING 2-Flute Long Neck End Mill

Page ➡ P-006

**DCHR230**       $\phi$  0.5 ~  $\phi$  6 Total 19 sizes



Original DIAMOND COATING realized a tool long life for the machining of graphite



Work size       $\phi$  14 mm  
                    (Height of blade 6 mm)

Work material    Graphite (TTK-5)

Coolant          Air blow

Total machining time    1 hr 20 min

|                                    |                      |                     |                |           |
|------------------------------------|----------------------|---------------------|----------------|-----------|
| Process                            | Cylindrical roughing | Roughing            | Semi-finishing | Finishing |
| Tool                               | DCSE235 $\phi$ 6     | DCHR230 $\phi$ 1×10 |                |           |
| Spindle speed [min <sup>-1</sup> ] | 8,000                | 20,000              |                |           |
| Feed [mm/min]                      | 600                  | 2,000               | 1,000          | 800       |
| Depth of cut apxae [mm]            | 8×0.5                | 0.2×0.6             | 0.05×0.2       |           |
| Machining time                     | 5 min                | 1 hr 5 min          |                | 10 min    |

Machining Case  
Hard Brittle Material  
Milling

Machining Case  
Graphite  
Milling

MUGEN COATING Flat Drill

Page ➡ Q-004

**MFD**       $\phi$  0.1 ~  $\phi$  6 Total 69 sizes



Possible for high-precision drilling on slopes of various angles with less burr

Inclined angle 15°(Blind hole)  
115 holes

Hole diameter  $\phi$  0.101

Inclined angle 30°(Blind hole)  
256 holes

Hole diameter  $\phi$  0.104

Inclined angle 70°(Blind hole)  
45 holes

Hole diameter  $\phi$  0.100

Semicircular hole (Blind hole)  
35 holes

Hole diameter  $\phi$  0.100

Work size      20 × 30 mm

Work material      SUS304

Coolant      Water-soluble fluid

Total machining time      1 hr 10 min

| Process                            | Inclined angle 15°<br>(Blind hole) | Inclined angle 30°<br>(Blind hole) | Inclined angle 70°<br>(Blind hole) | Semicircular hole<br>(Blind hole) |
|------------------------------------|------------------------------------|------------------------------------|------------------------------------|-----------------------------------|
| Tool                               | MFD<br>$\phi$ 0.1                  | MFD<br>$\phi$ 0.1                  | MFD<br>$\phi$ 0.1                  |                                   |
| Spindle speed [min <sup>-1</sup> ] | 25,000                             | 25,000                             | 25,000                             |                                   |
| Feed [mm/min]                      | 3                                  | 3                                  | 2                                  |                                   |
| Cutting depth [mm]                 | 0.2<br>(Non-Step)                  | 0.2<br>(Non-Step)                  | 0.2<br>(Non-Step)                  |                                   |
| Machining time                     | 15 min<br>(8 sec / hole)           | 40 min<br>(8 sec / hole)           | 10 min<br>(10 sec / hole)          | 5 min<br>(10 sec / hole)          |

MUGEN COATING M-Thread Mill  
(for Internal Thread)

Page ➡ R-004

**MMTM**      M1 ~ M6 Total 11 sizes



Thread mill used for threading instead of a tap. Cutting resistance can significantly be reduced in comparison with a tap, and tool life and accuracy can be improved in processing heat resistant alloy

450 Holes

| New | After 450 holes |
|-----|-----------------|
|     |                 |

Retreat amount 0.002 mm

Work size      35 × 35 mm

Work material      SUS316L

Coolant      Water-soluble fluid

Total machining time      3 hr 20 min

| Process                            | Center hole milling  | Pilot hole milling   | Thread milling                      |
|------------------------------------|----------------------|----------------------|-------------------------------------|
| Tool                               | MDR-PD<br>$\phi$ 0.7 | MDR-R<br>$\phi$ 0.76 | MMTM<br>M1                          |
| Spindle speed [min <sup>-1</sup> ] | 6,000                |                      | 17,500                              |
| Feed [mm/min]                      | 30                   | 90                   | 300                                 |
| Depth of cut apxae [mm]            | Step amount 0.05     | Step amount 0.1      | ae 0.088×2<br>Final helical R 0.155 |
| Machining time                     | 1 hr 21 min 5 sec    | 1 hr 24 min 35 sec   | 34 min 20 sec                       |

Thread milling : Up-cut

7

## Technical Guidance

Technical Guidance

PAGE

X-002



# What is End mill ?

## What is Cutting tool?

Cutting tools generally include milling tools, end mills, cutters and drills, turning tools, drilling tools, gear hob cutters and etc.



Drilling



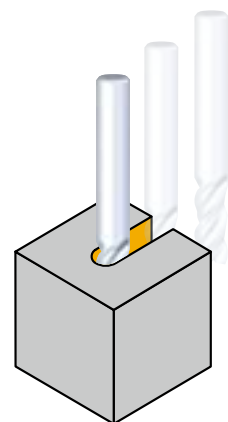
Turning processing



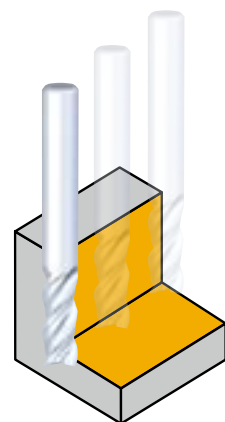
Gear processing

## What is end mill?

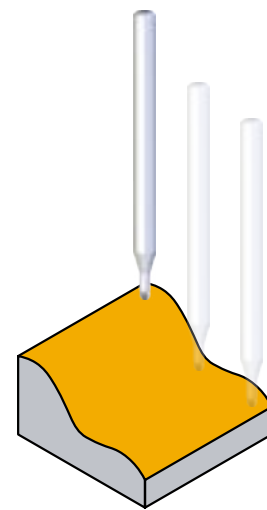
End mill is similar to drill that supports variety of cutting processes, and is used to produce many industrial products. The biggest dimension is up to about  $\phi 30\text{mm}$ . Recently, with the development of Japanese industrial products, the small diameter end mill that under  $\phi 6\text{mm}$  is becoming popular. Furthermore, the materials of end mill are getting various from high speed steel to cemented carbide, ceramics, and even CBN, PCD brazed on cemented carbide.



Slotting by square end mill



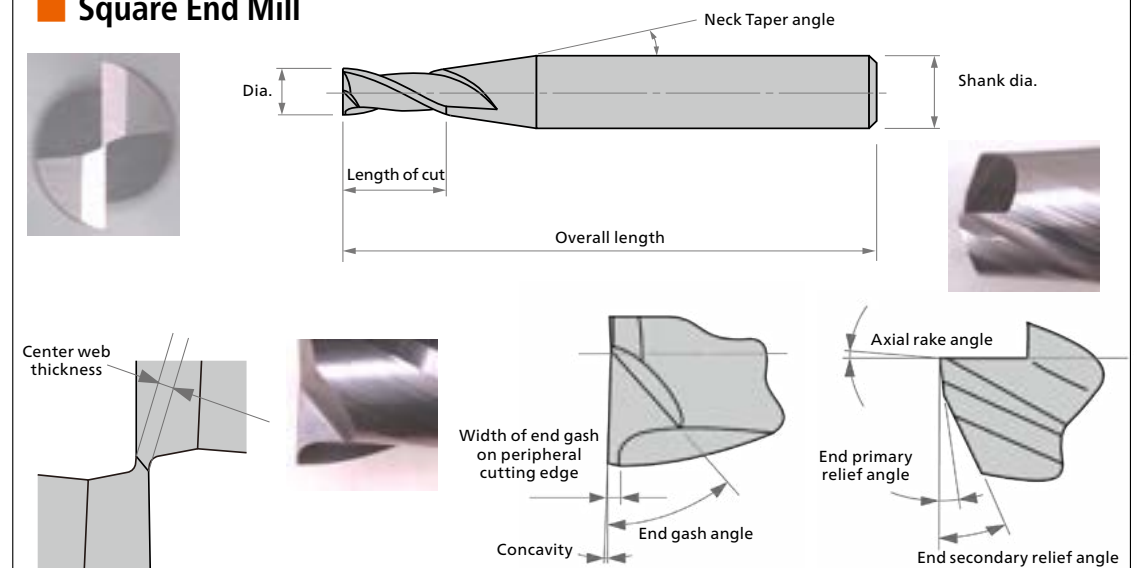
Side milling by square end mill



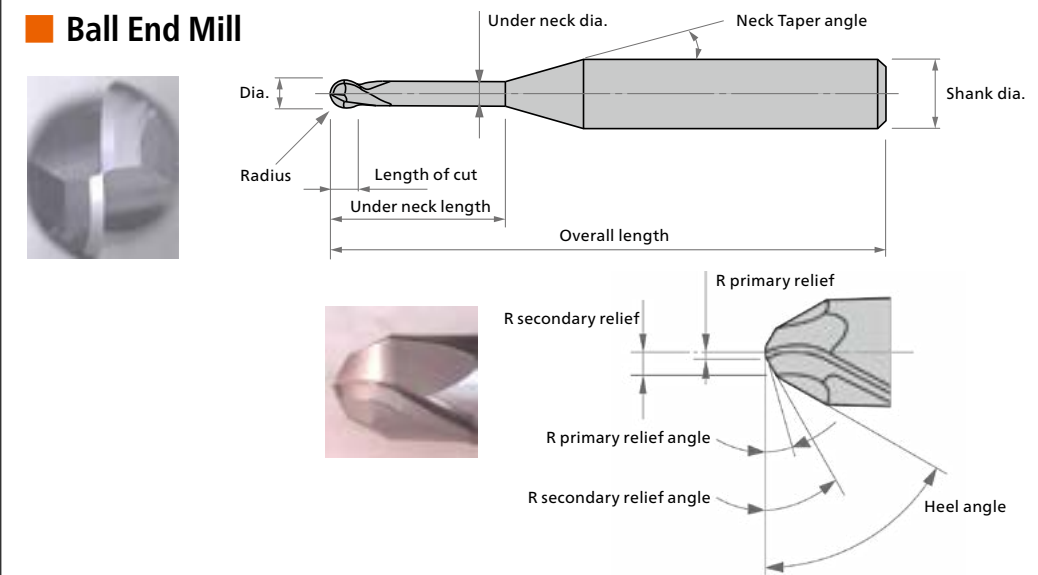
3D milling by ball end mill

# Name of parts for End mill

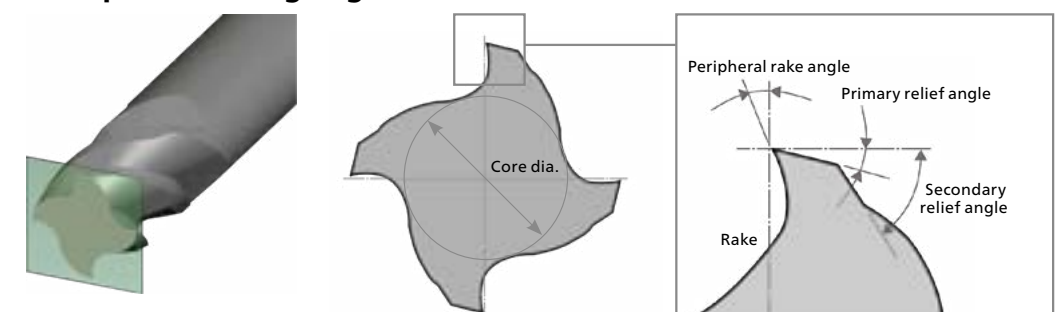
## Square End Mill



## Ball End Mill

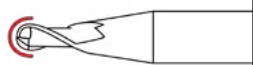
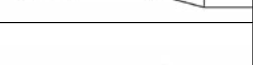


## Peripheral cutting edge (Cross section of 4-flute end mill)



# Type of End mill

## Type of peripheral and end cutting edge

|                                 |               |                                                                                   |                                                         |
|---------------------------------|---------------|-----------------------------------------------------------------------------------|---------------------------------------------------------|
| Type of End cutting edge        | Square        |  | Square end cutting edge                                 |
|                                 | Ball          |  | Ball end cutting edge                                   |
|                                 | Corner Radius |  | Square end cutting edge                                 |
|                                 | Formed        |  | Generic name for special types                          |
| Type of Peripheral cutting edge | Straight      |  | Cylindrical peripheral cutting edge                     |
|                                 | Taper         |  | Tapered peripheral cutting edge                         |
|                                 | Long Neck     |  | Thinner neck diameter than end diameter                 |
|                                 | Taper Neck    |  | Thinner neck diameter than end diameter but taper shape |

## Shapes of NS TOOL's end mill

Square End Mill



Corner Radius End Mill



Long Neck square End Mill



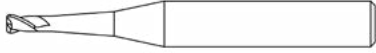
Long Neck Corner Radius End Mill



Ball End Mill



Long Neck Tapered Corner Radius End Mill



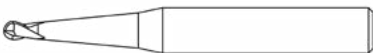
Long Neck Ball End Mill



Tapered Square End Mill



Long Neck Tapered Ball End Mill



Tapered Ball End Mill



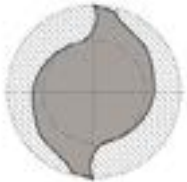
Tapered Corner Radius End Mill



# Differences on number of flute

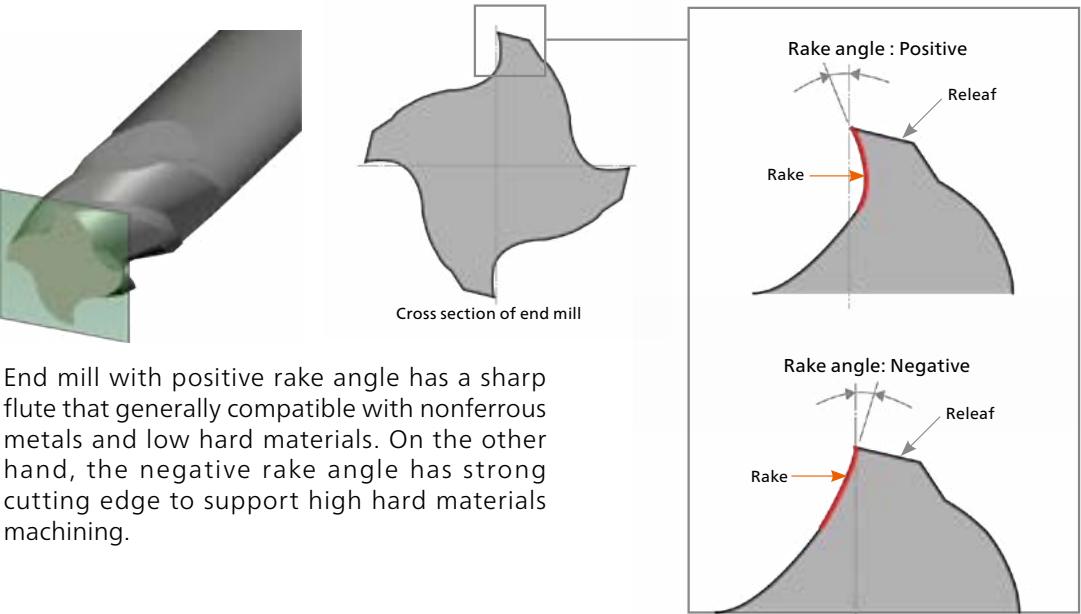
## Number of flute

It is important to choose the number of flute of the end mill according to the usage. Introduction of the advantages, disadvantages, and usage of each number of flute are as below.

|          |              |  |  |  |  |
|----------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|          |              | 2-flute                                                                             | 3-flute                                                                             | 4-flute                                                                             | 6-flute                                                                             |
| Features | Advantage    | Well chip removal                                                                   | Well chip removal                                                                   | High tool rigidity                                                                  | High tool rigidity                                                                  |
|          | Disadvantage | Low tool rigidity                                                                   | Difficult to measure dia.                                                           | Low chip removal                                                                    | Low chip removal                                                                    |
| Usage    |              | For General use                                                                     | Slotting & Side milling                                                             | Side milling                                                                        | Side milling                                                                        |

## Rake angle at peripheral cutting edge

Variety of rake angles to support different cutting materials.



End mill with positive rake angle has a sharp flute that generally compatible with nonferrous metals and low hard materials. On the other hand, the negative rake angle has strong cutting edge to support high hard materials machining.

# Cutting conditions of End Mill (1)

## Calculation for Cutting Speed, Spindle Speed and Feed

|                                        |                                         |                                                                                |
|----------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------|
| Cutting Speed $vc$ (m/min)             | $= \frac{\pi \times D \times n}{1,000}$ | $n$ = Spindle Speed<br>$D$ = End mill diameter<br>$\pi$ = Circle ratio (3.14)  |
| Spindle Speed $n$ (min <sup>-1</sup> ) | $= vc \div \pi \div D \times 1,000$     | $vc$ = Cutting Speed<br>$\pi$ = Circle ratio (3.14)<br>$D$ = End mill diameter |
| Feed $vf$ (mm/min)                     | $= n \times fz \times Z$                | $n$ = Spindle Speed<br>$fz$ = feed per tooth<br>$Z$ = number of flute          |
| Feed per Tooth $fz$ (mm/tooth)         | $= \frac{vf}{n \times Z}$               | $vf$ = Feed<br>$n$ = Spindle Speed<br>$Z$ = number of tooth                    |

When maximum speed of the machine spindle less than value of recommended milling conditions, adjust conditions by calculation as follows.

- Rate ( $\alpha$ ) is calculated by chosen Spindle Speed ( $n$ ) and Recommended Spindle Speed ( $n1$ ).

$$n \text{ (min}^{-1}\text{)} \div n1 \text{ (min}^{-1}\text{)} = \alpha$$

Rate

- Obtain Feed ( $vf$ ) for actual machining by multiplying. Recommended Feed ( $vf1$ ) from Rate ( $\alpha$ ).

$$vf1 \text{ (mm/min)} \times \alpha = vf \text{ (mm/min)}$$

Feed for actual machining

Example

Machining S50C with MSE430  $\phi 1$

Recommended milling condition

Spindle Speed  $n$ ; 20,700 min<sup>-1</sup>

Feed  $vf$ ; 330 mm/min

In case Maximum Spindle Speed of the machine is 10,000min<sup>-1</sup>...

Feed for Spindle Speed 10,000min<sup>-1</sup>

10,000 ÷ 20,700 = 0.483 (Rate)

330 × 0.483 = 159mm/min

Feed  $vf$  ; 159 mm/min

## Cutting Speed (vc) (m/min)

Appropriate Cutting Speed should be decided by parameters such as tool material, diameter, length of cut, work material, cutting machine, rigidity of tool holder, machining configuration, accuracy, cutting fluid, and etc.  
Generally tool material and work material are main factors to determine the Cutting Speed.

Table 1.  
Cutting Speed

| Work Material                                     | Cutting Speed (m/min) |                     |
|---------------------------------------------------|-----------------------|---------------------|
|                                                   | Solid Carbide Tool    | Coated Carbide Tool |
| Carbon Steels<br>e.g.)S50C                        | 30 ~ 60               | 60 ~ 150            |
| Alloy Steels<br>e.g.)SCM, SKD                     | 30 ~ 40               | 60 ~ 100            |
| Prehardened Steels<br>e.g.)NAK, HPM               | 30 ~ 40               | 60 ~ 100            |
| Stainless Steels<br>e.g.)SUS304                   | 20 ~ 30               | 40 ~ 80             |
| Hardened Steels(45 ~ 60HRC)<br>e.g.)SKD61, STAVAX | —                     | 20 ~ 100            |

## Feed per Tooth (fz) (mm/tooth)

Feed per Tooth is an important element for efficient machining which should be determined by parameters such as tool diameter, type, work material, cutting machine, rigidity of tool holder, machining configuration, accuracy and cutting depth.  
Table 2 is a guideline of Feed per Tooth for short flute end mills.

Table 2.  
Feed per Tooth

| Dia. (mm) | Feed per Tooth (mm/tooth) |             |
|-----------|---------------------------|-------------|
|           | 2-Flutes                  | 4-Flutes    |
| 1         | 0.001 ~ 0.005             |             |
| 6         | 0.02 ~ 0.04               | 0.01 ~ 0.03 |
| 10        | 0.04 ~ 0.08               | 0.03 ~ 0.06 |
| 20        | 0.08 ~ 0.12               | 0.06 ~ 0.1  |

※ Note: Feed per Tooth for standard flute size end mills should be adjusted to 80% or less from table 2.

Referring above parameters of Cutting Speed and Feed per Tooth, both Spindle Speed and Feed are calculated considering all other related factors as well.

# Cutting conditions of End Mill (2)

## Metal Removal Rate (cm<sup>3</sup>/min)

Metal removal rate (the volume of metal removed in cubic mm per minute) is calculated by the following formula.

$$Q_{(\text{cm}^3/\text{min})} = \frac{a_p \times a_e \times v_f}{1,000}$$

$Q$  : Metal removal rate (cm<sup>3</sup>/min)

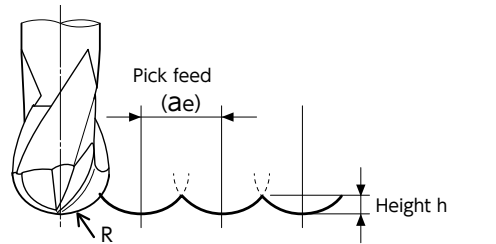
$a_p$  : Axial depth of cut (mm)  
 $a_e$  : Radial depth of cut (mm)  
 $v_f$  : Feed (mm/min)

## all end mill and pick feed (ae) (theoretical surface finish)

In ball end mill milling, height  $h$  of the unmachined part like mountain shape below be formed by ball radius and pick feed, which are called cusp height or scallop height and which is considered theoretical surface finish. Since pick feed is the same  $a_e$  radial depth of cut at the milling in flat part, it is calculated by the following formula.

$$h_{(\mu\text{m})} = \left( R - \sqrt{R^2 - \left(\frac{ae}{2}\right)^2} \right) \times 1000 \approx ae^2 \times 1000 \div 8R$$

$R$  : Radius (mm)  
 $ae$  : Radial depth of cut (mm)



| Cusp Height Quick Reference Matrix |                             |        |      |      |      |      |      |      |      |      |      |
|------------------------------------|-----------------------------|--------|------|------|------|------|------|------|------|------|------|
| Radius                             | Radial depth of cut ae [mm] |        |      |      |      |      |      |      |      |      |      |
|                                    | 0.005                       | 0.01   | 0.02 | 0.03 | 0.04 | 0.05 | 0.08 | 0.1  | 0.15 | 0.2  | 0.3  |
| 0.05                               | 0.06                        | 0.25   | 1.01 | 2.30 | —    | —    | —    | —    | —    | —    | —    |
| 0.1                                | 0.03                        | 0.13   | 0.50 | 1.13 | 2.02 | 3.18 | —    | —    | —    | —    | —    |
| 0.3                                | 0.01                        | 0.04   | 0.17 | 0.38 | 0.67 | 1.04 | 2.68 | 4.20 | —    | —    | —    |
| 0.5                                | ~ 0.01                      | 0.03   | 0.10 | 0.23 | 0.40 | 0.63 | 1.60 | 2.51 | 5.66 | —    | —    |
| 0.75                               | —                           | 0.02   | 0.07 | 0.15 | 0.27 | 0.42 | 1.07 | 1.67 | 3.76 | 6.70 | —    |
| 1                                  | —                           | 0.01   | 0.05 | 0.11 | 0.20 | 0.31 | 0.80 | 1.25 | 2.82 | 5.01 | —    |
| 1.5                                | —                           | ~ 0.01 | 0.03 | 0.08 | 0.13 | 0.21 | 0.53 | 0.83 | 1.88 | 3.34 | 7.52 |
| 2                                  | —                           | —      | 0.03 | 0.06 | 0.10 | 0.16 | 0.40 | 0.63 | 1.41 | 2.50 | 5.63 |
| 2.5                                | —                           | —      | 0.02 | 0.05 | 0.08 | 0.13 | 0.32 | 0.50 | 1.13 | 2.00 | 4.50 |
| 3                                  | —                           | —      | 0.02 | 0.04 | 0.07 | 0.10 | 0.27 | 0.42 | 0.94 | 1.67 | 3.75 |

※In finishing in flat part, the above values in the table are theoretical values by the radial depth of cut (ae).

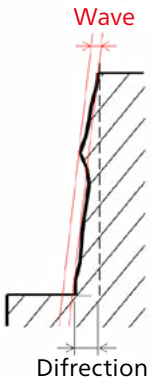
## Selection of Number of Flute

|              | 2-Flutes | 3-Flutes | 4-Flutes | 6-Flutes |
|--------------|----------|----------|----------|----------|
| Slotting     | ○        | ⊙        | ○        | ×        |
| Side Milling | ○        | ⊙        | ⊙        | ⊙        |

Generally 2-flutes and 3-flutes are selected for slotting because of the larger chip pocket. 4-flutes and 6-flutes are recommended for side milling as no problem of chip disposal.

## Selection of Helix Angle

|                    |                 | Helix 25° | Helix 30° | Helix 35° | Helix 40° | Helix 45° |
|--------------------|-----------------|-----------|-----------|-----------|-----------|-----------|
| Shearing ability   |                 | ○         | ○         | ⊙         | ⊙         | ⊙         |
| Chatter resistance |                 | ○         | ○         | ⊙         | ⊙         | ⊙         |
| Surface roughness  |                 | ○         | ○         | ⊙         | ⊙         | ⊙         |
| Inclination        |                 | ⊙         | ⊙         | ⊙         | ○         | ○         |
| Wave               |                 | ⊙         | ⊙         | ⊙         | ○         | ○         |
| Application        | Slotting        | ⊙         | ⊙         | ○         | ○         | △         |
|                    | Side milling    | ○         | ⊙         | ⊙         | ⊙         | ⊙         |
|                    | Hardened steels | △         | △         | ○         | ⊙         | ⊙         |

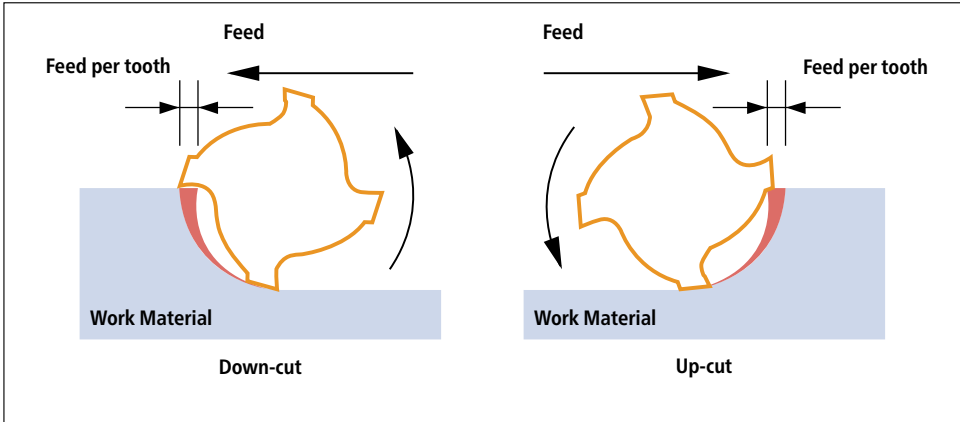


※ Remarks

- Helix 25°  
Suitable for slotting.
- Helix 30°  
Recommendable for both slotting and side milling.
- Helix 35°, Helix 40°, Helix 45°  
Selectable within the required tolerance.  
As larger angle gives higher shearing ability and reduce chattering, it is possible to relatively prolong the length of cut.
- Helix 45°  
Suitable for machining for hardened steels and tough materials.

## Cutting Direction (Up-cut and Down-cut)

Cutting structure of Up-cut and Down-cut



Difference of edge wear by cutting directions

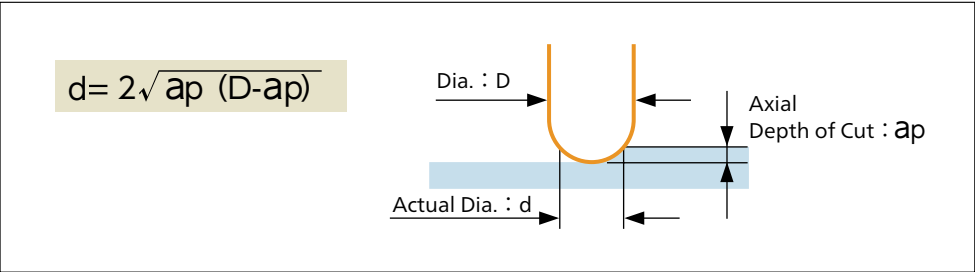


Down-cut tooth first cuts thicker then progressively thinner, while Up-cut goes the opposite. As shown by above photos, Down-cut is recommended since the wear of cutting edge is comparatively small and tool life is eventually longer.

# Summary of diameter of cutting point of Ball End Mill

| (R)    | (D)  | Axial Depth of Cut (ap) 【mm】 |       |       |       |       |       |      |      |      |      |      |      |      |       |       |
|--------|------|------------------------------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|-------|-------|
| Radius | Dia. | 0.01                         | 0.02  | 0.03  | 0.04  | 0.05  | 0.08  | 0.1  | 0.15 | 0.2  | 0.3  | 0.5  | 0.8  | 1    | 2     | 3     |
| 0.1    | 0.2  | 0.087                        | 0.12  | 0.143 | 0.16  | 0.173 | 0.196 | 0.2  |      |      |      |      |      |      |       |       |
| 0.2    | 0.4  | 0.125                        | 0.174 | 0.211 | 0.24  | 0.265 | 0.32  | 0.35 | 0.39 | 0.4  |      |      |      |      |       |       |
| 0.3    | 0.6  | 0.154                        | 0.215 | 0.262 | 0.299 | 0.332 | 0.41  | 0.45 | 0.52 | 0.57 | 0.6  |      |      |      |       |       |
| 0.4    | 0.8  | 0.178                        | 0.25  | 0.304 | 0.349 | 0.387 | 0.48  | 0.53 | 0.62 | 0.69 | 0.77 |      |      |      |       |       |
| 0.5    | 1    | 0.199                        | 0.28  | 0.341 | 0.392 | 0.436 | 0.54  | 0.6  | 0.71 | 0.8  | 0.92 | 1    |      |      |       |       |
| 1      | 2    | 0.282                        | 0.398 | 0.486 | 0.56  | 0.624 | 0.78  | 0.87 | 1.05 | 1.2  | 1.43 | 1.73 | 1.96 | 2    |       |       |
| 1.5    | 3    | 0.346                        | 0.488 | 0.597 | 0.688 | 0.768 | 0.97  | 1.08 | 1.31 | 1.5  | 1.8  | 2.24 | 2.65 | 2.83 |       |       |
| 2      | 4    | 0.399                        | 0.564 | 0.69  | 0.796 | 0.889 | 1.12  | 1.25 | 1.52 | 1.74 | 2.11 | 2.65 | 3.2  | 3.46 | 4     |       |
| 2.5    | 5    | 0.447                        | 0.631 | 0.722 | 0.891 | 0.995 | 1.25  | 1.4  | 1.71 | 1.96 | 2.37 | 3    | 3.67 | 4    | 4.9   |       |
| 3      | 6    | 0.489                        | 0.692 | 0.846 | 0.977 | 1.091 | 1.38  | 1.54 | 1.87 | 2.15 | 2.62 | 3.32 | 4.08 | 4.47 | 5.66  | 6     |
| 4      | 8    | 0.565                        | 0.799 | 0.978 | 1.129 | 1.261 | 1.59  | 1.78 | 2.17 | 2.5  | 3.04 | 3.87 | 4.8  | 5.29 | 6.93  | 7.75  |
| 5      | 10   | 0.632                        | 0.894 | 1.094 | 1.262 | 1.411 | 1.78  | 1.99 | 2.43 | 2.8  | 3.41 | 4.36 | 5.43 | 6    | 8     | 9.17  |
| 6      | 12   | 0.693                        | 0.979 | 1.198 | 1.383 | 1.546 | 1.95  | 2.18 | 2.67 | 3.07 | 3.75 | 4.8  | 5.99 | 6.63 | 8.94  | 10.39 |
| 7      | 14   | 0.748                        | 1.058 | 1.295 | 1.495 | 1.67  | 2.11  | 2.36 | 2.88 | 3.32 | 4.05 | 5.2  | 6.5  | 7.21 | 9.8   | 11.49 |
| 8      | 16   | 0.8                          | 1.131 | 1.384 | 1.598 | 1.786 | 2.26  | 2.52 | 3.08 | 3.56 | 4.34 | 5.57 | 6.97 | 7.75 | 10.58 | 12.49 |
| 9      | 18   | 0.848                        | 1.199 | 1.468 | 1.695 | 1.895 | 2.39  | 2.68 | 3.27 | 3.77 | 4.61 | 5.92 | 7.42 | 8.25 | 11.31 | 13.42 |
| 10     | 20   | 0.894                        | 1.264 | 1.548 | 1.787 | 1.997 | 2.52  | 2.82 | 3.45 | 3.98 | 4.86 | 6.24 | 7.84 | 8.72 | 12    | 14.28 |

Calculation of Actual Dia.



Technical  
Guidance

# Measurement and Symbol of Surface Roughness (Extracted from JIS B 0601-2001)

| Type                                     | Symbol | Description                                                                                                                                                                                                                                             | Reference chart                                                                             |
|------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Maximum Height of the Profile            | Rz     | The maximum height of the profile is the distance between the maximum peak height and the maximum valley depth from the mean line in each sampling length. Rz(ISO/JIS)is the mean value of the maximum peak-to-valley heights in the evaluation length. | <p><math>Rz = R_p + R_v</math></p>                                                          |
| Arithmetic Mean Deviation of the Profile | Ra     | The arithmetic mean deviation of the profile is the arithmetic mean of the absolute values of distances from the mean line to the profile.                                                                                                              | <p><math>Ra = \frac{1}{L} \int_0^L  f(x)  dx</math></p> <p><b>L</b> = Evaluation Length</p> |

| Value of Maximum Height of the Profile | Value of Arithmetic Mean Deviation of the Profile | Finishing Symbol | Indication of surface texture in technical product documentation |
|----------------------------------------|---------------------------------------------------|------------------|------------------------------------------------------------------|
| 0.05S<br>0.1S<br>0.2S<br>0.4S<br>0.8S  | 0.012a<br>0.025a<br>0.05a<br>0.1a<br>0.2a         |                  | $\sqrt{Ra\ 0.012} \sim \sqrt{Ra\ 0.2}$                           |
| 1.6S<br>3.2S<br>6.3S                   | 0.4a<br>0.8a<br>1.6a                              |                  | $\sqrt{Ra\ 0.4} \sim \sqrt{Ra\ 1.6}$                             |
| 12.5S<br>25S                           | 3.2a<br>6.3a                                      |                  | $\sqrt{Ra\ 3.2} \sim \sqrt{Ra\ 6.3}$                             |
| 50S<br>100S                            | 12.5a<br>25a                                      |                  | $\sqrt{Ra\ 12.5} \sim \sqrt{Ra\ 25}$                             |

※ Note: Triangle Finishing Symbol Mark presents approximate surface roughness specified by Ra and Rz.

Technical  
Guidance

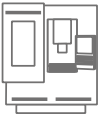
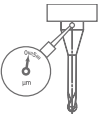
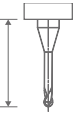


Comparison Table of Hardness

| Rockwell Hardness C Scale150kg Brale (HRC) | Diamond Pyramid Hardness Number, Vickers (HV) | Brinell Hardness Standard10mm Ball 29.42kN (HB) | Rockwell Hardness A Scale 60kg Brale (HRA) | Shore Scleroscope Hardness Number (HS) | Approx Tensile Strength N/mm <sup>2</sup> |
|--------------------------------------------|-----------------------------------------------|-------------------------------------------------|--------------------------------------------|----------------------------------------|-------------------------------------------|
| 68                                         | 940                                           | –                                               | 85.6                                       | 97                                     | –                                         |
| 67                                         | 900                                           | –                                               | 85.5                                       | 95                                     | –                                         |
| 66                                         | 865                                           | –                                               | 84.5                                       | 92                                     | –                                         |
| 65                                         | 832                                           | –                                               | 83.9                                       | 91                                     | –                                         |
| 64                                         | 800                                           | –                                               | 83.4                                       | 88                                     | –                                         |
| 63                                         | 772                                           | –                                               | 82.8                                       | 87                                     | –                                         |
| 62                                         | 746                                           | –                                               | 82.3                                       | 85                                     | –                                         |
| 61                                         | 720                                           | –                                               | 81.8                                       | 83                                     | –                                         |
| 60                                         | 697                                           | –                                               | 81.2                                       | 81                                     | –                                         |
| 59                                         | 674                                           | –                                               | 80.7                                       | 80                                     | –                                         |
| 58                                         | 653                                           | –                                               | 80.1                                       | 78                                     | –                                         |
| 57                                         | 633                                           | –                                               | 79.6                                       | 76                                     | –                                         |
| 56                                         | 613                                           | –                                               | 79.0                                       | 75                                     | –                                         |
| 55                                         | 595                                           | –                                               | 78.5                                       | 74                                     | 2079                                      |
| 54                                         | 577                                           | –                                               | 78.0                                       | 72                                     | 2010                                      |
| 53                                         | 560                                           | –                                               | 77.4                                       | 71                                     | 1952                                      |
| 52                                         | 544                                           | 500                                             | 76.8                                       | 69                                     | 1883                                      |
| 51                                         | 528                                           | 487                                             | 76.3                                       | 68                                     | 1824                                      |
| 50                                         | 513                                           | 475                                             | 75.9                                       | 67                                     | 1755                                      |
| 49                                         | 498                                           | 464                                             | 75.2                                       | 66                                     | 1687                                      |
| 48                                         | 484                                           | 451                                             | 74.7                                       | 64                                     | 1639                                      |
| 47                                         | 471                                           | 442                                             | 74.1                                       | 63                                     | 1578                                      |
| 46                                         | 458                                           | 432                                             | 73.6                                       | 62                                     | 1530                                      |
| 45                                         | 446                                           | 421                                             | 73.1                                       | 60                                     | 1481                                      |
| 44                                         | 434                                           | 409                                             | 72.5                                       | 58                                     | 1432                                      |
| 43                                         | 423                                           | 400                                             | 72.0                                       | 57                                     | 1383                                      |
| 42                                         | 412                                           | 390                                             | 71.5                                       | 56                                     | 1334                                      |
| 41                                         | 402                                           | 381                                             | 70.9                                       | 55                                     | 1294                                      |
| 40                                         | 392                                           | 371                                             | 70.4                                       | 54                                     | 1245                                      |
| 39                                         | 382                                           | 362                                             | 69.9                                       | 52                                     | 1216                                      |
| 38                                         | 372                                           | 353                                             | 69.4                                       | 51                                     | 1177                                      |
| 37                                         | 363                                           | 344                                             | 68.9                                       | 50                                     | 1157                                      |
| 36                                         | 354                                           | 336                                             | 68.4                                       | 49                                     | 1118                                      |
| 35                                         | 345                                           | 327                                             | 67.9                                       | 48                                     | 1079                                      |
| 34                                         | 336                                           | 319                                             | 67.4                                       | 47                                     | 1059                                      |
| 33                                         | 327                                           | 311                                             | 66.8                                       | 46                                     | 1030                                      |
| 32                                         | 318                                           | 301                                             | 66.3                                       | 44                                     | 1000                                      |
| 31                                         | 310                                           | 294                                             | 65.8                                       | 43                                     | 981                                       |
| 30                                         | 302                                           | 286                                             | 65.3                                       | 42                                     | 952                                       |
| 29                                         | 294                                           | 279                                             | 64.7                                       | 41                                     | 932                                       |
| 28                                         | 285                                           | 271                                             | 64.3                                       | 41                                     | 912                                       |
| 27                                         | 279                                           | 264                                             | 63.8                                       | 40                                     | 883                                       |
| 26                                         | 272                                           | 258                                             | 63.3                                       | 38                                     | 863                                       |
| 25                                         | 266                                           | 253                                             | 62.8                                       | 38                                     | 843                                       |
| 24                                         | 260                                           | 247                                             | 62.4                                       | 37                                     | 824                                       |
| 23                                         | 254                                           | 243                                             | 62.0                                       | 36                                     | 804                                       |
| 22                                         | 248                                           | 237                                             | 61.5                                       | 35                                     | 785                                       |
| 21                                         | 243                                           | 231                                             | 61.0                                       | 35                                     | 775                                       |
| 20                                         | 238                                           | 226                                             | 60.5                                       | 34                                     | 755                                       |
| (18)                                       | 230                                           | 219                                             | –                                          | 33                                     | 736                                       |
| (16)                                       | 222                                           | 212                                             | –                                          | 32                                     | 706                                       |
| (14)                                       | 213                                           | 203                                             | –                                          | 31                                     | 677                                       |
| (12)                                       | 204                                           | 194                                             | –                                          | 29                                     | 647                                       |
| (10)                                       | 196                                           | 187                                             | –                                          | 28                                     | 618                                       |
| ( 8)                                       | 188                                           | 179                                             | –                                          | 27                                     | 598                                       |
| ( 6)                                       | 180                                           | 171                                             | –                                          | 26                                     | 579                                       |
| ( 4)                                       | 173                                           | 165                                             | –                                          | 25                                     | 549                                       |
| ( 2)                                       | 166                                           | 158                                             | –                                          | 24                                     | 530                                       |
| ( 0)                                       | 160                                           | 152                                             | –                                          | 24                                     | 520                                       |

Technical Guidance

Factors for End Mill Operation

| Factor                                                                                                                      | Instruction and Advice                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rigidity of Machine                      | ① Use a rigid machine.<br>② Adjust cutting conditions according to the rigidity of machine.                                                                                                                  |
| Collet Chuck and Run out of End Mill     | ① Use a rigid and precise collet chuck.<br>② Minimize the run out of end mill.                                                                                                                               |
| Work Clamp                               | ① Work piece must be firmly clamped.<br>② In case work piece cannot be firmly clamped, relieve cutting condition.                                                                                            |
| Cutting Fluid and Chips                 | ① Give a sufficient cutting fluid.<br>② Recommend water soluble fluid for heavy cutting.<br>③ Some end mills apply dry cutting only.<br>④ Use air blow for dry cutting.<br>⑤ Remove chips from working area. |
| Selection of End Mill                  | ① Select most suitable end mills according to work material and dimension.<br>② Refer to the index table on front page.                                                                                      |
| Cutting Conditions<br><b>vc vf ap ae</b>                                                                                    | ① Refer to recommended milling condition table.<br>② It is necessary to adjust conditions according to the machine rigidity and clamping condition of work material.                                         |
| Overhang of End Mill from Tool Holder  | ① Overhang of end mill must be as short as possible from tool holder.<br>② In case overhang cannot be shorten, relieve cutting condition.                                                                    |

Technical Guidance

Troubleshooting for End Mill Operation

| Symptoms of troubles                                                                                        | Cause                                                                                                                                                                                                                                                                                                                                | Solution                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chattering                 | <ul style="list-style-type: none"><li>Excessive spindle speed</li><li>Excessive feed</li><li>Excessive long of effective length or overhang of end mill</li><li>Work material is not firmly clamped</li><li>Wear of cutting edge progressed</li><li>Excessive chucking runout</li></ul>                                              | <ul style="list-style-type: none"><li>Reduce spindle speed</li><li>Reduce feed</li><li>Adjust effective length and overhang as short as possible</li><li>Clamp work material firmly</li><li>Use new end mill or regrind</li><li>Adjust chucking runout</li></ul>                                                                  |
| Breakage of End Mill       | <ul style="list-style-type: none"><li>Excessive depth of cut</li><li>Chips clogged</li><li>Excessive feed per tooth</li><li>Wear of cutting edge progressed</li></ul>                                                                                                                                                                | <ul style="list-style-type: none"><li>Reduce depth of cut</li><li>Adjust coolant nozzle to right direction to dispose chips</li><li>Reduce feed per tooth</li><li>Use new end mill or regrind</li></ul>                                                                                                                           |
| Chipping of Cutting Edge   | <ul style="list-style-type: none"><li>Excessive depth of cut</li><li>Excessive feed</li><li>Work material is not firmly clamped</li><li>Excessive spindle speed</li><li>Excessive long of effective length or overhang of end mill</li><li>Wear of cutting edge progressed</li><li>Built up edge</li><li>Excessive cooling</li></ul> | <ul style="list-style-type: none"><li>Reduce depth of cut</li><li>Reduce feed</li><li>Clamp work material firmly</li><li>Reduce spindle speed</li><li>Adjust effective length and overhang as short as possible</li><li>Use new end mill or regrind</li><li>Choose appropriate coating</li><li>Use air blow or oil mist</li></ul> |
| Abnormal Wear              | <ul style="list-style-type: none"><li>Excessive spindle speed</li><li>Too low feed</li></ul>                                                                                                                                                                                                                                         | <ul style="list-style-type: none"><li>Reduce spindle speed</li><li>Increase feed</li></ul>                                                                                                                                                                                                                                        |
| Clogging and Depositing    | <ul style="list-style-type: none"><li>Chips are not well disposed</li><li>Excessive feed</li><li>Excessive depth of cut</li><li>Inappropriate number of flute</li><li>Wear of cutting edge progressed</li></ul>                                                                                                                      | <ul style="list-style-type: none"><li>Adjust coolant nozzle to right direction to dispose chips</li><li>Reduce feed</li><li>Reduce depth of cut</li><li>Use fewer flutes end mill</li><li>Use new end mill or regrind</li></ul>                                                                                                   |
| Deflection of End Mill     | <ul style="list-style-type: none"><li>Excessive feed</li><li>Excessive depth of cut</li><li>Excessive long of effective length or overhang of end mill</li><li>Large helix angle of flutes</li></ul>                                                                                                                                 | <ul style="list-style-type: none"><li>Reduce feed</li><li>Reduce depth of cut</li><li>Adjust effective length and overhang as short as possible</li><li>Use smaller helix angle</li></ul>                                                                                                                                         |
| Burr on Finished Surface   | <ul style="list-style-type: none"><li>Wear of cutting edge progressed</li><li>Small helix angle of flutes</li><li>Excessive depth of cut</li></ul>                                                                                                                                                                                   | <ul style="list-style-type: none"><li>Use new end mill or regrind</li><li>Use larger helix angle</li><li>Reduce depth of cut</li></ul>                                                                                                                                                                                            |
| Poor Surface Roughness   | <ul style="list-style-type: none"><li>Wear of cutting edge progressed</li><li>Chips bite</li><li>Excessive feed</li><li>Excessive long of effective length or overhang of end mill</li><li>Too low spindle speed</li><li>Stock removals vary for finishing</li><li>Excessive chucking runout</li></ul>                               | <ul style="list-style-type: none"><li>Use new end mill or regrind</li><li>Use coolant to remove chips</li><li>Reduce feed</li><li>Adjust effective length and overhang as short as possible</li><li>Increase spindle speed</li><li>Improve semi-finishing process</li><li>Adjust chucking runout</li></ul>                        |
| Poor Machining Accuracy  | <ul style="list-style-type: none"><li>Inconsistent thermal extension of spindle</li><li>Stock removals vary for finishing</li><li>Excessive feed</li><li>Excessive chucking runout</li></ul>                                                                                                                                         | <ul style="list-style-type: none"><li>Warm up spindle by idling before starting operation</li><li>Improve semi-finishing process</li><li>Reduce feed</li><li>Adjust chucking runout</li></ul>                                                                                                                                     |

Technical Guidance

Comparison Table of Die and Mold Materials

● For Cold Work Die Steels

| Classification                      | JIS                                | AISI  | Hardness (HRC) | AICHI STEEL | SANYO SPECIAL STEEL            | DAIDO STEEL         | NIHON KOSHUHA STEEL | HITACHI METALS    | NACHI FUJIKOSHI                                 | UDDEHOLM                                   | BOHLER              |
|-------------------------------------|------------------------------------|-------|----------------|-------------|--------------------------------|---------------------|---------------------|-------------------|-------------------------------------------------|--------------------------------------------|---------------------|
| Carbon Tool Steels                  | SK105 (SK3)                        | W1-10 |                |             | QK3                            | YK3                 |                     |                   |                                                 |                                            | K990                |
| Alloy steels                        | SKS93                              |       | 55-60          | SK301       | QK3M                           | YK30                | K3M                 | YCS3              |                                                 |                                            |                     |
|                                     | SKS3                               | -     | 55-62          | SKS3        | QKS3                           | GOA                 | KS3                 | SGT               |                                                 | ARNE                                       | K460                |
|                                     | SKD1                               | D3    | 55-62          |             |                                | DC1                 | KD1                 | CRD               |                                                 | SVERKER3                                   | K100 K107           |
|                                     | SKD11                              | D2    | 55-62          | SKD11       | QC11                           | DC11                | KD11                | SLD SLD-i         | CDS11                                           | SVERKER21                                  | K105 K110           |
|                                     | SKD11                              |       | 55-62          |             |                                |                     | KD11S KD11MAX       |                   |                                                 |                                            |                     |
|                                     | 8%Cr type                          |       |                | AUD11 AUD15 | QCM7 QCM8                      | DC53                | KD21                | SLD8 SLD10        | MD59                                            | SLEPNER                                    | K340                |
|                                     | Die steel Matrix type              |       |                | SXACE       |                                | DCMX                | NOGA                | ARK1              |                                                 | CALDIE UNIMAX                              | W360                |
|                                     | SKD12                              | A2    | 55-62          |             |                                | DC12                | KD12                |                   |                                                 | RIGOR                                      | K305                |
|                                     | Pre-hardened Steels                |       | 40             |             |                                | G040F               | KAP65               | HPM-MAGIC         |                                                 | IMPAX HH                                   |                     |
|                                     | Flame Hardening Steels             |       | 55-62          | SX105V      | QF3                            | G05                 | KRCX                | HMD5              |                                                 | FERMO                                      |                     |
|                                     | Low Temperature Air Quenched Steel |       | 58-62          |             |                                | G04                 | KSM                 | ACD37             |                                                 |                                            |                     |
|                                     | Steels for Impact Resistance       |       | 55-60          |             | QF1                            | GS5                 | KTV5                | YSM               |                                                 |                                            |                     |
|                                     | Other                              |       | -              |             |                                |                     |                     | SLD-MAGIC         | ICS22                                           | CALMAX ELMAX VANCRON40 VANADIS4E VANADIS10 | K390 K490 K890      |
| High-Speed steels                   | SKH51                              | M2    | 55-65          |             | QH51                           | MH51                | H51                 | YXM1              | SKH9                                            |                                            | S600                |
|                                     | SKH51 type                         |       | 57-66          |             |                                |                     |                     |                   | SKH9D                                           |                                            |                     |
|                                     | SKH55 type                         |       | 57-66          |             |                                |                     | HM35                | YXM4              | HM35 HS53M                                      |                                            | S705                |
|                                     | SKH57 type                         |       |                |             |                                |                     | MV10                | XVC5              | HS93R DURO-SP                                   |                                            | S700                |
|                                     | Matrix type                        |       | 55-64          |             | QHZ                            | DRM1 DRM2 DRM3 MH85 | KMX1 KMX2 KMX3      | YXR3 YXR7 YXR33   | DURO-FZ DURO-F1 DURO-F3 DURO-F7 DURO-V2 DURO-V5 |                                            |                     |
| Powder Metal High Speed Tool Steels | SKH40                              |       | 58-70          |             | SPM30                          | DEX40               |                     | HAP40             | FAX38                                           | VANADIS30                                  | S590                |
|                                     | Matrix type                        |       | 58-70          |             |                                | DEX-M1 DEX-M3       |                     | HAP5R             |                                                 |                                            |                     |
|                                     | Other                              |       | 58-70          |             | SPM23 SPM60 SPMR8 SPMV6 SPMX4N | DEX20 DEX60         |                     | HAP10 HAP50 HAP72 | FAX31 FAX40 FAX55 FAXG2                         | VANADIS23 VANADIS60                        | S290 S390 S690 S790 |

Technical Guidance

Comparison Table of Die and Mold Materials

Hot Die Steels

| Classification    | JIS                  | AISI | Hardness (HRC) | AICHI STEEL     | SANYO SPECIAL STEEL                        | DAIDO STEEL                                        | NIHON KOSHUHA STEEL     | HITACHI METALS                                   | NACHI FUJIKOSHI    | MITSUBISHI SEIKO | UDDEHOLM                     | BOHLER       |
|-------------------|----------------------|------|----------------|-----------------|--------------------------------------------|----------------------------------------------------|-------------------------|--------------------------------------------------|--------------------|------------------|------------------------------|--------------|
| Alloy steels      | SKD4                 |      | 40-50          |                 |                                            | DH4                                                | KD4                     |                                                  |                    |                  |                              |              |
|                   | SKD5                 | H21  | 45-50          |                 |                                            | DH5                                                | KD5                     |                                                  |                    |                  |                              |              |
|                   | SKD6                 | H11  | 40-52          |                 |                                            | DH62                                               | KD6                     |                                                  |                    |                  | VIDAR                        | W300<br>W400 |
|                   | SKD61                | H13  | 40-52          | SKD61           | QD61                                       | DHA<br>DHA1                                        | KDA                     | DAC                                              |                    |                  | ORVAR 2M                     | W302         |
|                   | SKD61                |      | 40-52          | AUD61<br>AUD60A | QDA61<br>QDN<br>QDX-<br>HARMOTEX<br>QDN1-R | DHA2<br>DH21<br>DHA-<br>WORLD<br>DH31-S<br>DH31-EX | KDA1<br>KDA1S<br>KDAMAX | DAC-S<br>DAC3<br>DAC10<br>DAC55<br>DAC-<br>MAGIC |                    |                  | ORVAR-S<br>DIEVAR<br>FORMVAR | W303<br>W403 |
|                   | SKD61 (Free-cutting) |      |                |                 |                                            | DH2F                                               | KAP90F                  | FDAC                                             |                    |                  |                              |              |
|                   | SKD62                | H12  | 40-52          |                 | QD62                                       | DH62                                               | KDB                     |                                                  |                    |                  |                              |              |
|                   | SKD7                 | H10  | 40-50          |                 |                                            | DH72                                               | KDH1                    |                                                  |                    |                  |                              | W320         |
|                   | SKD7                 |      | 40-50          | AUD72           | QDH                                        | DH32<br>DH71<br>DH73                               |                         | DAC40<br>YEM-K                                   | DURO-N1            |                  |                              |              |
|                   | SKD8                 | H19  | 40-50          |                 |                                            | DH41                                               | KDF                     |                                                  |                    |                  |                              |              |
|                   | SKD8                 |      | 40-50          |                 |                                            | DH42                                               | KDF4                    | MDC-K                                            |                    |                  |                              |              |
|                   | SKT4                 | L6   | 38-45          | SKT4A           | QT41-<br>HARMOTEX                          | GFA                                                | KTV                     | DM                                               |                    |                  | ALVAR14                      | W500         |
|                   | SKT4                 |      | 38-45          |                 | QDT                                        | GF78                                               | TD3                     |                                                  |                    |                  |                              |              |
|                   | Precipitation Steel  |      |                | AUD91<br>MPH-K  |                                            | DH76                                               |                         |                                                  |                    | HD22B            |                              |              |
|                   | Other                |      |                |                 | QF5                                        | DHA-<br>Thermo                                     |                         |                                                  |                    |                  | BURE<br>BALDER               |              |
| High-Speed steels | Matrix type          |      | 53-65          |                 | QHZ                                        | DRM1<br>DRM2                                       | KMX1                    | YXR33                                            | DURO-FZ<br>DURO-F1 |                  |                              | W360         |

Technical Guidance

Comparison Table of Die and Mold Materials

From the book end appendix of the Special Steel Guide First Edition (Revised edition)  
Author: Special Steel Association of JAPAN  
Since March, 2017

Plastic Mold Steels

| Classification          | JIS                     | AISI                 | Hardness (HRC) | AICHI STEEL | JFE STEEL          | SANYO SPECIAL STEEL | DAIDO STEEL                | NIHON KOSHUHA STEEL | HITACHI METALS           | NACHI FUJIKOSHI        | UDDEHOLM                              | BOHLER                               |
|-------------------------|-------------------------|----------------------|----------------|-------------|--------------------|---------------------|----------------------------|---------------------|--------------------------|------------------------|---------------------------------------|--------------------------------------|
| Pre-hardened Steels     | SC type                 | 1055                 | 13             |             | JFE-MD1            | PC55                |                            | KPM1<br>KPMAX       |                          |                        |                                       |                                      |
|                         | SCM type                | 4140                 | 28             |             | JFE-MD3<br>JFE-MD5 |                     | PD53                       |                     |                          |                        |                                       |                                      |
|                         | SCM                     | P20                  | 33             |             |                    | PCM30               | PX5<br>PXA30               | KPM30               | HPM7                     |                        |                                       | M200<br>M201<br>M238                 |
|                         | SUS type                | S420 type            |                |             |                    |                     | S-STAR<br>D-STAR           | GHX                 | HPM38                    | PROVA-400<br>PROVA-450 | STAVAX                                | M303<br>M310                         |
|                         | SUS type (Free-cutting) |                      |                |             |                    |                     | G-STAR                     |                     | HPM77                    |                        | RoyAlloy                              | M315                                 |
|                         | SUS type                | S17400               | 35             |             |                    | QSH6                | NAK101                     | U630                | PSL                      |                        | CORRAX                                | N700                                 |
|                         | SCM                     | P20                  | 36             |             |                    |                     |                            | JHX                 |                          |                        | IMPAXHH                               |                                      |
|                         | SUS type                |                      | 40             |             |                    |                     |                            |                     |                          |                        | EDRO400                               | M303HH                               |
|                         | SKD61                   | H13                  |                |             |                    |                     | DH2F                       | KAP90F              | FDAC                     |                        |                                       |                                      |
|                         |                         | P21                  |                |             |                    | PCM40S              | NAK80                      | KAP88               | HPM-PRO                  |                        |                                       | M461                                 |
|                         |                         | P21 (Free-cutting)   |                |             |                    | PCM40               | NAK55                      | KAP65               | HPM1                     |                        |                                       | M261                                 |
|                         |                         | P21 (Rust resistant) |                |             |                    |                     |                            |                     | CENA1<br>CENA-V          |                        |                                       |                                      |
|                         |                         |                      |                |             |                    |                     |                            |                     | HPM-<br>MAGIC            |                        | NIMAX                                 |                                      |
|                         |                         |                      |                |             |                    |                     |                            |                     |                          |                        |                                       |                                      |
| Quenching and Tempering | SKD11                   | D2                   | 60             | AUD11       |                    | QCM8<br>SPMR8       | PD613                      | NOGA                | HPM31<br>ZCD-M           |                        | RIGOR<br>SLEIPNER<br>CALDIE<br>CALMAX | K105<br>K110<br>K340                 |
|                         | SUS type 440C           | S44004               | 57             |             |                    | QPD5<br>SPC5        | SUS440C                    | SUS440C             | SUS440C                  | 440C<br>PROVA-500      | ELMAX                                 | M340<br>M390<br>N685<br>N690<br>N695 |
|                         | SUS type 420            | S420 type            | 52             |             |                    |                     | S-STAR<br>D-STAR<br>G-STAR | GHX                 | HPM38<br>HPM38S<br>HPM77 | PROVA-400<br>PROVA-450 | STAVAX<br>POLMAX<br>MIRRAX            | M310<br>M333                         |
| Age Hardening           | Maraging Steels         |                      | 50 ~           |             |                    | QM300               | MAS1C                      | KMS                 | YAG                      | EXEO-M21               |                                       | V720<br>V721                         |
|                         | Other                   |                      |                |             |                    |                     |                            |                     |                          |                        | CORRAX                                |                                      |
|                         | Non-magnetic steels     |                      | 40             |             |                    |                     |                            | NMS1                | HPM75                    |                        |                                       |                                      |

Technical Guidance

Comparison Table of Die and Mold Materials

For High Speed Steels

| Classification  | JIS         | AISI | Hardness (HRC) | SANYO SPECIAL STEEL                        | DAIDO STEEL                        | NIHON KOSHUHA STEEL  | HITACHI METALS                   | NACHI FUJIKOSHI                                                | UDDEHOLM               | BOHLER                       |
|-----------------|-------------|------|----------------|--------------------------------------------|------------------------------------|----------------------|----------------------------------|----------------------------------------------------------------|------------------------|------------------------------|
| Tungsten type   | SKH2        | T1   | 63 ~           |                                            |                                    | H2                   | YHX2                             | SKH2                                                           |                        | S200                         |
|                 | SKH3        | T4   | 64 ~           |                                            |                                    | H3                   |                                  | SKH3                                                           |                        | S305                         |
|                 | SKH4        | T5   | 64 ~           |                                            |                                    | H4                   |                                  | SKH4                                                           |                        |                              |
|                 | SKH10       | T15  | 64 ~           |                                            |                                    | HV5                  |                                  |                                                                |                        |                              |
| Molybdenum type | SKH51       | M2   | 55-65          | QH51                                       | MH51                               | H51                  | YXM1                             | SKH9                                                           |                        | S600<br>S614<br>S401         |
|                 | SKH52       | M3-1 | 57-66          |                                            |                                    | H52                  |                                  | HM31                                                           |                        |                              |
|                 | SKH53       | M3-2 | 64 ~           |                                            |                                    | HV1                  |                                  |                                                                |                        | S607                         |
|                 | SKH54       | M4   | 64 ~           |                                            |                                    | HV2                  |                                  | HM4                                                            |                        |                              |
|                 | SKH55       |      | 60-66          |                                            |                                    | HM35                 | YXM4                             | HM35                                                           |                        | S705                         |
|                 | SKH56       | M36  | 60-66          |                                            |                                    | HM36                 |                                  | HM36                                                           |                        |                              |
|                 | SKH57       |      | 62-67          |                                            |                                    | HV10                 | XVC5                             | HS93R                                                          |                        | S700                         |
|                 | SKH58       | M7   | 64 ~           |                                            |                                    | HM3                  |                                  | HM7NN                                                          |                        | S400                         |
|                 | SKH59       | M42  | 62-67          |                                            |                                    | HM42                 | YXM42                            | HM42                                                           |                        | S500                         |
|                 | Other       |      |                |                                            |                                    | S70                  | YXM27<br>YXM60                   | HS53M<br>HS97R<br>HM1<br>HMT12<br>HM33<br>SKH9D<br>DURO-SP     |                        |                              |
| Matrix type     | Matrix type |      | 45-65          | QHZ                                        | DRM1<br>DRM2<br>DRM3<br>MH85       | KMX1<br>KMX2<br>KMX3 | YXR3<br>YXR33<br>YXR7            | DURO-FZ<br>DURO-F1<br>DURO-F3<br>DURO-F7<br>DURO-V2<br>DURO-V5 |                        | W360                         |
| Powdered type   | SKH40       |      | 58-70          | SPM30                                      | DEX40                              |                      | HAP40                            | FAX38                                                          | VANADIS30              | S590                         |
|                 | Other       |      | 58-70          | SPM23<br>SPM60<br>SPMR8<br>SPMV6<br>SPMX4N | DEX20<br>DEX60<br>DEX-M1<br>DEX-M3 |                      | HAP10<br>HAP50<br>HAP72<br>HAP5R | FAX31<br>FAX40<br>FAX55<br>FAXG2                               | VANADIS23<br>VANADIS60 | S290<br>S390<br>S690<br>S790 |

Read Following Precautions for Safe Use



Attention on Safety

- When removing tools from cases, be careful of getting-out of tools and don't touch directly the cutting edges.
- Never touch the cutting edges directly with bare hand.
- Use safety covers and eye protection, as tools may be broken.
- Use holders, etc. that match the tools and nature of the machining operations. The tool should be firmly attached to the holder to prevent shaking.
- The work materials clamp firmly.
- Make sure of dimensions of tools and work pieces before starting operation.
- It is necessary to adjust conditions according to the dimensions of work materials and the machine.
- Select a cutting fluid appropriate to the particular usage. Using water-insoluble fluid could lead to fires due to sparks generated during machining or heat caused by breakage. Ensure that you take proper fire-prevention measures.
- If abnormal sound, etc. occurs during machining, stop the machine immediately.
- Don't modify tools.

Attention on Regridding

- When the tool is reground, grinding dust is generated which is dangerous to your health. Be sure to wear protective glasses and a dust proof mask.
- Regrind tools at proper period.

Technical Guidance

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