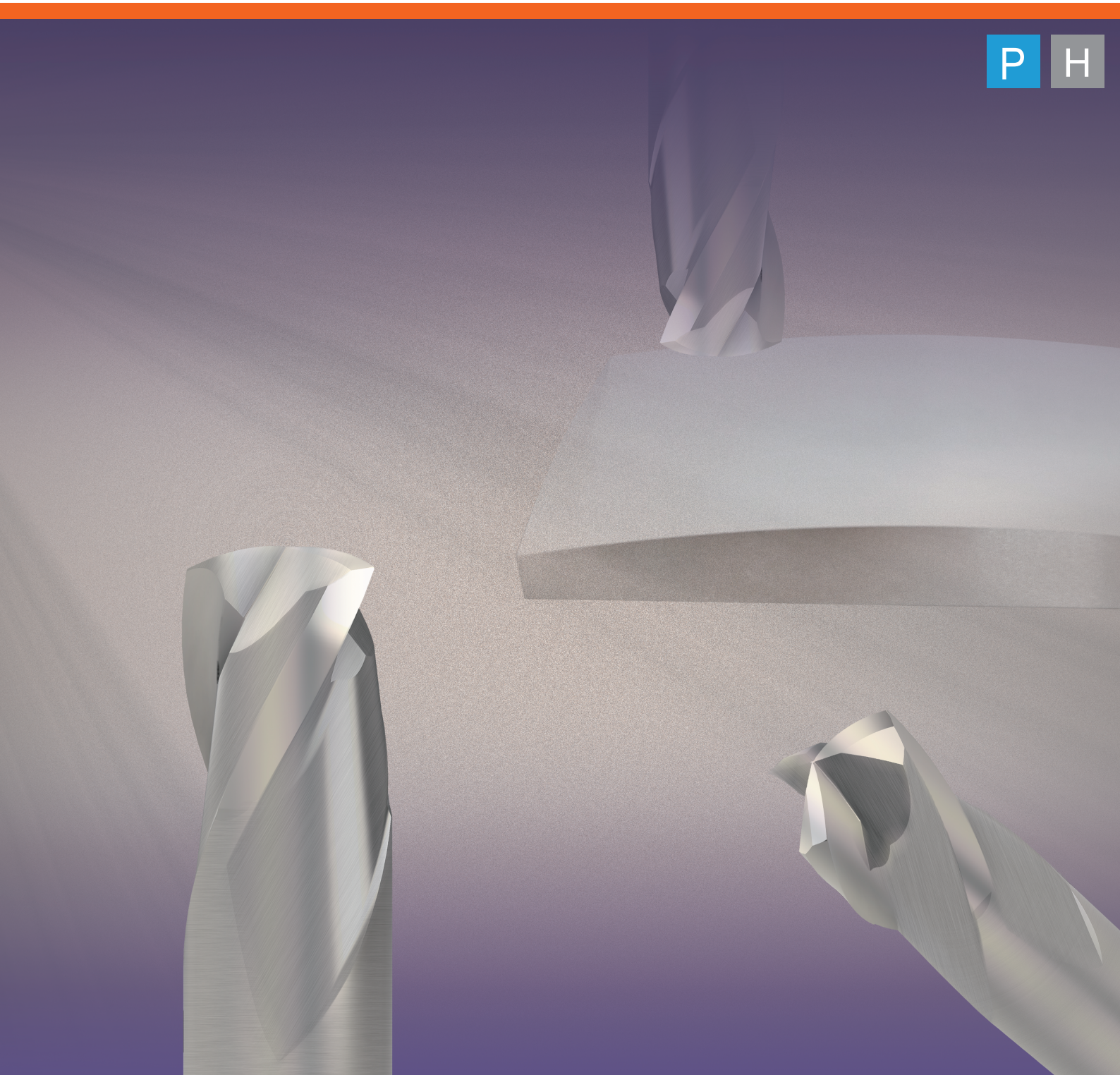
NS TOOL

For Crafting Tomorrow

MUGEN COATING PREMIUM
High Efficiency Lens Form 3-Flute End Mill

MLFH330



Realizes large pick feed even with small size diameter
Specialized lens form 3-Flute end mill improves productivity compared to ball end mills

MUGEN COATING PREMIUM
High Efficiency Lens Form 3-Flute End Mill

MLFH330

R accuracy on corner radius is ±0.01mm

φ1 ×R1 ～ φ6 × R8　　Total 7 sizes

Features

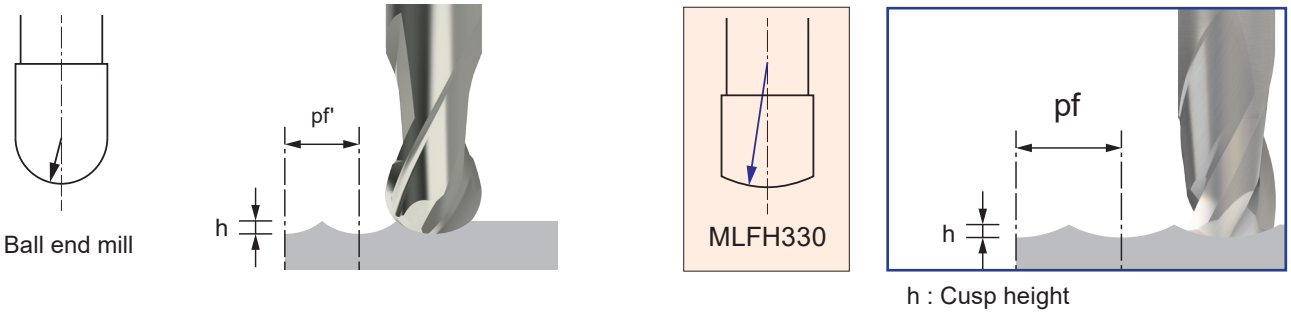
Feature 1 — Coating — Performance of MUGEN COATING PREMIUM

Most optimize for work materials from 40HRC to 65HRC.
MUGEN COATING PREMIUM has further improved than the conventional MUGEN COATING that achieves longer tool life.

MUGEN COATING PREMIUM		
Prehardened Steel P	Hardened Steel H	
	40～60HRC	～65HRC
◎	◎	○

Feature 2 — Improved productivity — Lens Form 3-Flute

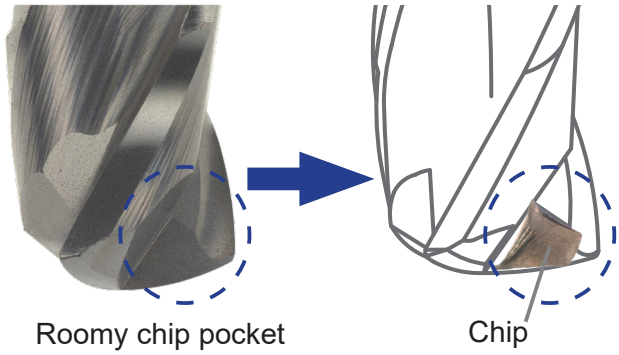
2-1 Realize large pick feed than conventional ball end mills that achieve high efficiency machining.



h : Cusp height

2-2

Large enough chip pockets prevent unexpected chipping of cutting edge or chip jamming due to the size of the chips by large pick feed.



■ Comparison of machining efficiency with conventional products

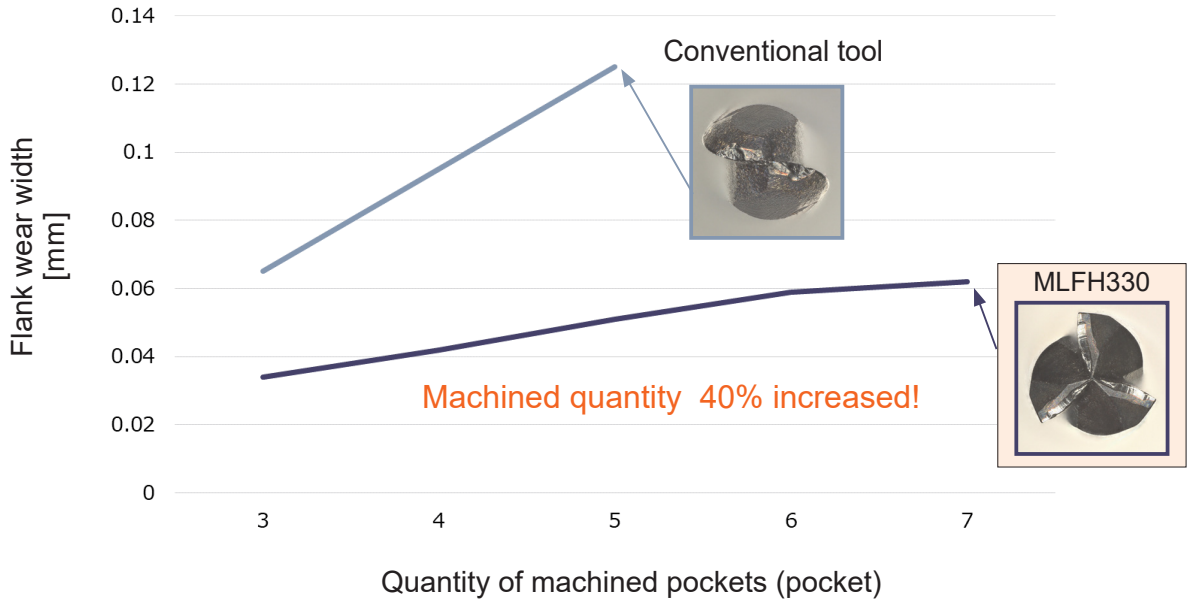
Work material : STAVAX (52HRC)
Coolant : Oil mist
Machining size : 14.5 × 30.8 × 3 mm

Achieves high efficiency with both productivity and cost performance through shortening machining time and increasing tool life.

Process	Conventional 2-flute ball end mill	MLFH330
Tool size	R0.5 × 3	φ1×R1 × 3
Spindle speed [min^{-1}]	40,000	27,500
Feed [mm/min]	2,500	3,750
Depth of cut ap × ae [mm]	0.1 × 0.3	0.1 × 0.425
Feed per tooth [mm/tooth]	0.031	0.045
Machining time (1 pocket)	25 min	15 min

Machining time reduced by 40%

Comparison between machined pocket quantity and flank wear width



Realizes large pick feed even with small size diameter
Specialized lens form 3-Flute end mill improves productivity compared to ball end mills

■ If your CAM can use lens form end mills, please use it as is.

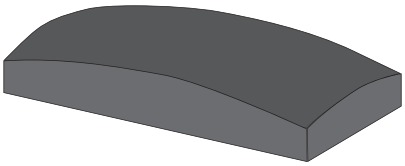
※ Make an inquiry to CAM manufacturer regarding the availability of tool registration and tool path generation.

■ Example of procedure when the shape of this tool cannot be defined with the CAM are using.

☆ There are no special settings other than tool settings.

For open shape

Machining example 1



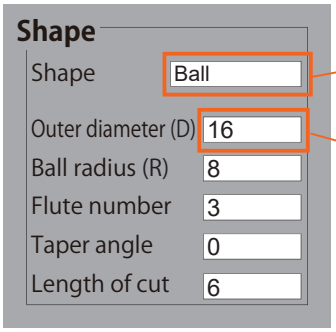
Key points of this machining shape

1. No walls

2. Maximum inclined angle

◆ Setting for Roughing process (Same for Finishing)

• Tool setting

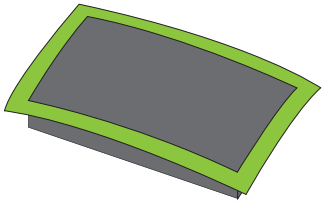


Tool：MLFH330 φ6×R8×20

Define the tool shape as “Ball end mill”

Enter twice the end tooth bottom radius (R) of MLFH330 as the tool diameter.

• Model shape adjustment



Adjust and extend the surface of the model shape so that the tool tip overruns more than 50% diameter of the tool diameter entered above parameter.

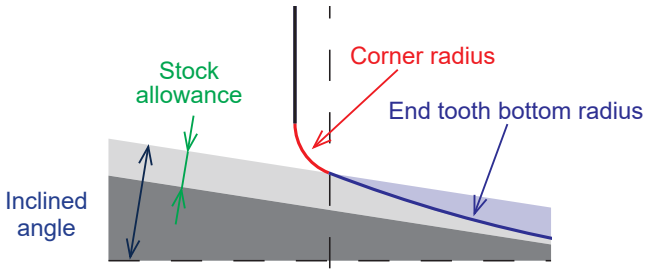
※ Recommended feed direction is the same as the feed rate is stable on the machined surface.

◆ Setting for Finishing process

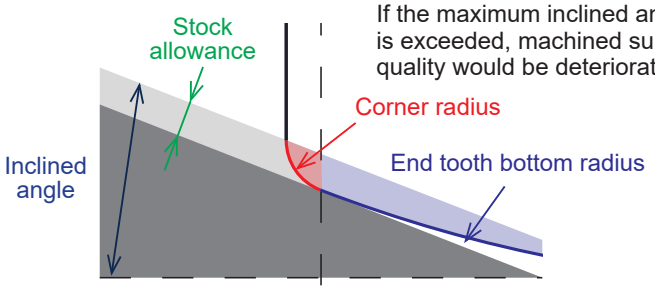
Make sure to set the inclined angle within the maximum inclined angle that does not exceed the machining range of the end tooth bottom radius.

■ Maximum inclined angle means the workpiece that can be machined without problems with the machining allowance shown in the recommended cutting conditions.

Within the maximum inclined angle

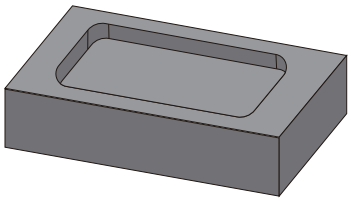


Exceed the maximum inclined angle



For pocket shape

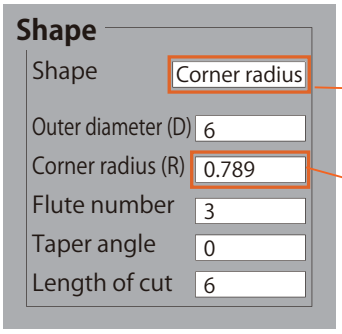
Machining example 2



Key points of this machining shape

1. Enclosed shape
2. Leftover materials

◆ Tool setting



For example
Tool：MLFH330 φ6×R8×20
Define the tool shape as “Corner radius end mill”

Enter the theoretical corner radius(R) of MLFH330 shown below.

◆ Leftover materials

When defined as a corner radius end mill, the leftover materials between the actual cutting edge and the theoretical cutting edge will be generated, especially in the corners. Refer to the table below for the amount of leftover materials.

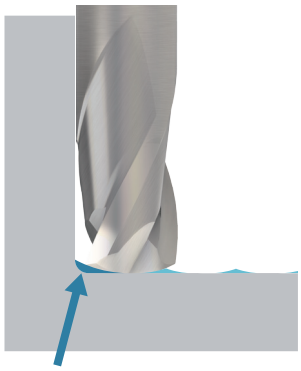
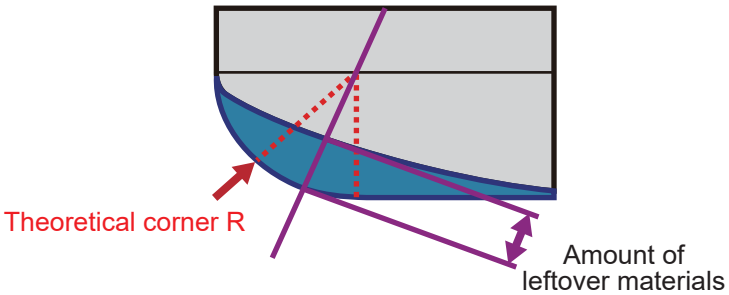


Image of the leftover materials when defined as corner radius end mill with theoretical corner R.

Dia. (D)	End Edge Radius (R)	Corner Radius (r)	Theoretical Corner R (R)	Remains
1	R1	R0.03	0.151	0.069
2	R2	R0.05	0.297	0.139
3	R3	R0.1	0.460	0.205
4	R4	R0.1	0.594	0.279
5	R5	R0.2	0.787	0.335
6	R6	R0.3	0.980	0.391
6	R8	R0.3	0.789	0.331



MLFH330

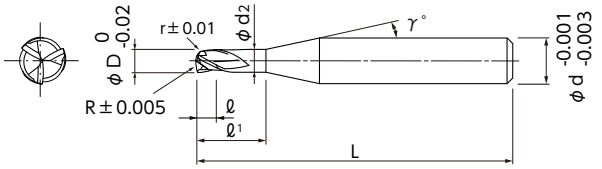
Size φ1 × R1 ～ φ6 × R8

MUGEN COATING PREMIUM High Efficiency Lens Form 3-Flute End Mill

Total 7 Sizes

Realizes large pick feed even with small size diameter Specialized lens form 3-Flute end mill improves productivity compared to ball end mills

R accuracy on corner radius is ±0.01mm



- Adopt MUGEN COATING PREMUIM for hardened steel to support machining hardened steel up to 65HRC.
- 3-flute lens form combines larger pick feed than ball end mills improve machining efficiency.
- High productivity can be achieved by using the 5-axis machining to take large pick feeds while keeping the cut point constant.

Work Material

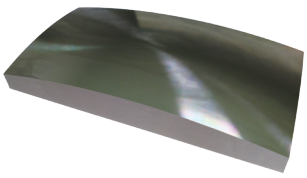
Prehardened Steel P	Hardened Steel H	
	40～60HRC	～65HRC
◎	◎	○

Unit [Size : mm]

Code No.	Dia. (D)	End Tooth Bottom Radius (R)	Under Neck Length (ℓ1)	Corner Radius (r)	Length of Cut (ℓ)	Neck Dia. (d2)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
08-00790-10103	1	R1	3	R0.03	1	0.95	12°	6	50
08-00790-20206	2	R2	6	R0.05	2	1.91	12°	6	50
08-00790-30309	3	R3	9	R0.1	3	2.85	12°	6	60
08-00790-40412	4	R4	12	R0.1	4	3.8	12°	6	60
08-00790-50515	5	R5	15	R0.2	5	4.75	12°	6	60
08-00790-60620	6	R6	20	R0.3	6	5.7	-	6	60
08-00790-60820	6	R8	20	R0.3	6	5.7	-	6	60

How to Order When you order, indicate MLFH330 (D)×(R)×(ℓ1). (γ) is reference value.

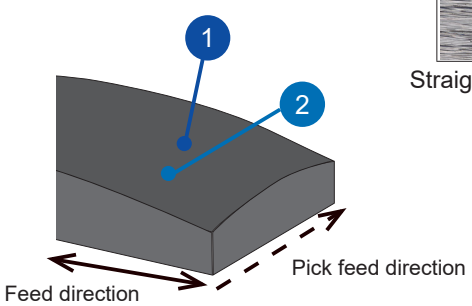
Machining case

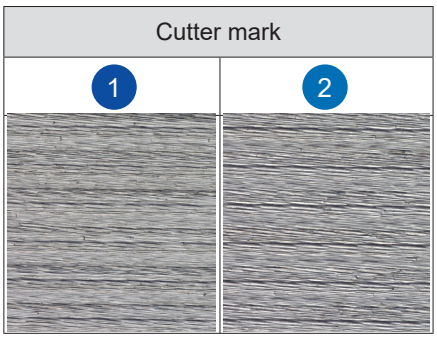


Work material : STAVAX (52HRC)
Work size : 200 × 100 × 30 mm
Curvature of shape : R500 × R250
Machining depth : 16 mm
Coolant : Oil mist

Process	Finishing
Tool	MLFH330 φ6 × R8 × 20
Spindle speed [min-1]	9,650
Feed [mm/min]	2,100
Stock allowance [mm]	0.04
Pick feed [mm]	0.08
Inclined angle [°]	2 ～ 26

※5-axis machining allows machining exceeding the maximum inclined angle.





Straight and uniform machined surface quality

Unit [μm]

Surface roughness	
Ra	0.12

Roughing

Work Material			Prehadened Steels・Hardened Steels HPM・NAK(～42HRC) HAP38・STAVAX・SKD61(～55HRC)				Hardened Steels SKD11・PD613(～62HRC)				High Speed Steels SKH(～65HRC)			
Dia.	End Tooth Bottom Radius	Under Neck Length	Depth of Cut		Feed	Spindle Speed	Depth of Cut		Feed	Spindle Speed	Depth of Cut		Feed	Spindle Speed
			a_p mm	a_e mm	mm/min	min^{-1}	a_p mm	a_e mm	mm/min	min^{-1}	a_p mm	a_e mm	mm/min	min^{-1}
1	1	3	0.1	0.4	3,500	26,000	0.1	0.28	2,400	21,000	0.08	0.15	1,500	14,000
2	2	6	0.2	0.7	3,500	16,000	0.2	0.5	2,400	12,000	0.15	0.45	1,800	10,000
3	3	9	0.2	1.1	4,200	13,000	0.2	0.85	3,000	10,000	0.2	0.7	2,200	7,600
4	4	12	0.3	2.1	4,200	11,000	0.2	1.2	3,000	9,000	0.2	1	2,200	6,600
5	5	15	0.3	2.4	4,200	10,000	0.2	1.6	3,000	8,200	0.2	1.2	2,200	6,000
6	6	20	0.3	2.8	4,200	9,500	0.3	1.8	3,000	7,000	0.2	1.6	2,200	5,600
6	8	20	0.3	3.2	4,200	9,000	0.3	2	3,000	6,500	0.2	1.8	2,200	5,000

Notes

※1 Depth of Cut: ap=Axial Depth of Cut / ae=Radial Depth of Cut.
※2 Adjust milling condition according to machine rigidity and clamp condition of work material.
※3 In case of chattering etc., please adjust cutting conditions if necessary.
※4 Required careful set up of milling conditions, tool path and etc. at cutting parts, such as corners where will become overloaded.
※5 If machine tool vibration is high during machining, adjust the feed rate as necessary.
※6 Attention to a risk of chipping and breakage when insucient chip flow.
※7 Adjust both spindle speed and feed at the same rate.
※8 Overhang of end mill should be as short as possible form spindle nose.
※9 Oil mist coolant is recommended.
※10 When creating toolpaths in CAM software, tool difinition is recommended by using a lens-shaped end mill.
※11 When measuring tool lengths, download the DXF of the tool geometry from our website and check the tool geometry before measuring.

Finishing

Work Material							Prehadened Steels・Hardened Steels HPM・NAK(～42HRC) HAP38・STAVAX・SKD61(～55HRC)		Hardened Steels SKD11・PD613 (～62HRC)		High Speed Steels SKH (～65HRC)	
Dia.	End Tooth Bottom Radius	Under Neck Length	Maximum Inclined Angle	Cusp Height μm	Depth of Cut		Feed	Spindle Speed	Feed	Spindle Speed	Feed	Spindle Speed
					Stock Allowance mm	Pick Feed mm	mm/min	min^{-1}	mm/min	min^{-1}	mm/min	min^{-1}
1	1	3	17°	0.1	0.02	0.025	2,000	26,000	1,700	21,000	1,100	14,000
2	2	6	20°	0.1	0.02	0.04	1,900	16,000	1,400	12,000	1,100	10,000
3	3	9	20°	0.1	0.03	0.05	1,900	13,000	1,400	10,000	1,100	7,600
4	4	12	21°	0.1	0.03	0.055	1,800	11,000	1,400	9,000	1,100	6,600
5	5	15	21°	0.1	0.04	0.06	1,800	10,000	1,400	8,200	1,100	6,000
6	6	20	21°	0.1	0.04	0.065	1,800	9,500	1,400	7,000	1,100	5,600
6	8	20	14°	0.1	0.04	0.08	2,100	9,000	1,500	6,500	1,200	5,000

Notes

※1 The cutting condition is set that the pick feed achieves a cusp height of 0.1 μm, feed per tooth achieves as same amount as pick feed.
Adjust according to machine rigidity and accuracy requirements.
※2 Adjust milling condition according to machine rigidity and clamp condition of work material.
※3 Overhang of end mill should be as short as possible form spindle nose.
※4 Oil mist coolant is recommended.
※5 Adjust both spindle speed and feed at the same rate.
※6 Cutting depth set with care, as the larger the depth of cut, the smaller the maximum inclination angle.
※7 When creating toolpaths in CAM software, tool difinition is recommended by using a lens-shaped end mill.
※8 When measuring tool lengths, download the DXF of the tool geometry from our website and check the tool geometry before measuring.

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CAUTION Attention on Safety

1) When removing tools from cases, be careful of getting-out of tools and don't touch directly the cutting edges.
2) Never touch the cutting edges directly with bare hand.
3) Use safety covers and eye protection, as tools may be broken.
4) Use holders, etc. that match the tools and nature of the processing operations. The tool should be firmly attached to the holder to prevent shaking.
5) The work materials clamp firmly.
6) Make sure of dimensions of tools and work pieces before starting operation.
7) It is necessary to adjust conditions according to the dimensions of work materials and the machine.
8) Select a cutting fluid appropriate to the particular usage. Using a non-water cutting fluid could lead to fires due to sparks generated during processing or heat caused by breakage. Ensure that you take proper fire-prevention measures.
9) If abnormal sound, etc. occurs during processing, stop the machine immediately.
10) Don't modify tools.

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