NS TOOL

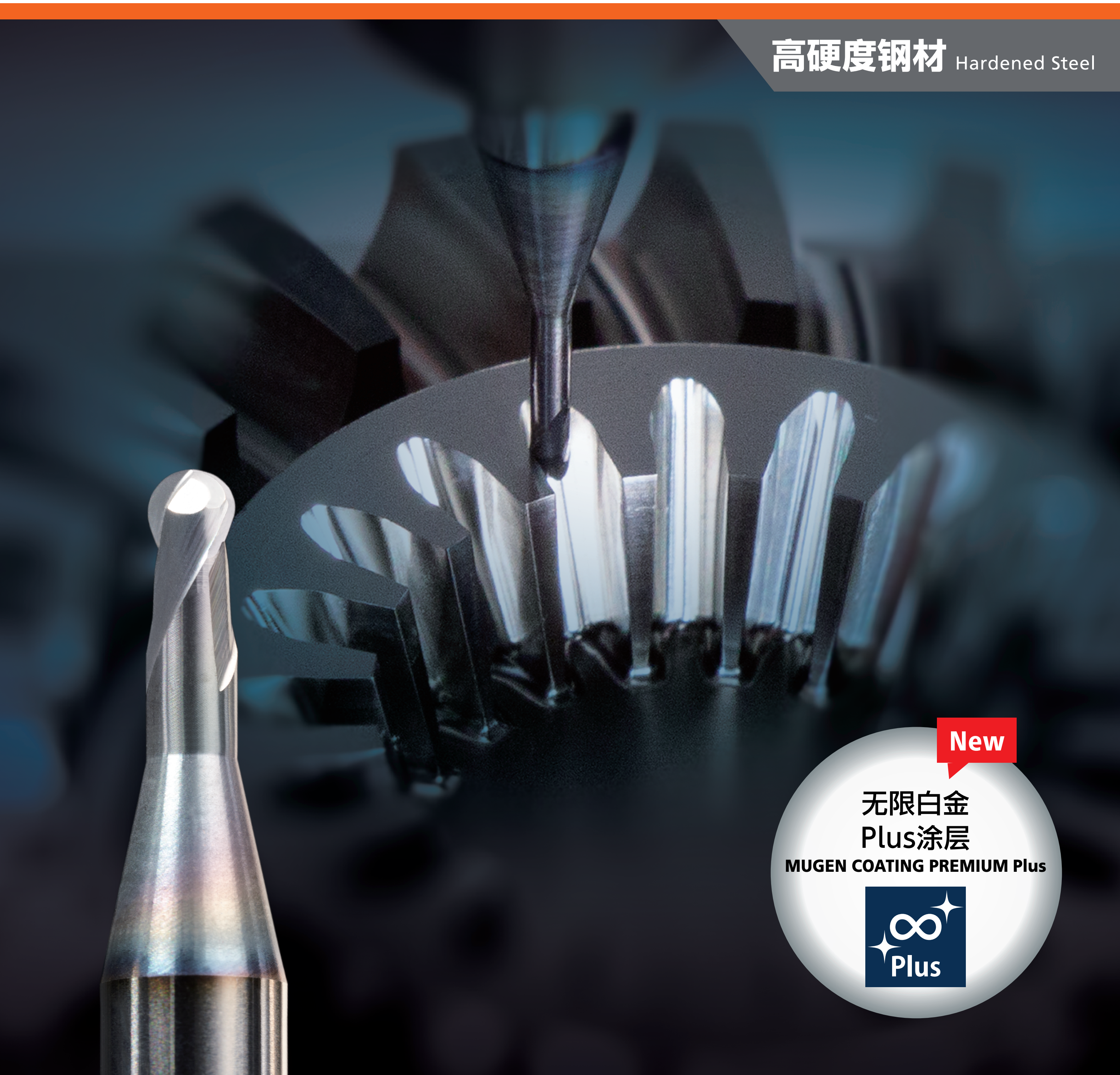
「匠」心创先

无限白金Plus涂层
高硬度钢材高精度加工用
2刃长颈球头铣刀
可对应热缩刀柄的短柄造型

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

New **MRBSH230SF**

高硬度钢材 Hardened Steel



70HRC的高精度材料也能实现长寿命·高精度的加工

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

MRBSH230SF

R0.05 ～ R3 共 83 种规格 Total 83 sizes

无限白金Plus涂层

New

MUGEN COATING PREMIUM Plus

新研发的高耐氧化·高耐磨耗性的全新涂层，可加工到70HRC

New developed coating realized cutting hardened steel up to 70HRC with high oxidation resistance and abrasion resistance

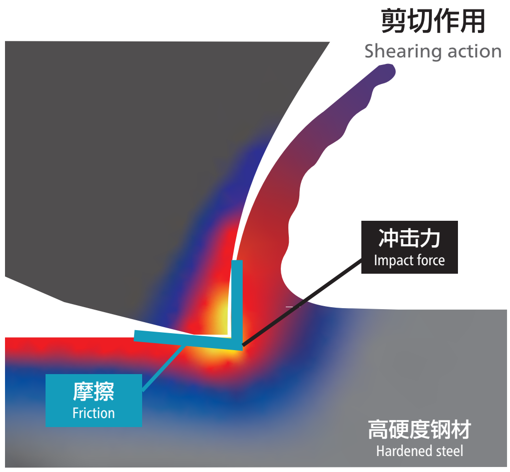
高硬度钢材的特征

Features of hardened steel

加工60~70HRC高硬度钢材时经常发生的现象是加工材料硬度高·韧性大，导致刀尖所遭受的切削抵抗增加。
进而在刀尖所发生的「剪切作用」造成以下三种现象。

As a phenomenon when machining hardened steel of 60 to 70 HRC, the cutting load during processing is extremely high because hardness and toughness of work material are high. Therefore, the "shearing action" at tool edge cause that…

- 「摩擦」使刀具容易磨耗
  Tools to wear easily causing frict
- 「切削热」使涂层容易氧化造成硬度下降，进而导致刀具容易磨耗
  Tools tends to wear to reduced hardness of material on coating oxidizes of cutting heat
- 「冲击力」过大容易造成刀具崩损
  Tool is easily damaged if impact force is large



涂层构造

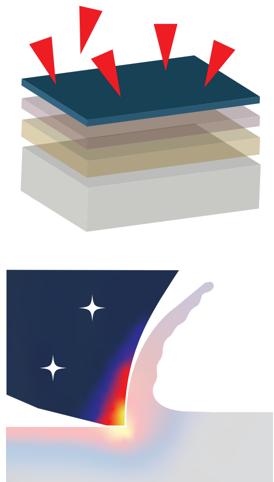
Coating structure

加工材料硬度
Work material hardness

最适用于加工高硬度钢材
60~70HRC
Optimized for cutting 60 to 70 HRC material

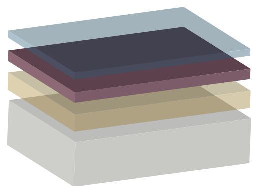
涂层作用
Role of coating

耐氧化涂层
Oxidation resistant layer

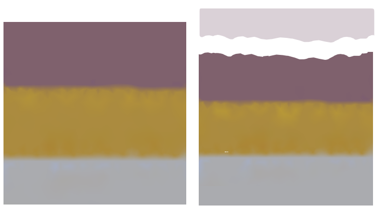


可以抑制切削热所引起的氧化现象
Prevents oxidation due to heat generated during cutting

硬质涂层（超微细结晶构造）
Hard coating layer (Ultra micro crystal structure)

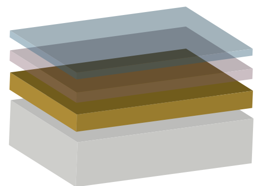


发生磨耗现象示意图
Image of wear progress cross section of coating

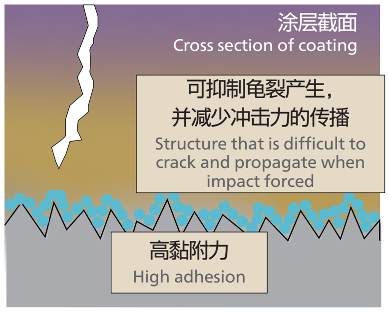


加工高硬度钢材时可以抑制刀具磨耗
Tool wear can be reduced when machining on high hardened steel

高黏附性涂层（微细结晶构造）
High adhesion coating layer (micro crystal structure)

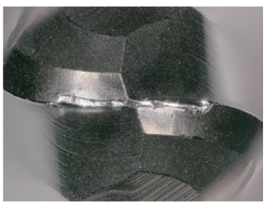
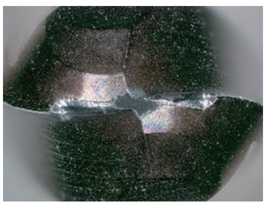
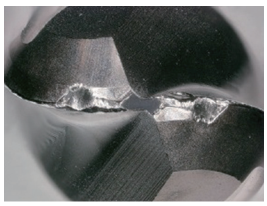
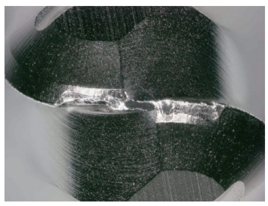


抑制龟裂与加强黏附力的示意图
Image diagram of crack growth and adhesion



针对加工HAP40（64HRC）刀具寿命对比
Tool life comparison for HAP40 (64HRC)

切削条件n= 20,000min^{-1}, vf= 1,600mm/min, ap 0.15 × ae 0.3mm, 冷却方式: 油雾
Cutting condition n= 20,000 min^{-1}, Vf= 1,600mm/min ap 0.15xae 0.3mm, Coolant: Oil Mist

	MRBSH230SF	其他品牌 A Other tool brand A	其他品牌 B Other tool brand B	其他品牌 C Other tool brand C
磨耗图片 Wear pictures	 磨耗宽度 :0.102mm Wear width : 0.102mm	 磨耗宽度 :0.137mm Wear width : 0.137mm	 磨耗宽度 :0.190mm Wear width : 0.190mm	 磨耗宽度 :0.157mm Wear width : 0.157mm
加工时间 Cutting time	70 分钟 70 min			

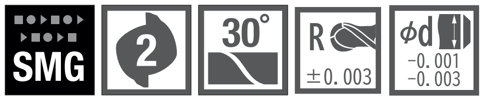
70HRC的高精度材料也能实现长寿命·高精度的加工

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

MRBSH230SF　R0.05 ～ R3 全 83 种规格　Total 83 sizes

70HRC的高硬度钢材也能实现长时间的高精度加工

Achieves long-tool life and high precision cutting even for 70 HRC hardened steel



R 角精度以实际刃径的 1/2 为基准值

R accuracy is based on a half value of actual diameter

特色

Features

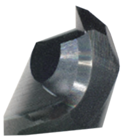
涂　层 Coating

1	耐氧化性・耐磨耗性的无限白金 Plus 涂层 New coating MUGEN COATING PREMIUM Plus with high Oxidation resistance and abrasion resistance

在上一页中介绍

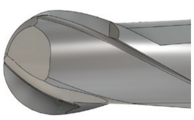
Introduced in the previous page

形　状 Shape



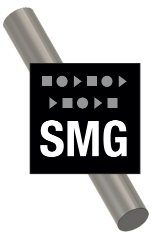
公差范围 0.002 mm

Tolerance range



2-1	减轻切削抵抗的刃口设计 Cutting edge shape with reduced cutting load
2-2	优化刀具夹持伸出量，实现高刚性加工 Achieves high rigidity with optimal tool overhung
	可对应高精度热缩式刀柄 High accuracy precision shank supported shrink fit chuck
2-3	无段差的高精度 R 角造型 Highly accurate R shape that is smooth and seamless

母　材 Material



3	采用堤高耐崩损性的超超微粒子硬质合金 Super micro grain carbide with improved fracture resistance

Feature 2-1 提升切削性能 Improved machinability

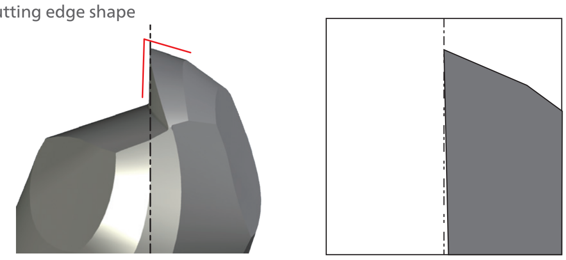
形状 Shape　刃口 Cutting edge

采用锐角设计，可减轻切削抵抗提高切削性能的刃口造型，并配合耐崩损性好的新母材。
使得针对高硬度钢材加工时，高精度与高效能的要求可以得到实现

Sharp cutting edge with reduced cutting load and new material with fracture resistance realizes long tool life and high precision for hardened steel

MRBSH230SF

刃口形状
Cutting edge shape



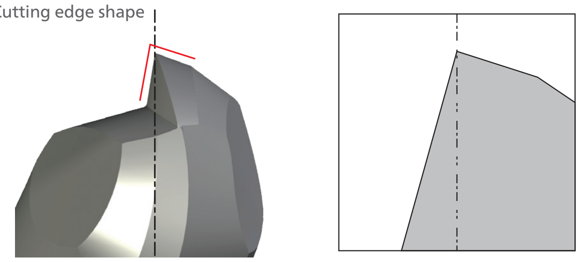
锐角刃口设计
Positive cutting edge

刃口采用锐角造型来减轻切削抵抗并使用新素材制作出加工高硬度钢材也不易崩刃的造型

Cutting load is reduced by positive cutting edge and by adopting a new material Super micro grain carbide prevent chipping even with hardened steel

一般高硬度用铣刀
General end mill for hardened steel

刃口形状
Cutting edge shape



钝角刃口设计
Negative cutting edge

切削抵抗大的钝角造型

Negative cutting edge shape with high cutting load

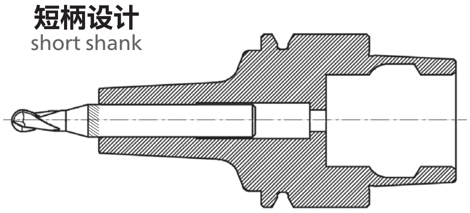
Feature 2-2 提升加工精度 Improved cutting accuracy

形状 Shape　最适合的刀具伸出量 Optimal overhung length

MRBSH230SF

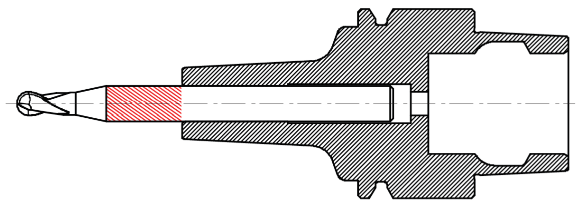
刀具夹持伸出量较短，可在高刚性状态下加工
Possible to machining with high rigidity, with short tool overhung

短柄设计
short shank



一般全长设计
Normal shank length

刀具夹持伸出量较长，低刚性状态
Tool overhung length is long, and tool rigidity is low



Feature 2-2 可对应高精度热缩式刀柄 Compatible with high accuracy shrink-fit chuck

形状 Shape　高精度柄径 High accuracy shank

ϕd $\begin{matrix}-0.001\\-0.003\end{matrix}$

公差范围
Tolerance range
0.002 mm

70HRC的高硬度材料也能实现长寿命·高精度的加工

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

Feature 2-3 高精度 R 角 High accuracy R

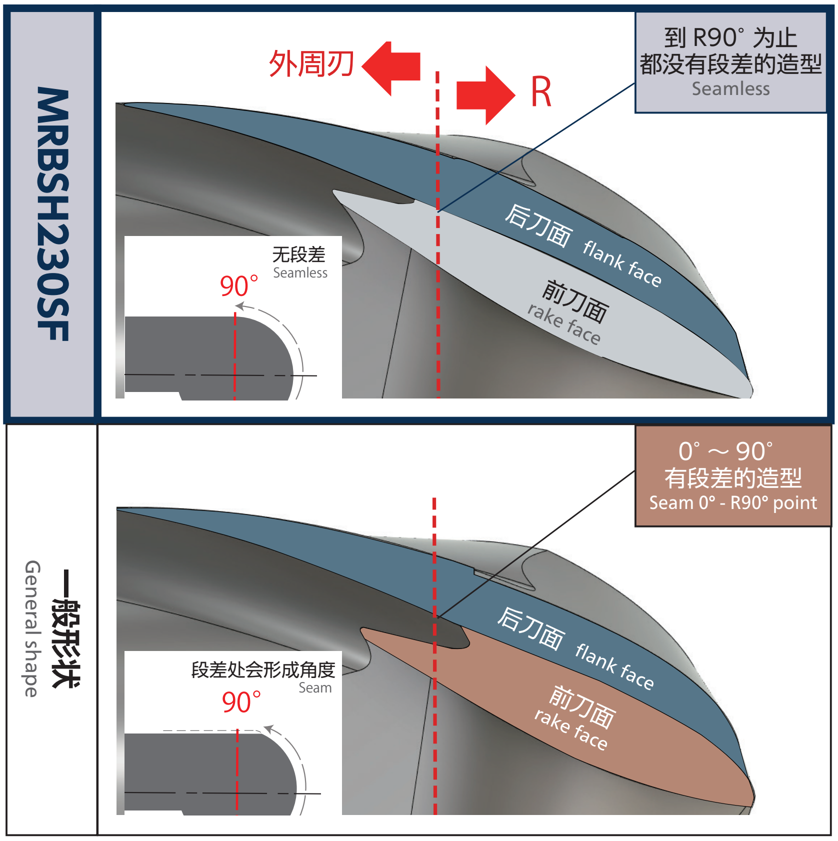
形状 shape　R 角的高精度化 Highly accurate R

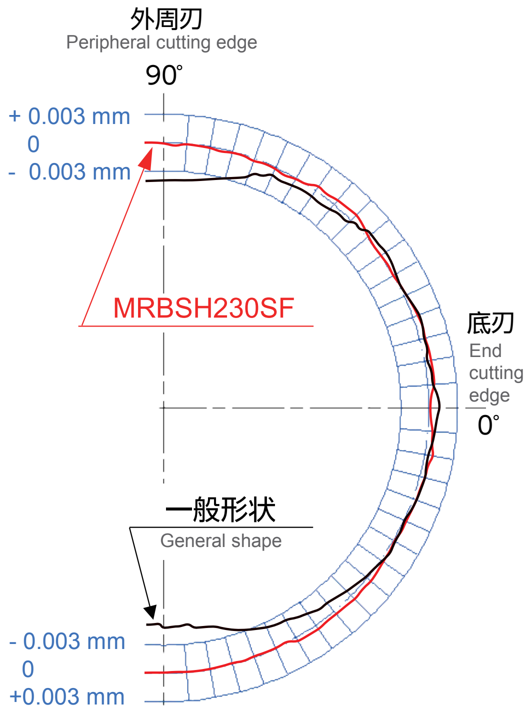
从R角到侧刃的接续位置,刀面都采用无段差设计, 实现R精度的高精度化

Seamless design on rake face and flank face from R-curve to peripheral cutting edge. Realized high precision R accuracy

专利申请中
PATEND PENDING

R ±0. 003





＊ R角精度以实际刃径的1/2为基准值
R accuracy is based on a half value of actual diameter

Feature 3 提升耐摩耗性 Upgrade abrasion ability

母材 Material　硬质合金 Carbide material

SMG

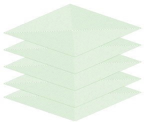
采用新母材的 **「超超微粒子硬质合金」**,
强化耐磨耗性、耐崩损性

New material adopted「Super micro grain carbide」to specialize abrasion resistance and fracture resistance.

高精度加工案例 1
High precision cutting sample 1

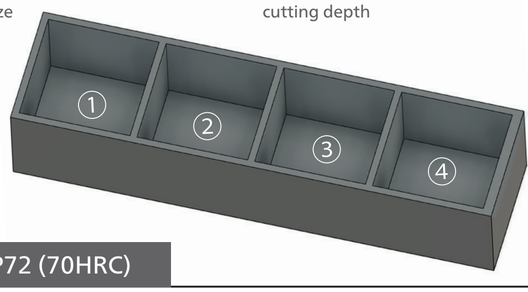
HAP72 (70HRC)：粗加工后的尺寸精度对比
HAP72 (70HRC) : Comparison of dimensional accuracy after rough cutting

刀具 Tool ：MRBSH230SF R1×6
加工内容 ：等高线粗加工 4 个方槽
Cutting content : Roughing contour lines for 4 pockets



余　量 Stock ：0.02mm
目 标 值 Target ：7.960mm
加工时间 Cutting time ：20 分钟 / 个 min / per pocket
刀路轨迹 Tool path ：等高线粗加工 Roughing contour line

加工形状 Cutting shape
方槽内尺寸：8 mm× 8 mm × 加工深度 6 mm
Pocket Size cutting depth

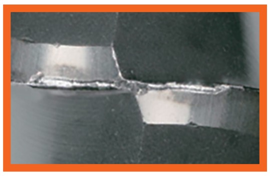
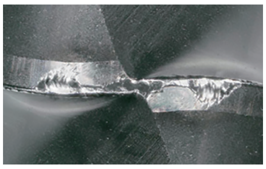


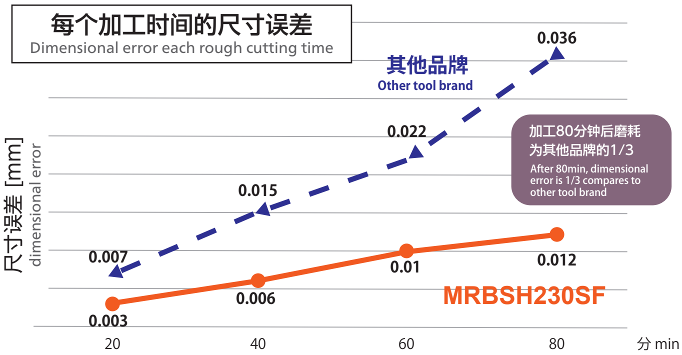
HAP72 (70HRC)

粗加工 Roughing

n= 16,000min-1 Vf = 1,200mm/min ap 0.1 × ae 0.3mm 油雾 Oil Mist

80 分钟加工后的刀具磨耗状态
Tool wear condition after 80min machining

MRBSH230SF	其他品牌 Other tool brand
	
后刀面磨耗宽度 Frank wear width 0.055mm	后刀面磨耗宽度 Frank wear width 0.102mm



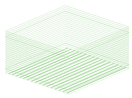
相对于其他品牌可实现更安定的余量管理
Realized stable demensional accurasy compares to other tool brand

高精度加工案例 2
High precision cutting sample 2

HAP72 (70HRC)：精加工后的尺寸精度对比
HAP72 (70HRC) : Comparison of dimensional accuracy after finish cutting

刀　具 Tool ：MRBSH230SF R1×6
加工内容 ：精加工 1 个方槽
Cutting content : Finishing cutting for 1 pocket

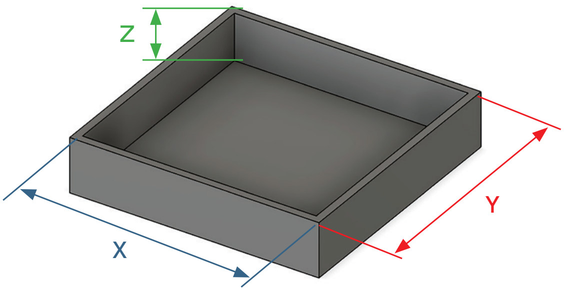
加工时间 Cutting time ：32 分钟 / 个 min / per pocket
刀路轨迹 Tool path ：等高线精加工（侧面）
Contour line finishing
平行线精加工（底面）
Scanning line finishing



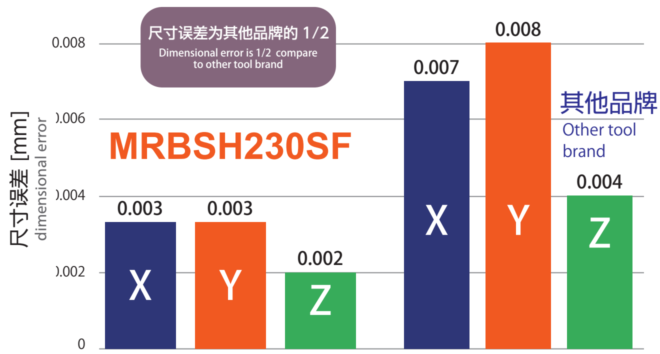
精加工 Finishing

n= 16,000min-1 Vf= 1,000mm/min ap 0.03 × ae 0.03mm 油雾 Oil Mist

加工形状 Cutting shape
方槽内尺寸：30 mm × 30 mm × 加工深度 6 mm
Pocket Size cutting depth



HAP72 (70HRC)



相对于其他品牌可实现更高精度的精加工效果
Realized high precision finishing compares to other tool brand

MRBSH230SF

R0.05 ～ R3　全 83 规格

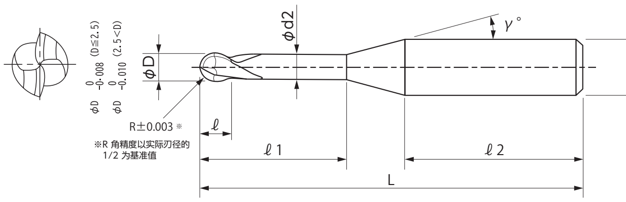
无限白金Plus涂层
高硬度钢材高精度加工用2刃长颈球头铣刀可对应热缩刀柄的短柄造型
MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill with Short Shank for Hardened Steel

Plus ≦70 HRC

New

3D

SMG　2　30°　R ±0.003　φd -0.001 -0.003

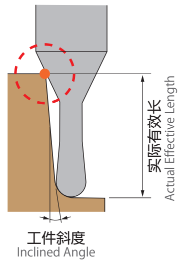


※R角精度以实际刃径的1/2 为基准值
R accuracy is based on a half value of actual diameter

- 70HRC高硬度钢材也可实现长寿命稳定的切削性能。
- 新研发出无限白金Plus涂层，提升耐氧化性・耐磨耗性。
- 采用提升耐崩损性的新母材与减轻切削抵抗的刃刃设计。
- R角精度以实际刃径的1/2为基准值。
- 柄径公差为-0.001mm ～ -0.003mm，2 μm范围内的高精度设计。
- 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 ±0.003mm (R accuracy is based on a half value of actual diameter).
- Shank diameter tolerance , high accuracy type, is - 0.001 ～ - 0.003.

加工材料 Work Material

高硬度钢材 Hardened Steels	
45 ～ 60 HRC	60 ～ 70 HRC
○	◎



单位 [尺寸:mm / 价格:日元]　Unit [Size : mm / Retail Price : JPY]

产品代码 Code No.	(R) 球头半径 Radius	(ℓ1) 颈长 Under Neck Length	(ℓ) 刃长 Length of Cut	(D) 刃径 Dia.	(d2) 颈径 Neck Dia.	(γ) 颈角 Neck Taper Angle	(d) 柄径 Shank Dia.	(ℓ2) 柄长 Shank Length	(L) 全长 Overall Length	标准价格 Retail Price	相对于工件斜度的有效长 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	9,000	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	9,200	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	9,900	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	9,500	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	9,900	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	7,200	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	7,200	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	7,200	0.81	0.83	0.86	0.89	0.95
08-00537-00105		1	0.15	0.2	0.18	15°	4	26.8	35	7,200	1.06	1.10	1.13	1.17	1.26
08-00537-00150	R0.15	0.5	0.2	0.3	0.28	15°	4	27.5	35	7,100	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	7,100	0.65	0.67	0.69	0.71	0.75
08-00537-00152		0.75	0.2	0.3	0.28	15°	4	27.3	35	7,100	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	7,100	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	7,600	1.58	1.63	1.68	1.74	1.87
08-00537-00201	R0.2	0.5	0.3	0.4	0.37	15°	4	27.7	35	5,200	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	5,200	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	5,200	1.08	1.11	1.14	1.18	1.26
08-00537-00204		1.5	0.3	0.4	0.37	15°	4	26.7	35	5,400	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	5,500	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	5,700	2.63	2.72	2.81	2.90	3.13
08-00537-00252	R0.25	1	0.35	0.5	0.46	15°	4	27.3	35	5,200	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	5,200	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	5,200	2.13	2.20	2.27	2.34	2.51
08-00537-00255		2.5	0.35	0.5	0.46	15°	4	25.8	35	5,200	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	5,200	3.16	3.27	3.38	3.49	3.76
08-00537-00300	R0.3	1	0.45	0.6	0.56	15°	4	27.5	35	4,500	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	4,100	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	4,100	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	4,200	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	4,200	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	4,300	3.68	3.80	3.92	4.06	4.37
08-00537-00306		4	0.45	0.6	0.56	15°	4	29.5	40	4,300	4.20	4.33	4.48	4.64	4.99
08-00537-00402	R0.4	2	0.6	0.8	0.76	15°	4	26.9	35	4,100	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	4,300	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	4,300	4.19	4.33	4.47	4.62	4.97
08-00537-00406		5	0.6	0.8	0.76	15°	4	28.9	40	4,300	5.23	5.40	5.58	5.77	6.21
08-00537-00501	R0.5	2	0.75	1	0.95	15°	4	27.3	35	3,500	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	3,500	2.66	2.73	2.82	2.90	3.10
08-00537-00503		3	0.75	1	0.95	15°	4	26.3	35	3,500	3.18	3.27	3.37	3.48	3.72
08-00537-00504		4	0.75	1	0.95	15°	4	25.3	35	3,900	4.21	4.34	4.48	4.63	4.97
08-00537-00505		5	0.75	1	0.95	15°	4	29.3	40	3,900	5.24	5.41	5.59	5.78	6.21
08-00537-00506		6	0.75	1	0.95	15°	4	28.3	40	4,300	6.28	6.48	6.69	6.93	7.45

订购方式

请指定MRBSH230SF 球头半径(R)×颈长(ℓ1)
When you order, indicate MRBSH230SF (R) × (ℓ1).

※(γ)为参考值
※(γ) is reference value.

单位 [尺寸:mm / 价格:日元]　Unit [Size : mm / Retail Price : JPY]

产品代码 Code No.	(R) 球头半径 Radius	(ℓ1) 颈长 Under Neck Length	(ℓ) 刃长 Length of Cut	(D) 刃径 Dia.	(d2) 颈径 Neck Dia.	(γ) 颈角 Neck Taper Angle	(d) 柄径 Shank Dia.	(ℓ2) 柄长 Shank Length	(L) 全长 Overall Length	标准价格 Retail Price	相对于工件斜度的有效长 Actual effective length depending on inclined angle of workpiece.				
											30′	1°	1°30′	2°	3°
08-00537-00602	R0.6	2.4	0.9	1.2	1.15	15°	4	27.2	35	5,100	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	5,100	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	5,600	6.27	6.47	6.68	6.91	7.43
08-00537-00606		8	0.9	1.2	1.15	15°	4	26.6	40	5,600	8.34	8.61	8.90	9.21	9.91
08-00537-00752	R0.75	3	1.1	1.5	1.45	15°	4	27.2	35	4,000	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	4,000	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	4,000	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	4,200	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	4,500	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	5,600	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	3,500	3.18	3.25	3.34	3.43	3.63
08-00537-01001		4	1.5	2	1.94	15°	4	27.1	35	3,500	4.21	4.32	4.45	4.58	4.87
08-00537-01002		6	1.5	2	1.94	15°	4	25.1	35	3,900	6.28	6.46	6.66	6.88	7.36
08-00537-01003		8	1.5	2	1.94	15°	4	28.1	40	4,200	8.35	8.60	8.88	9.18	9.84
08-00537-01004		10	1.5	2	1.94	15°	4	26.1	40	4,200	10.41	10.74	11.10	11.48	12.33
08-00537-01005		12	1.5	2	1.94	15°	4	29.1	45	4,200	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	5,200	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	4,600	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	5,500	10.48	10.81	11.15	11.52	12.36
08-00537-01256		15	2.3	2.5	2.4	15°	4	27.0	45	5,600	15.65	16.15	16.69	17.27	Free
08-00537-01500	R1.5	6	2.5	3	2.85	15°	6	33.1	45	4,200	6.44	6.61	6.79	7.00	7.45
08-00537-01501		8	2.5	3	2.85	15°	6	31.1	45	4,200	8.5	8.75	9.01	9.29	9.93
08-00537-01502		10	2.5	3	2.85	15°	6	29.1	45	4,800	10.57	10.89	11.23	11.59	12.42
08-00537-01503		12	2.5	3	2.85	15°	6	27.1	45	5,000	12.64	13.03	13.44	13.89	14.91
08-00537-01504		14	2.5	3	2.85	15°	6	30.1	50	5,600	14.71	15.17	15.66	16.19	17.39
08-00537-01505		16	2.5	3	2.85	15°	6	28.1	50	5,600	16.77	17.31	17.88	18.49	19.88
08-00537-01506		20	2.5	3	2.85	15°	6	29.1	55	5,400	20.91	21.58	22.31	23.09	24.85
08-00537-02000	R2	8	3	4	3.8	15°	6	32.8	45	4,300	8.58	8.81	9.06	9.33	9.93
08-00537-02001		10	3	4	3.8	15°	6	30.8	45	4,300	10.65	10.95	11.28	11.63	12.42
08-00537-02002		12	3	4	3.8	15°	6	28.8	45	5,600	12.72	13.09	13.49	13.93	14.90
08-00537-02004		15	3	4	3.8	15°	6	30.8	50	5,600	15.82	16.30	16.82	17.38	18.63
08-00537-02005		20	3	4	3.8	15°	6	30.8	55	5,600	20.99	21.65	22.36	23.13	Free
08-00537-02006		25	3	4	3.8	15°	6	30.8	60	5,600	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	6,500	10.63	10.92	11.22	11.55	Free
08-00537-02503		15	3.5	5	4.8	15°	6	27.7	45	9,000	15.8	16.27	16.77	Free	Free
08-00537-02504		20	3.5	5	4.8	15°	6	27.7	50	9,100	20.97	21.62	Free	Free	Free
08-00537-03000	R3	10	6	6	5.7	–	6	34.4	45	7,000	Free	Free	Free	Free	Free
08-00537-03001		15	6	6	5.7	–	6	29.4	45	7,000	Free	Free	Free	Free	Free
08-00537-03002		20	6	6	5.7	–	6	29.4	50	7,000	Free	Free	Free	Free	Free
08-00537-03003		25	6	6	5.7	–	6	29.4	55	7,000	Free	Free	Free	Free	Free
08-00537-03004		30	6	6	5.7	–	6	29.4	60	7,200	Free	Free	Free	Free	Free

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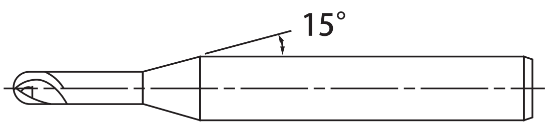
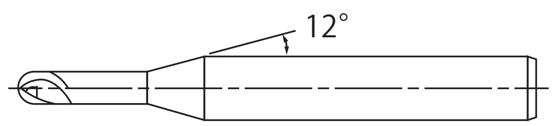
※(γ)为参考值
※(γ) is reference value.

● MRBSH230SF 颈角（γ）为 15°。我公司其他产品也有颈角（γ）12° 的产品。

● Neck taper angle (γ) of MRBSH230SF is 15°. Our other products have a neck taper angle (γ) of 12°.



MRBSH230SF



我公司其他产品也有颈角 (γ) 12° 的产品
Our other products have a neck taper angle (γ) of 12°

MRBSH230SF

切削参数参考表 Recommended Milling Conditions

加工材料 Work Material			高速钢·淬火钢 High Speed Steels / Hardened Steels SKH51·SKD11 (~62HRC)				高速钢 High Speed Steels SKH55·HAP40 (~66HRC)				高速钢 High Speed Steels SKH57·HAP72 (~70HRC)			
R球头半径 Radius	颈长 Under Neck Length	L(有效长) D(刃径) L/D	切深量 Depth of Cut		进给速度 Feed	主轴转速 Spindle Speed	切深量 Depth of Cut		进给速度 Feed	主轴转速 Spindle Speed	切深量 Depth of Cut		进给速度 Feed	主轴转速 Spindle Speed
			ap mm	ae mm	mm/min	min^{-1}	ap mm	ae mm	mm/min	min^{-1}	ap mm	ae mm	mm/min	min^{-1}
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
R0.1	**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
	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
	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
R0.25	**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
	3	6	0.007	0.01	420	35,000	0.005	0.007	320	35,000	0.005	0.007	220	30,000
R0.3	**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
R0.4	**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
	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
R0.5	**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
	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

加工材料 Work Material			高速钢·淬火钢 High Speed Steels / Hardened Steels SKH51·SKD11 (～62HRC)				高速钢 High Speed Steels SKH55·HAP40 (～66HRC)				高速钢 High Speed Steels SKH57·HAP72 (～70HRC)			
R球头半径 Radius	颈长 Under Neck Length	L(有效长) D(刃径) L/D	切深量 Depth of Cut		进给速度 Feed	主轴转速 Spindle Speed	切深量 Depth of Cut		进给速度 Feed	主轴转速 Spindle Speed	切深量 Depth of Cut		进给速度 Feed	主轴转速 Spindle Speed
			ap mm	ae mm	mm/min	min^{-1}	ap mm	ae mm	mm/min	min^{-1}	ap mm	ae mm	mm/min	min^{-1}
R0.6	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
	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
R0.75	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
	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
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
	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
R2	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
	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
R2.5	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

备注
Notes

※1 切深量的 ap 表示轴向切入量，ae 表示步距量。
※2 发生振刀时，请调整切削参数。
※3 拐角等切削负荷大的加工部位，请特别注意参数设定和刀路轨迹等。
※4 请以相同的比率调整主轴转速和进给速度。
※5 建议使用热缩式刀柄。如使用筒夹式刀柄时请确认刀具所需的最短夹持量。
※6 建议使用油雾冷却方式。
※1 Depth of cut ap indicates Axial Depth of Cut, ae indicates Radial Depth of Cut.
※2 In case of chattering etc., please adjust cutting conditions if necessary.
※3 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly.
※4 Adjust both spindle speed and feed at the same rate.
※5 A shrink fit type is recommended for holding tool. When using collet type or others, strictly adhere to minimum gripping length.
※6 We recommend using Oil Mist coolant.

加工案例 1 Machining case 1

加工材料：**HAP72（70HRC）**
Material : HAP72 (70HRC)

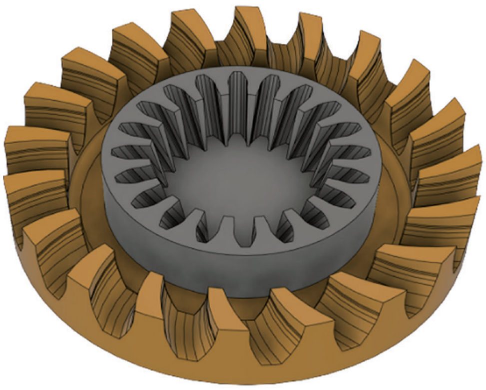
冷却方式：**油雾**
Coolant : Oil Mist

总加工时间：**11 小时 33 分钟**
Total machining time : 11hr 33min

工件尺寸：ϕ40（底座 50 × 45 mm）
Work size : ϕ40 (Base 50×45 mm)

加工深度：6mm
Cutting depth : 6mm

外齿 Peripheral gear



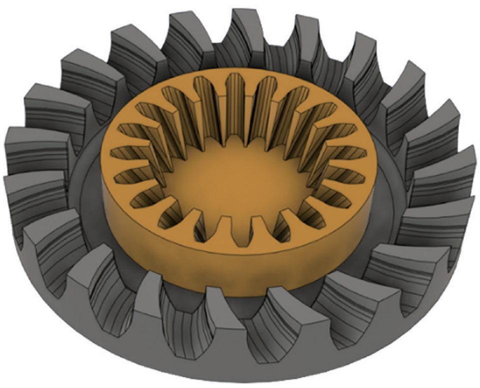
加工 ■ 部 Milling part

外齿加工时间：**6 小时 57 分钟**
Peripheral gear machining time : 6hr 57min

加工工序 Process	粗加工 Roughing	中精加工 Semi-finishing	精加工 Finishing
使用刀具 Tool	MRBSH230SF R1×6	MRBSH230SF R1×6	MRBSH230SF R1×6
主轴转速 [min^{-1}] Spindle speed	12,000		
进给速度 [mm/min] Feed	1,800		1,200
切深量 [mm] Depth of cut	ap 0.06 × ae 0.3	pf : 0.01 Pick feed	pf : 0.03 Pick feed
余量 [mm] Stock	0.03	0.01	—
加工时间 Machining times	2小时36分钟 2 hr 36 min	51分钟 51 min	3小时30分钟 3 hr 30 min

※pf:步距量 pick feed

内齿 Inside gear



加工 ■ 部 Milling part

内齿加工时间：**4 小时 36 分钟**
Inside gear machining time : 4hr 36min

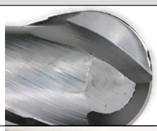
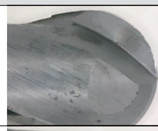
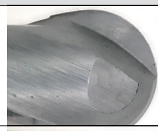
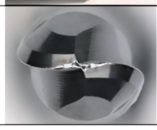
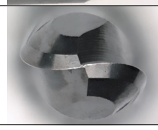
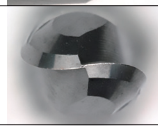
加工工序 Process	粗加工 Roughing	中精加工 Semi-finishing	精加工 Finishing
使用刀具 Tool	MRBSH230SF R0.5×6	MRBSH230SF R0.5×6	MRBSH230SF R0.5×6
主轴转速 [min^{-1}] Spindle speed	14,000		
进给速度 [mm/min] Feed	1,000		700
切深量 [mm] Depth of cut	ap 0.03 × ae 0.15	pf : 0.05 Pick feed	pf : 0.02 Pick feed
余量 [mm] Stock	0.03	0.01	—
加工时间 Machining times	3小时6分钟 3 hr 6 min	22分钟 22 min	1小时8分钟 1 hr 8 min

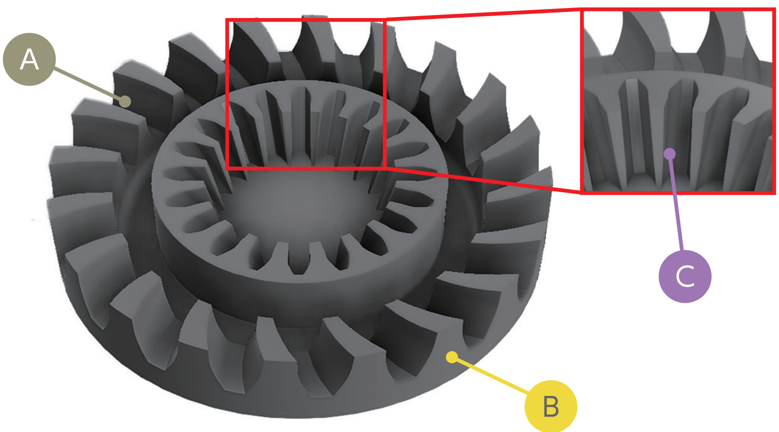
※pf:步距量 pick feed

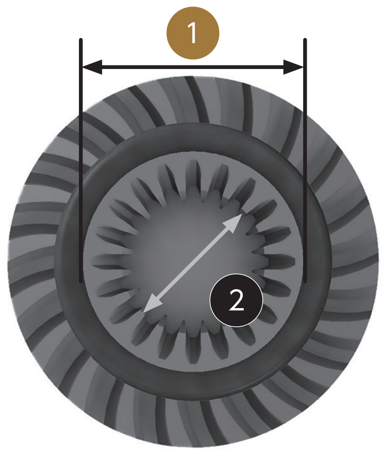
刀具磨耗
Tool wear

【切削条件】n :12,000min-1，粗加工 / 中精加工 Vf :1,800mm/min，精加工 Vf :1,200mm/min

Cutting condition n= 12,000 min-1, Roughing / Semi-finishing Vf= 1,800 mm/min, Finishing Vf= 1,200 mm/min

加工HAP72 (70HRC) 的刀具磨耗 Tool wear after cutting on HAP72 (70HRC)	MRBSH230SF R1 × 6		
	粗加工 Roughing 2 小时 36 分钟 2hr36min	中精加工 Semi-finishing 51 分钟 51min	精加工 Finishing 3 小时 30 分钟 3hr 30min
前刀面 Rake face			
外周刃 Peripheral cutting edge			
R 底刃部 R end cutting edge			





面粗度
Roughness

单位 Unit [μm]

	A	B	C
使用刀具 Tool	MRBSH230SF R1×6		MRBSH230SF R0.5×6
Ra	0.133	0.137	0.282
Rz	0.815	1.336	1.676

测定机:基恩士 VK-X250
Mesuring Instrument: Keyence VK-X250

精度
Accuracy

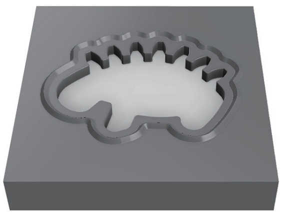
单位 Unit [mm]

	1	2
使用刀具 Tool	MRBSH230SF R1×6	MRBSH230SF R0.5×6
目标值 Target	24.500	15.480
实测值 Actual	24.505	15.472
误差 Error	0.005	0.008

测定机:尼康测定显微镜 MM-60
Measuring instrument : Nikon microscope MM-60

加工案例 2 Machining Case 2

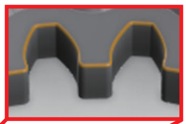
精密冲裁案例 Fine blanking machining sample



加工材料：**YXR3（61HRC）**
Material : YXR3 (61HRC)
冷却方式：**油雾**
Coolant : Oil Mist
总加工时间：**7 小时 27 分钟**
Total machining time : 7hr 27min
工件尺寸：60×60mm
Work size : 60×60mm
加工深度：4mm
Cutting depth : 4mm

※总加工时间包含压板部、凹模与形状部分（白色部）的加工时间
※Total machining time includes WEDM process (white part) both blank holder part and die part

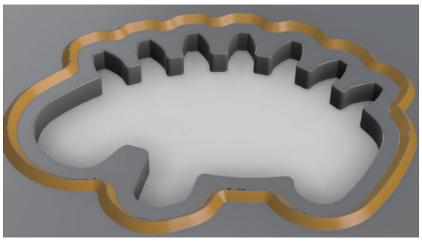
加工 部
Milling part



压板部 Blank holder

加工时间：5 小时 41 分钟
Machining time : 5hr 41min

加工 部 Milling part



凹模部 Die

加工时间：1 小时 46 分钟
Machining time : 1hr 46min

压板部 Blank holder

加工工序 Process	粗加工 Roughing	中精加工 Semi-Finishing	清角加工 Stock removal	精加工 Finishing	清角加工 Stock removal	清角加工 Stock removal
使用刀具 Tool	MRBSH230SF R1×4		MRBSH230SF R0.5×2		MRBSH230SF R0.25×1.5	MRBSH230SF R0.2×1
主轴转速[min^{-1}] Spindle speed	25,000		30,000			
进给速度[mm/min] Feed	2,500		1,000		540	540
切深量[mm] Depth of cut	ap 0.2 ae 0.5	pf:0.05 pick feed		pf:0.03		pf:0.02
余量[mm] Stock	0.03	0.01		–（只加工内角部0.005）Only corner part		–
加工时间 Machining times	39分钟 39 min	40分钟 40 min	1小时3分钟 1 hr 3 min		47分钟 47 min	1小时26分钟 1 hr 26min

※pf:步距量 pick feed

凹模部 Die

加工工序 Process	粗加工 Roughing	精加工 Finishing
使用刀具 Tool	MRBSH230SF R0.25×1.5	MRBSH230SF R0.2×1
主轴转速[min^{-1}] Spindle speed	30,000	
进给速度[mm/min] Feed	540	
切深量[mm] Depth of cut	ap 0.01 ae 0.03	pf:0.01
余量[mm] Stock	0.003	–
加工时间 Machining times	1小时11分钟 1 hr 11 min	35分钟 35 min

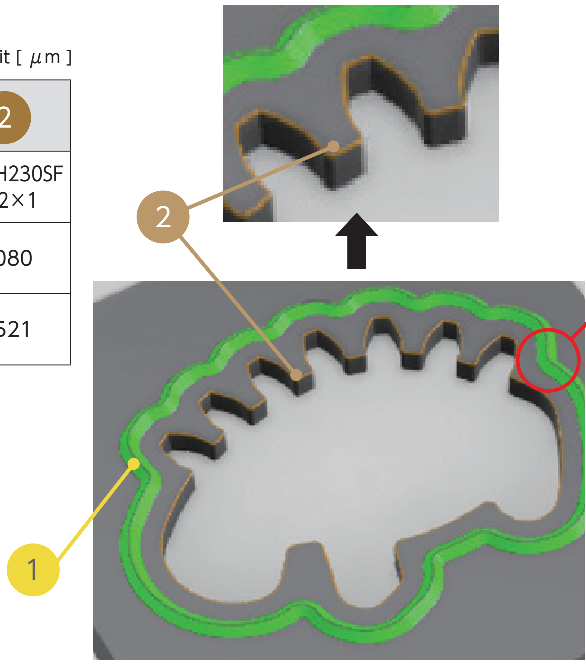
※pf:步距量 pick feed

面粗度 Roughness

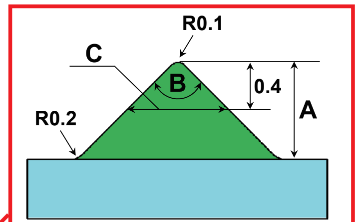
单位 Unit [μm]

	1	2
使用刀具 Tool	MRBSH230SF R0.5×2	MRBSH230SF R0.2×1
Ra	0.145	0.080
Rz	1.192	0.521

测定机：基恩士 VK-X250
Measuring Instrument : Keyence VK-X250



精度 Accuracy



凸V字形状截面
Convex V shape cross section

	A	B	C
目标值 Target	0.958mm	90° 0′ 00″	0.883mm
实测值 Actual	0.958mm	90° 15′ 10″	0.888mm
误差 Error	0.000mm	0° 15′ 10″	0.005mm

测定机：基恩士 VK-X250
Measuring Instrument : Keyence VK-X250

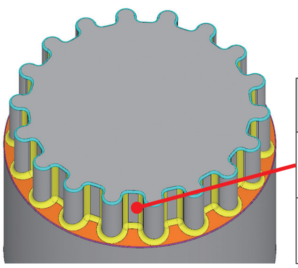
加工案例 3 Machining Case 3

加工材料：**HAP40（65HRC）**
Material : HAP40 (65HRC)
冷却方式：**油雾**
Coolant : Oil Mist
总加工时间：**8 小时 46 分钟**
Total machining time : 8hr 46min
工件尺寸：ϕ25×50mm
Work size : ϕ25×50mm
加工深度：6mm
Cutting depth : 6mm

※pf:步距量 pick feed

加工工序 Process	粗加工 Roughing	清角加工 Stock removal	中精加工 Semi-finishing	精加工 Finishing
使用刀具 Tool	MRBSH230SF R1×6	MRBSH230SF R0.5×5	MRBSH230SF R0.5×5	MRBSH230SF R0.5×5
主轴转速 [min^{-1}] Spindle speed	20,000			12,000
进给速度 [mm/min] Feed	1,600	920	920	460
切深量 [mm] ap × ae Depth of cut	0.15 × 0.3	0.03×0.1	侧面 Side face 0.03×0.02 平面 Surface 0.02×0.05	pf:0.015 Pick feed
余量 [mm] Stock	0.03		0.01	—
加工时间 Machining time	24分钟 24 min	3小时8分钟 3 hr 8 min	1小时8分钟 1 hr 8 min	4小时6分钟 4 hr 6 min

面粗度 Roughness

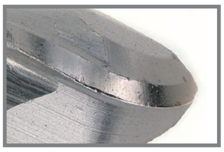


单位 Unit [μm]

	侧面部 Side face
Ra	0.031
Rz	0.225

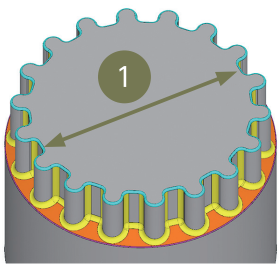
测定机：基恩士 VK-X250
Measuring Instrument : Keyence VK-X250

刃尖后退量0.003mm
(侧面精加工2小时后)
R edge retreat amount 0.003mm
after side finishing for 2 hours



0.003mm

精度 Accuracy

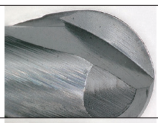
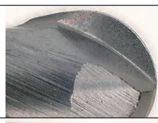
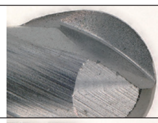
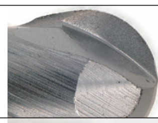
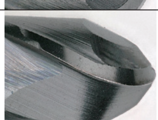
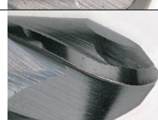
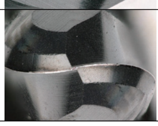
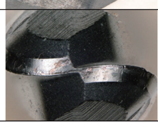
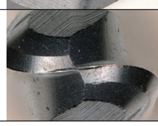
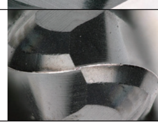


单位 Unit [mm]

	1
目标值 Target	20.644
实测值 Actual	20.647
误差 Error	0.003

测定机：尼康测定显微镜 MM-60
Mesuring instrument : Nikon microscope MM-60

刀具磨耗 Tool wear

加工工序 Process	粗加工 Roughing	清角加工 Stock removal	中精加工 Semi-finishing	精加工 Finishing
使用刀具 Tool	MRBSH230SF R1×6	MRBSH230SF R0.5×5	MRBSH230SF R0.5×5	MRBSH230SF R0.5×5
前刀面 Rake side				
外周刃 Peripheral cutting edge				
R 底刃部 R end cutting edge				

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警告 CAUTION 使用上的安全注意事项 Attention on Safety

1) 拿取刀具使用时，请特别小心避免损坏刀刃。
2) 请勿空手触摸刀刃。
3) 为了安全，使用刀具时请带防护眼镜。
4) 选用适合刀具和实际加工内容的刀柄。刀柄装夹后将刀柄的偏摆量控制最低。
5) 加工工件必须固定好。
6) 请预先测量刀具及加工材料的尺寸。
7) 请根据工件形状和使用设备情况来调节切削参数。
8) 根据实际用途请选择适合的冷却方式。使用切削油时，请采取防火措施以免发生火花引起火灾等发生。
9) 加工过程中如发生异常现象（异常声音或烟雾）时，请立即停止机床。
10) 请勿改造刀具。

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 water insoluble 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.

173
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