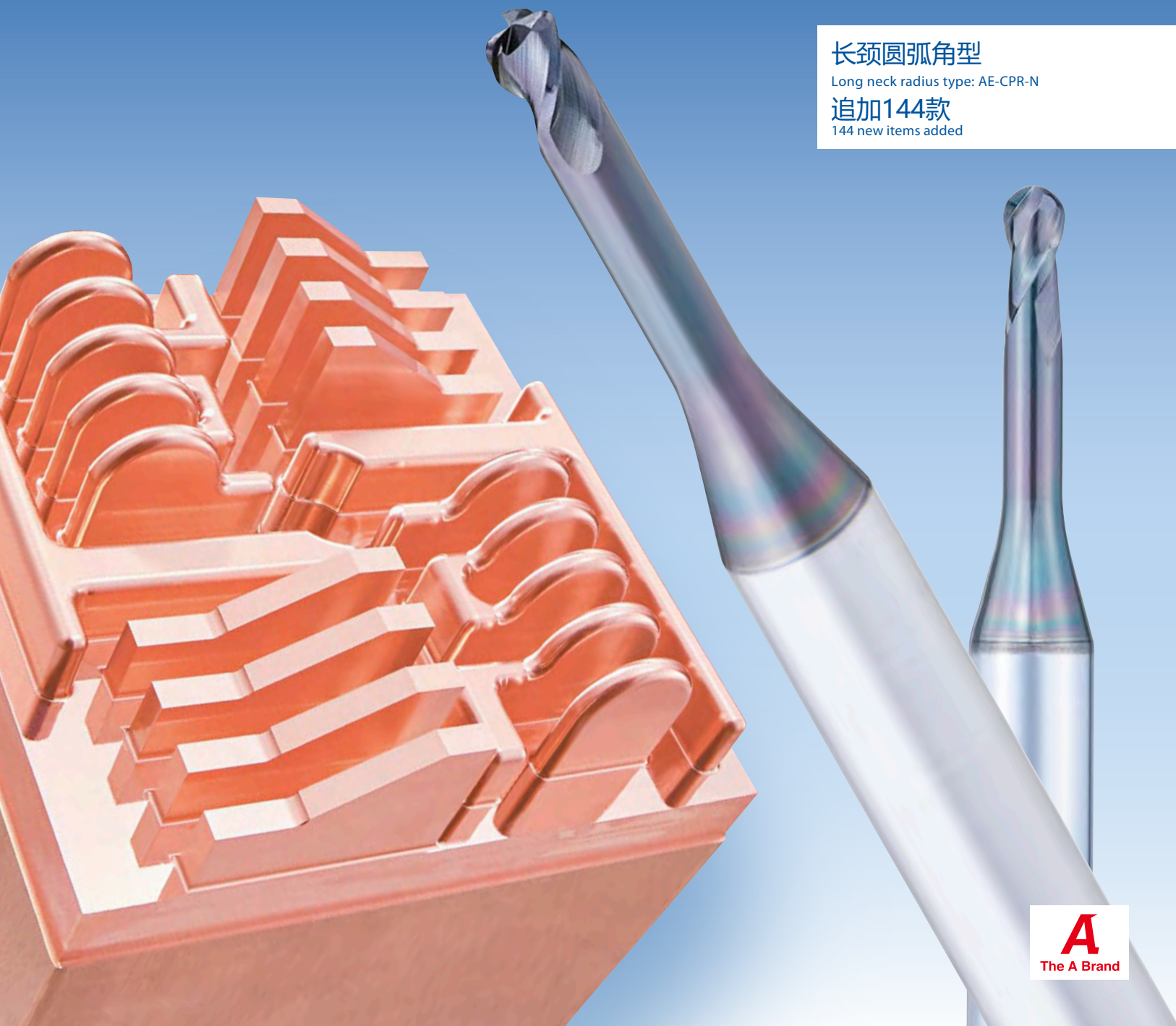
DLC Coated Carbide End Mills for Copper Electrodes

Vol.2

铜电极用DLC硬质合金铣刀

AE-LNBD-N·AE-CPR-N



长颈圆弧角型

Long neck radius type: AE-CPR-N

追加144款

144 new items added

The A Brand

丰富的产品尺寸，共216款

Full lineup of 216 items

LINE UP 产品种类

高精度精加工用2刃长颈球头型
2-flute long neck ball type for high precision finishing

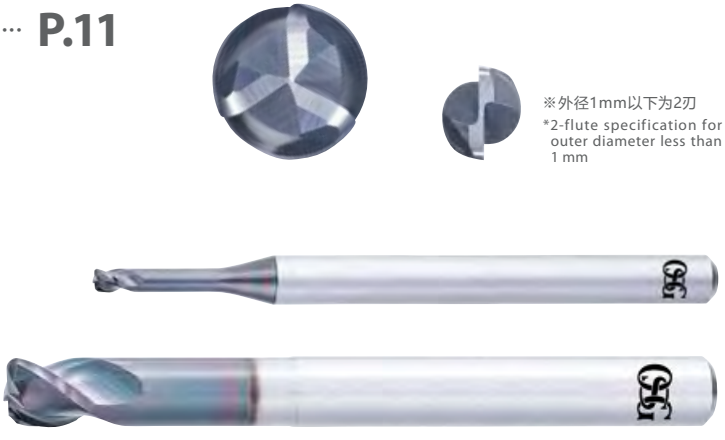
AE-LNBD-N P.3

- R0.05 ～ R3
- 共72款
  72 items in total

高效率精加工用长颈圆弧角型 NEW
Long neck radius type for high-efficiency finishing

AE-CPR-N P.11

- φ0.2 ～ φ6
- 共144款
  144 items in total



※外径1mm以下为2刃
*2-flute specification for outer diameter less than 1 mm

独特的DLC涂层改善了铜电极加工

Unique DLC coating that revamps copper electrode machining

由于DLC涂层表面的平滑度和低摩擦系数，对需求耐溶着性和润滑性的铜合金等非铁金属发挥出众的威力。

Due to its smooth surface and extremely low coefficient of friction, DLC coating is extremely effective against non-ferrous metals such as copper alloys, which require welding resistance and lubricity.

■ DLC-IGUSS 涂层 DLC-IGUSS Coating

与以往的DLC涂层相比，DLC-IGUSS涂层为厚涂层型，可抑制刃尖磨损，实现工具的高耐久性和良好的加工精度。

Compared to conventional DLC coating, DLC-IGUSS is a thick film type that suppresses wear on the cutting edge and achieves both high tool durability and good machining accuracy.

涂层名称 Name of Coating	涂层色 Coating Color	涂层种类 Coating Type	硬度 (GPa) Hardness	氧化开始温度（℃） Oxidation Temperature	摩擦系数 Coefficient of Friction	标准涂层厚度（μm） Coating Thickness	成膜温度（℃） Coating Temperature	表面粗糙度 Surface Roughness	耐磨损性 Wear Resistance	耐溶着性 Welding Resistance	韧性 Toughness
DLC-IGUSS	干涉色 Interference Color	DLC（SP^3 Rich）	60	550	0.10	0.8	400	☆	◎	☆	○

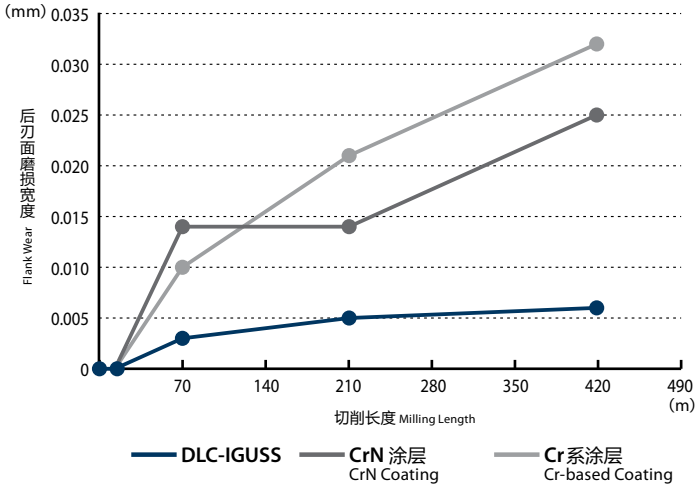
（标准）○ → ◎ → ☆（最佳）
(Good) (Best)

■ 耐磨损性 Wear Resistance

DLC-IGUSS能有效抑制紫铜(C1100)的磨损，可以长期保持稳定的加工精度。

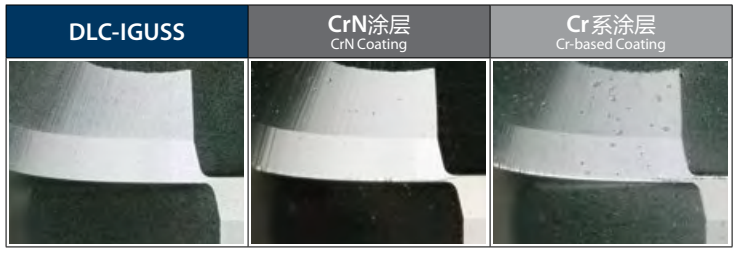
DLC-IGUSS is effective in suppressing wear against tough-pitch copper (C1100), and stable machining accuracy can be obtained for a long period of time.

使用工具 Tool	2刃硬质合金球头铣刀 R1.5 2-flute Carbide Ball End Mill
加工材料 Work Material	**C1100**
加工方法 Milling Method	啄铣 Pick Milling
切削速度 Cutting Speed	**141 m/min (15,000min^{-1})**
进给速度 Feed	**1,500 mm/min (0.05mm/t)**
切削深度 Depth of Cut	**a_p = 1.5mm Pf= 0.05mm**
切削油剂 Coolant	水溶性切削油剂 Water-soluble
使用机械 Machine	立式加工中心（BT40） Vertical Machining Center



加工420m 后球头部后刃面磨损状态

Wear condition of ball flank after milling 420m



高精度精加工用2刃长颈球头型
2-flute high-precision finishing long neck ball type

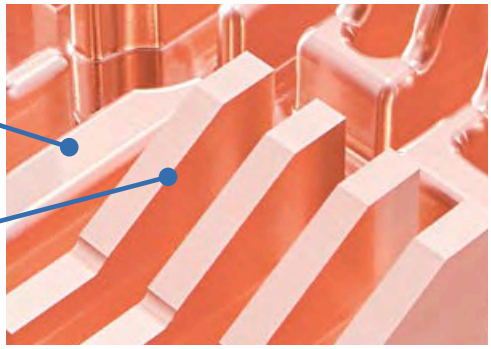
AE-LNBD-N

加工出无毛刺的精美铜电极！

Milling beautiful copper electrodes without burrs!

良好的加工面精度
Excellent machined surface accuracy

无毛刺的出色边缘
Beautiful edge without burrs



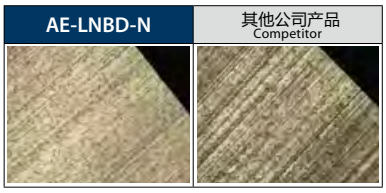
加工详细数据请见P.5
See page 5 for cutting data

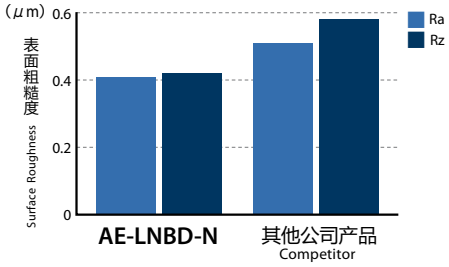
实现高品质加工的球头部
Ball specifications that enable high quality milling

- 最适合铜合金加工的锋利的切削刃形状
  - Optimal cutting edge shape for milling copper alloy
- 优良的球头R精度
  - Superior ball R precision

R ± 0.002	R ± 0.003	R ± 0.004
RE≦0.2	0.2<RE≦1.5	1.5<RE

- 高品质的后刃面粗糙度
  - High quality primary relief surface

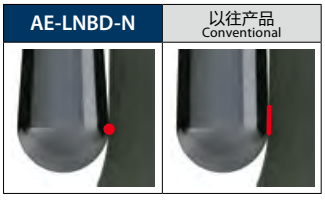




水滴形外周部
Teardrop-shaped outer periphery

- 大倒锥在红点处的切削可抑制振动，防止崩刃，提高加工面精度。
  - Strong back taper geometry enables milling by point, which prevents chattering and chipping, resulting in improvement of surface accuracy.

注1：R2以上无水滴形状
Note: Teardrop-shaped specification does not apply to items above R2.



优异的柄部精度
Superior shank accuracy

- 对应h4公差 (0/-0.004)
  - Supports h4 tolerance (0/-0.004).

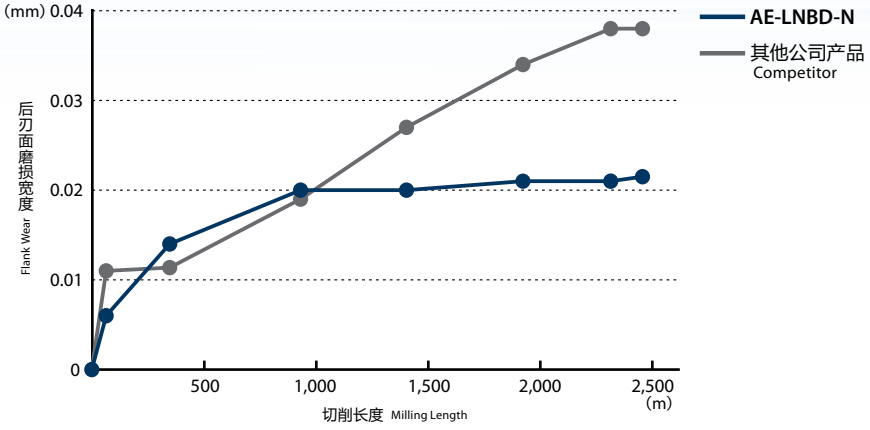
Environmental Considerations
环境保护

采用DLC-IGUSS涂层拥有压倒性的长寿命
Overwhelmingly long tool life with DLC-IGUSS coating

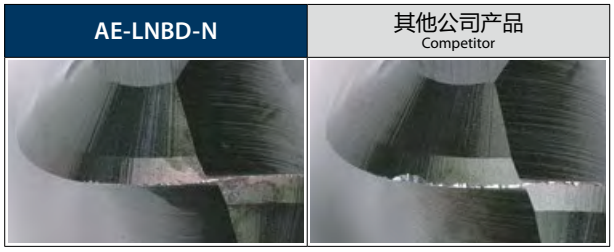
工具的长寿命化可以减少废弃物，从而节约资源。
另外、长寿命化可减少工具交换时间，实现降低功率消耗。
Extension of tool life leads to waste reduction and contributes to resource conservation.
In addition, longer tool life reduces power consumption by reducing tool change time.

采用DLC-IGUSS涂层，实现长寿命化。DLC-IGUSS coating is used to enable long tool life.

使用工具 Tool	AE-LNBD-N　R1×10×4
加工材料 Work Material	C1100
加工方法 Milling Method	啄铣 Pick Milling
切削速度 Cutting Speed	126m/min (20,000min^{-1})
进给速度 Feed	2,000mm/min (0.05mm/t)
切削深度 Depth of Cut	ap=0.2mm (0.1D) Pf=0.4mm (0.2D)
切削油剂 Coolant	水溶性切削油剂 Water-soluble
使用机械 Machine	立式加工中心 (BT40) Horizontal Machining Center

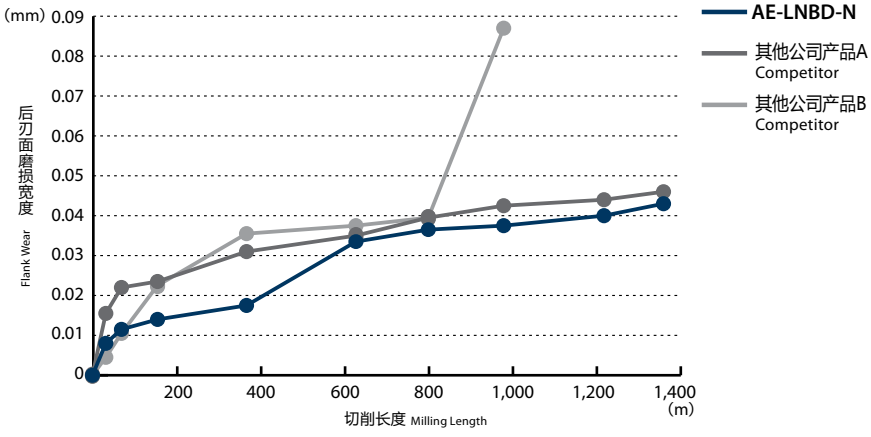


加工2,480m后的球头部后刃面磨损状态
Wearing condition of ball flank after milling 2,480m



在铜钨合金加工中，发挥优良的耐久性 Exhibits superior endurance in copper tungsten

使用工具 Tool	AE-LNBD-N　R1×10×4
加工材料 Work Material	铜钨合金 Copper Tungsten
加工方法 Milling Method	啄铣 Pick Milling
切削速度 Cutting Speed	101m/min (16,000min^{-1})
进给速度 Feed	1,400mm/min (0.04mm/t)
切削深度 Depth of Cut	ap=0.2mm (0.1D) Pf=0.4mm (0.2D)
切削油剂 Coolant	水溶性切削油剂 Water-soluble
使用机械 Machine	立式加工中心 (BT40) Horizontal Machining Center



球头部后刃面磨损状态
Wear condition of ball flank

与以往产品相比，可实现无毛刺的良好加工面

Achieves good machined surface without burrs compared to conventional products

加工材料：紫铜(C1100)

Work Material : Tough-Pitch Copper

加工尺寸：**60×60** （加工深度10mm）
Work Size　　Milling Depth

使用机械：立式加工中心（HSK-E32）

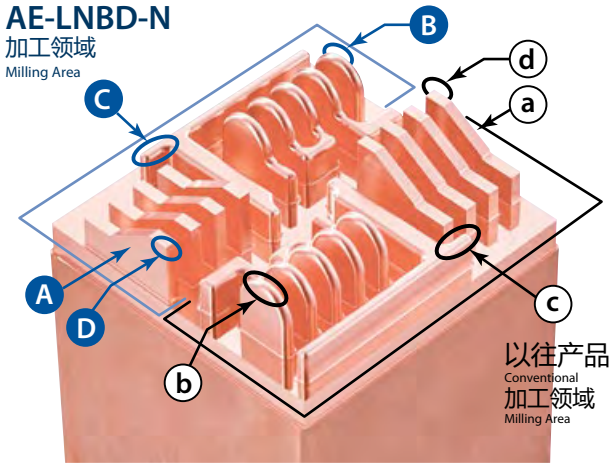
Machine : Vertical Machining Center

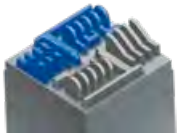
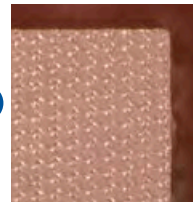
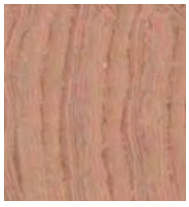
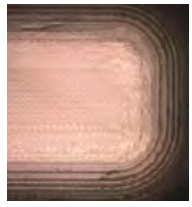
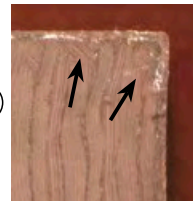
切削油剂：MQL※

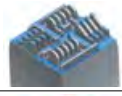
Coolant

※加工视频拍摄原因，使用MQL
MQL is used for filming purposes

扫一扫
观看加工视频
Watch it in action



使用工具 Tool	工序编号 Process	加工面状态 Condition of Machined Surface			毛刺的状态 Condition of Burrs
AE-LNBD-N R1×10×4	⑤ 	A  Ra : 0.1125μm	B 	C 	D 
以往产品 Conventional (Cr系涂层) (Cr-based Coating) R1×10×4	⑥ 	a  Ra : 0.19125μm	b  加工面粗糙 Tear	c  走形 Collapse of Shape	d  毛刺 Burrs

工序编号 Process	加工部位 Milling Part	加工内容 Milling Process	使用工具 Tool	切削速度 Cutting Speed (m/min)	进给速度 Feed (mm/min)	ap (mm)	Pf (mm)
①	全体 Overall 	等高线 Contouring Line 长刃高效率粗加工 Long Flute High Efficiency Roughing	**AE-TL-N** 3×15	**50** (5,300min^{-1})	**600** (0.038mm/t)	**11**	**0.3**
②	全体 Overall 	等高线 Contouring Line 粗加工 Roughing	**AE-LNBD-N** R1×10×4	**105** (16,800min^{-1})	**1,500** (0.045mm/t)	**0.25**	**0.25**
③	平面部 Surface Plane 	正面铣削 Frontal Milling 半粗加工 Semi-roughing	**AE-TL-N** 3×15	**50** (5,300min^{-1})	**400** (0.025mm/t)	**0.1**	**1**
④	全体 Overall 	等高线 Contouring Line 半精加工 Semi-finishing	**AE-LNBD-N** R1×10×4	**105** (16,800min^{-1})	**1,500** (0.045mm/t)	**0.25**	**0.25**
⑤	左侧形状部 Left Shape 	等高线 Contouring Line 高精度精加工 High-precision Finishing	**AE-LNBD-N** R1×10×4	**127** (20,160min^{-1})	**750** (0.019mm/t)	**0.03**	**0.03**
⑥	右侧形状部 Right Shape 	等高线 Contouring Line 高精度精加工 High-precision Finishing	以往产品 Conventional (Cr系涂层) (Cr-based Coating) R1×10×4	**127** (20,160min^{-1})	**750** (0.019mm/t)	**0.03**	**0.03**

与以往产品相比，实现稳定的磨损和加工精度

Achieves consistent tool wear over time and machining accuracy compared to conventional products

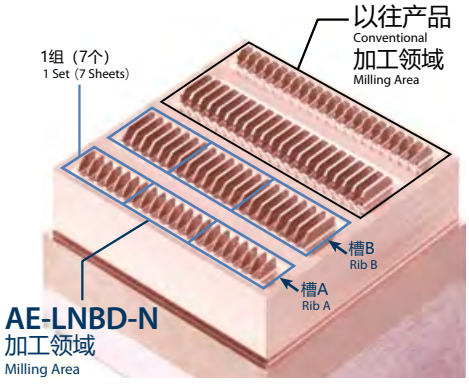
①、②的加工材料在以下切削条件下进行加工。

Work materials of ① and ② are processed under the following cutting conditions

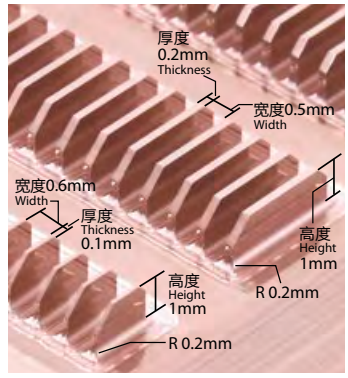
合作：碌々産業株式会社
Cooperation:
ROKU-ROKU SANGYO, LTD.

扫一扫
观看加工视频
Watch it in action

使用工具 Tool	**AE-LNBD-N R0.2×1×4**	以往产品 Conventional (Cr系涂层) Cr-based Coating
加工材料 Work Material	①铜钨合金 Copper Tungsten　②紫铜（C1100） Tough-Pitch Copper	
加工方法 Milling Method	等高线　高精度精加工 Contour and High Precision Finishing	
切削速度 Cutting Speed	**Vc=75 m/min（60,000min^{-1}）**	
进给速度 Feed	**Vf=600 mm/min（0.005mm/t）**	
切削深度 Depth of Cut	**ap＝0.005mm　Pf= 0.005mm**	
切削油剂 Coolant	油性切削油剂 Non-water-soluble	
使用机械 Machine	**Android Ⅱ (HSK-E25)**	



加工尺寸：19×19 Work Size　（加工深度1mm） Milling Depth



放大图 Enlarged Photo

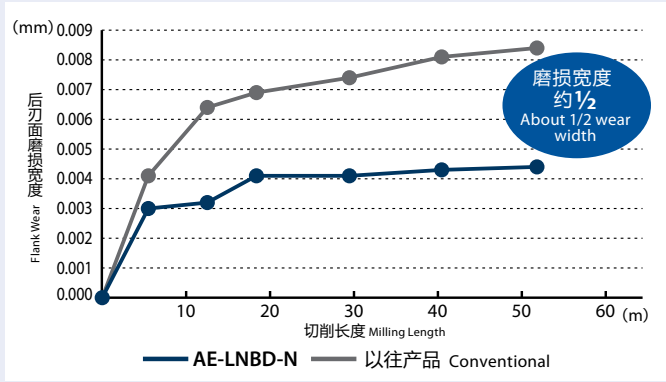
加工形状 Work Shape

①铜钨合金的加工 Machining Copper Tungsten

- 稳定磨损
  Stable wear transition

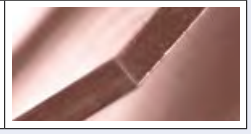
加工52.1m时的磨损状态
Wear comparison after milling **52.1 m**

AE-LNBD-N	以往产品 Conventional
	



②紫铜(C1100) 的加工 Machining Tough-Pitch Copper

- 无毛刺的良好边缘
  Good edge without burrs

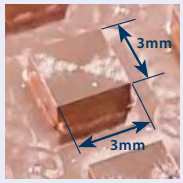
AE-LNBD-N	以往产品 Conventional
	

- 尺寸变化小，加工精度稳定 Stable machining accuracy with little dimensional change

加工试验的评价方法 Evaluation method of cutting test

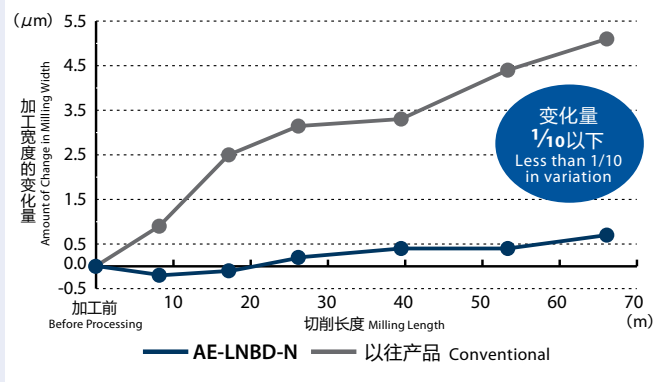
① 加工紫铜的一组槽（7个）
Milling 1 set of tough-pitch copper ribs (7 sheets)

② 每加工1组槽，加工尺寸测量用铜合金并测量尺寸
Dimensional measurement by processing a copper alloy block for dimensional measurement of each set of ribs



尺寸测量用铜合金形状
Block of copper alloy for dimensional measurement

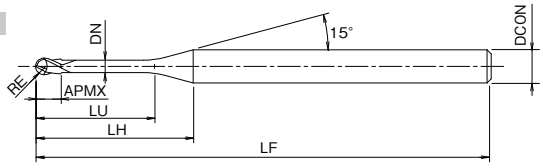
1组槽的切削长度 Cutting length of 1 set of ribs	
槽A Rib A	槽B Rib B
	
6.2 m/1组 set	11.1m/1组 set



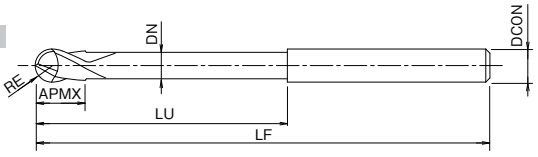
AE-LNBD-N

CARBIDE | DLC-IGUSS | R ±0.002 (RE≦0.2) | R ±0.003 (0.2<RE≦1.5) | R ±0.004 (1.5<RE) | SHANK h4 | SHRINK FIT | 30° | SPEED FEED P9~P10

Type1



Type2



涂层可能会有颜色不均的情况，但这并不影响刀具的性能。
End mills may have some discoloration, but it does not cause any performance problems.

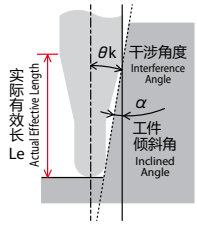
单位:mm Unit:mm

商品号 EDP No.	球半径×颈长×柄径 RE×LU×DCON	全长 LF	刃长 APMX	LH	颈径 DN	干涉角度 θk	相对于工件倾斜角α的实际有效长Le 注1 Effective length by inclined angles 0.5°	1°	1.5°	2°	3°	形状 Type	库存 Stock	
3056370	R0.05 × 0.3 ×4	45	0.08	7.6	0.09	14.52°	0.3	0.31	0.32	0.33	0.36	1	A	●
3056371	R0.05 × 0.5 ×4			7.8		14.07°	0.53	0.56	0.59	0.62	0.67			●
3056372	R0.075 × 0.3 ×4	45	0.12	7.5	0.135	14.55°	0.3	0.31	0.32	0.33	0.35	1	A	●
3056373	R0.075 × 0.5 ×4			7.7		14.12°	0.52	0.55	0.58	0.6	0.65			●
3056374	R0.075 × 1 ×4			8.2		13.29°	1.05	1.1	1.14	1.18	1.27			●
3056375	R0.1 × 0.3 ×4	45	0.16	7.4	0.19	14.59°	0.3	0.31	0.32	0.33	0.34	1	A	●
3056376	R0.1 × 0.5 ×4			7.6		14.12°	0.53	0.56	0.58	0.61	0.66			●
3056377	R0.1 × 1 ×4			8.1		13.28°	1.06	1.11	1.15	1.19	1.28			●
3056378	R0.1 × 1.5 ×4			8.6		12.53°	1.58	1.65	1.7	1.76	1.9			●
3056379	R0.15 × 0.6 ×4	45	0.24	7.5	0.285	14.02°	0.63	0.65	0.68	0.7	0.75	1	A	●
3056380	R0.15 × 1 ×4			7.9		13.33°	1.05	1.09	1.13	1.17	1.25			●
3056381	R0.15 × 1.5 ×4			8.4		12.56°	1.57	1.63	1.68	1.74	1.87			●
3056382	R0.15 × 2 ×4			8.9		11.87°	2.09	2.16	2.24	2.32	2.49			●
3056383	R0.2 × 1 ×4	45	0.3	7.7	0.38	13.38°	1.04	1.08	1.11	1.15	1.23	1	A	●
3056384	R0.2 × 2 ×4			8.7		11.87°	2.08	2.15	2.22	2.3	2.47			●
3056385	R0.2 × 3 ×4			9.7		10.66°	3.12	3.22	3.33	3.45	3.71			●
3056386	R0.2 × 4 ×4			10.7		9.68°	4.15	4.29	4.44	4.6	4.95			●
3056387	R0.25 × 1 ×4	45	0.4	7.6	0.475	13.43°	1.03	1.07	1.1	1.13	1.2	1	A	●
3056388	R0.25 × 2 ×4			8.6		11.87°	2.07	2.14	2.21	2.28	2.45			●
3056389	R0.25 × 3 ×4			9.6		10.63°	3.11	3.21	3.32	3.43	3.69			●
3056390	R0.25 × 4 ×4			10.6		9.63°	4.14	4.28	4.42	4.58	4.93			●
3056391	R0.25 × 5 ×4			11.6		8.79°	5.18	5.35	5.53	5.73	6.18			●
3056392	R0.3 × 1 ×4	45	0.5	7.3	0.55	13.5°	1.02	1.05	1.07	1.1	1.17	1	A	●
3056393	R0.3 × 2 ×4			8.3		11.89°	2.06	2.12	2.18	2.25	2.41			●
3056394	R0.3 × 3 ×4			9.3		10.62°	3.09	3.19	3.29	3.4	3.66			●
3056395	R0.3 × 4 ×4			10.3		9.59°	4.12	4.26	4.4	4.55	4.9			●
3056396	R0.3 × 5 ×4			11.3		8.74°	5.16	5.33	5.51	5.7	6.14			●
3056397	R0.3 × 6 ×4			12.3		8.02°	6.19	6.4	6.62	6.85	7.39			●
3056398	R0.4 × 2 ×4	45	0.6	8	0.75	11.87°	2.05	2.11	2.17	2.24	2.39	1	A	●
3056399	R0.4 × 3 ×4			9.1		10.53°	3.09	3.18	3.28	3.39	3.63			●
3056400	R0.4 × 4 ×4			10		9.46°	4.12	4.25	4.39	4.54	4.88			●
3056401	R0.4 × 6 ×4			12		7.86°	6.19	6.39	6.61	6.84	7.36			●
3056402	R0.4 × 8 ×4			14		6.72°	8.25	8.53	8.82	9.14	9.85			●

・标识说明请参考p.8。 See p.8 for explanation of icons.

● =标准库存品
● =Standard stock item

注 1：相对于工件倾斜角α的实际有效长Le 栏中，如果无数值时表示加工时不存在干涉
Note：Ifthereisnovalueintheactualeffectivelength(Lecolumn)fortheworkgradient angle α , it indicates no interference.



NEXT

■ 标识种类 Guide for Icons

1 材质 Tool Materials

CARBIDE 硬质合金 Tungsten Carbide

2 表面处理 Surface Treatment

DLC-IGUSS DLC-IGUSS 涂层 DLC-IGUSS Coating

3 R容许差 Tolerance of Radius

R ± 0.002 表示铣刀的R容许差 Identifies the tolerance of the radius for end mills

4 外径的容许差 Tolerance for milling diameter

表示铣刀的外径 Tolerance for milling diameter

5 柄部 Shank

SHANK h4 表示柄部精度 Tolerance for Shank Diameter

SHRINK FIT 也推荐热缩刀柄 Suitable for the shrink holder system

6 螺旋角 Helix Angle

30° 表示铣刀排屑槽的螺旋角 Helix angle of flute for end mills

7 切削条件 Cutting Conditions

SPEED FEED 表示切削条件基准表所在页码 Indicates page number for cutting conditions

FROM

单位:mm Unit:mm

商品号 EDP No.	球半径×颈长×柄径 RE×LU×DCON	全长 LF	刃长 APMX	LH	颈径 DN	干涉角度 θk	相对于工件倾斜角α的实际有效长Le 注1 Effective length by inclined angles 0.5°	1°	1.5°	2°	3°	形状 Type	库存 Stock	
3056403	R0.5 × 2 ×4	45	0.8	7.6	0.95	11.85°	2.05	2.1	2.16	2.22	2.37	1	A	●
3056404	R0.5 × 3 ×4			8.6		10.44°	3.08	3.17	3.27	3.37	3.61			●
3056405	R0.5 × 4 ×4			9.6		9.32°	4.12	4.24	4.38	4.52	4.85			●
3056406	R0.5 × 5 ×4			10.6		8.42°	5.15	5.31	5.49	5.67	6.1			●
3056407	R0.5 × 6 ×4			11.6		7.68°	6.18	6.38	6.59	6.82	7.34			●
3056408	R0.5 × 8 ×4			13.6		6.52°	8.25	8.52	8.81	9.12	9.83			●
3056409	R0.5 ×10 ×4			15.6		5.67°	10.32	10.66	11.03	11.42	12.31			●
3056410	R0.5 ×12 ×4			17.6		5.01°	12.39	12.8	13.24	13.72	14.8			●
3056411	R0.75 × 4 ×4	45	1.2	8.8	1.45	8.8°	4.18	4.33	4.46	4.6	4.92	1	A	●
3056412	R0.75 × 6 ×4			10.8		7.09°	6.27	6.47	6.68	6.9	7.4			●
3056413	R0.75 ×12 ×4	55		16.8		4.46°	12.48	12.89	13.33	13.8	14.86			●
3056414	R0.75 ×18 ×4			22.8		3.25°	18.68	19.31	19.98	20.7	22.32			●
3056415	R1 × 4 ×4	50	1.6	8.2	1.95	7.88°	4.22	4.44	4.65	4.86	5.26	1	A	●
3056416	R1 × 6 ×4			10.2		6.2°	6.35	6.67	6.96	7.23	7.75			●
3056417	R1 × 8 ×4			12.2		5.1°	8.47	8.87	9.22	9.54	10.24			●
3056418	R1 ×10 ×4			14.2		4.34°	10.58	11.05	11.45	11.84	12.73			●
3056419	R1 ×12 ×4			16.2		3.77°	12.68	13.21	13.67	14.14	15.21			●
3056420	R1 ×14 ×4			18.2		3.33°	14.78	15.36	15.88	16.44	17.7			●
3056421	R1 ×16 ×4			20.2		2.99°	16.87	17.5	18.1	18.74	—			●
3056422	R1 ×20 ×4	60		24.2		2.47°	21.04	21.78	22.53	23.34	—			●
3056423	R1 ×25 ×4			29.2		2.04°	26.24	27.13	28.07	29.09	—			●
3056424	R1.5 ×10 ×6	55	2.4	15.8	2.85	5.95°	10.44	10.83	11.18	11.55	12.37	1	A	●
3056425	R1.5 ×12 ×6			17.8		5.23°	12.53	12.98	13.4	13.85	14.85			●
3056426	R1.5 ×14 ×6			19.8		4.67°	14.62	15.12	15.62	16.15	17.34			●
3056427	R1.5 ×16 ×6			21.8		4.21°	16.7	17.26	17.83	18.45	19.83			●
3056428	R1.5 ×20 ×6			25.8		3.53°	20.85	21.54	22.27	23.05	24.8			●
3056429	R1.5 ×25 ×6	65		30.8		2.93°	26.03	26.89	27.81	28.8	—			●
3056430	R1.5 ×30 ×6			35.8		2.5°	31.2	32.24	33.35	34.54	—			●
3056431	R2 ×10 ×6	60	3.2	14	3.85	4.75°	10.42	10.79	11.13	11.47	12.25	1	A	●
3056432	R2 ×15 ×6			19		3.37°	15.64	16.16	16.67	17.22	18.47			●
3056433	R2 ×20 ×6	65		24		2.61°	20.84	21.51	22.21	22.97	—			●
3056434	R2 ×25 ×6			29		2.13°	26.02	26.85	27.75	28.72	—			●
3056435	R2 ×30 ×6	80		34		1.79°	31.18	32.2	33.3	—	—			●
3056436	R2 ×40 ×6			44		1.37°	41.52	42.9	—	—	—			●
3056437	R3 ×10 ×6	70	4.8	—	5.85	—	—	—	—	—	—	2	A	●
3056438	R3 ×15 ×6			—		—	—	—	—	—	—			●
3056439	R3 ×20 ×6			—		—	—	—	—	—	—			●
3056440	R3 ×30 ×6	90		—		—	—	—	—	—	—			●
3056441	R3 ×50 ×6			—		—	—	—	—	—	—			●

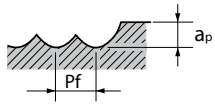
●＝标准库存品 ●=Standard stock item

AE-LNBD-N 切削条件基准表 Cutting Condition

⚠ 加工时产生的火花以及破损造成的发热现象有导致火灾的危险。
请做好防火措施。

Caution : Sparks generated during operation or heat caused by tool breakage can cause fire.
Be sure to use all proper fire-prevention measures.

加工材料 Work Material		铜 Copper (C1020,C1100)				铜钨合金 Copper Tungsten (W70% - Cu30%)			
RE	颈长 LU (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	切削深度 (mm) Depth of cut		转速 Speed (min^{-1})	进给速度 Feed (mm/min)	切削深度 (mm) Depth of cut	
				ap	Pf			ap	Pf
R0.05	0.3	38,400	225	0.005	0.01	32,000	120	0.005	0.008
	0.5	38,400	180	0.005	0.01	32,000	96	0.005	0.008
R0.075	0.3	38,400	257	0.008	0.02	32,000	137	0.008	0.015
	0.5	38,400	225	0.008	0.02	32,000	120	0.008	0.021
	1	38,400	180	0.005	0.01	32,000	96	0.005	0.011
R0.1	0.3	38,400	450	0.02	0.04	32,000	240	0.02	0.03
	0.5	38,400	450	0.02	0.04	32,000	240	0.02	0.03
	1	38,400	225	0.02	0.04	32,000	120	0.02	0.03
	1.5	38,400	225	0.02	0.04	32,000	120	0.02	0.03
R0.15	0.6	38,400	900	0.02	0.06	32,000	480	0.02	0.045
	1	38,400	675	0.02	0.06	32,000	360	0.02	0.045
	1.5	38,400	675	0.02	0.06	32,000	360	0.02	0.045
	2	38,400	675	0.02	0.06	32,000	360	0.02	0.045
R0.2	1	38,400	900	0.025	0.1	32,000	480	0.025	0.075
	2	32,400	675	0.025	0.1	27,000	360	0.025	0.075
	3	32,400	675	0.025	0.1	27,000	360	0.025	0.075
	4	32,400	675	0.01	0.06	27,000	360	0.01	0.045
R0.25	1	38,400	1,125	0.04	0.1	32,000	600	0.04	0.075
	2	38,400	900	0.04	0.1	32,000	480	0.04	0.075
	3	32,400	675	0.04	0.1	27,000	360	0.04	0.075
	4	32,400	675	0.04	0.1	27,000	360	0.04	0.075
	5	25,200	450	0.04	0.1	21,000	240	0.04	0.075
R0.3	1	38,400	2,250	0.09	0.12	32,000	1,440	0.08	0.12
	2	38,400	1,688	0.09	0.12	32,000	1,080	0.08	0.12
	3	36,000	938	0.09	0.12	30,000	600	0.08	0.12
	4	36,000	938	0.09	0.12	30,000	600	0.08	0.12
	5	36,000	938	0.09	0.12	30,000	600	0.08	0.12
	6	30,000	563	0.09	0.12	25,000	360	0.08	0.12
R0.4	2	32,400	1,688	0.12	0.16	27,000	1,080	0.11	0.16
	3	32,400	1,688	0.12	0.16	27,000	1,080	0.11	0.16
	4	32,400	1,688	0.12	0.16	27,000	1,080	0.11	0.16
	6	28,800	938	0.12	0.12	24,000	600	0.11	0.12
	8	26,400	563	0.12	0.12	22,000	360	0.11	0.12



1. 请使用刚性较高的机床和刀柄。
2. 请根据切削深度、机械刚性等使用情况，适当调整转速和进给速度。
3. 请使用水溶性切削油剂。
4. 重视加工表面、精度时，请使用油性切削油剂。请根据需求调整切削深度和进给速度。
5. 请务必使用切削油剂制造商推荐的切削油剂。可能会导致加工工件变色。

NEXT

FROM

加工材料 Work Material		铜 Copper (C1020,C1100)				铜钨合金 Copper Tungsten (W70% - Cu30%)			
RE	颈长 LU (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	切削深度 (mm) Depth of cut		转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap	Pf
				ap	Pf				
R0.5	2	33,600	1,875	0.15	0.2	28,000	1,200	0.14	0.2
	3	33,600	1,875	0.15	0.2	28,000	1,200	0.14	0.2
	4	33,600	1,875	0.15	0.2	28,000	1,200	0.14	0.2
	5	25,200	1,125	0.15	0.2	21,000	720	0.14	0.2
	6	25,200	1,125	0.15	0.2	21,000	720	0.14	0.2
	8	25,200	1,125	0.15	0.15	21,000	720	0.14	0.15
	10	21,600	750	0.12	0.12	18,000	480	0.11	0.12
	12	21,600	750	0.12	0.12	18,000	480	0.11	0.12
R0.75	4	24,000	2,250	0.24	0.3	20,000	1,440	0.22	0.3
	6	21,600	1,875	0.24	0.3	18,000	1,200	0.22	0.3
	12	20,400	1,125	0.24	0.24	17,000	720	0.22	0.24
	18	15,600	750	0.18	0.18	13,000	480	0.16	0.18
R1	4	19,800	2,625	0.3	0.56	16,500	1,680	0.27	0.56
	6	19,800	2,625	0.3	0.56	16,500	1,680	0.27	0.56
	8	19,800	2,625	0.3	0.56	16,500	1,680	0.27	0.56
	10	16,800	1,875	0.3	0.56	14,000	1,200	0.27	0.56
	12	16,800	1,875	0.3	0.56	14,000	1,200	0.27	0.56
	14	16,800	1,875	0.3	0.56	14,000	1,200	0.27	0.56
	16	16,800	1,875	0.3	0.42	14,000	1,200	0.27	0.42
	20	13,200	938	0.3	0.42	11,000	600	0.27	0.42
	25	13,200	938	0.3	0.42	11,000	600	0.27	0.42
R1.5	10	14,400	2,250	0.4	0.84	12,000	1,440	0.36	0.84
	12	12,000	2,250	0.4	0.84	10,000	1,440	0.36	0.84
	14	12,000	2,250	0.4	0.84	10,000	1,440	0.36	0.84
	16	12,000	1,125	0.4	0.84	10,000	720	0.36	0.84
	20	12,000	1,125	0.4	0.84	10,000	720	0.36	0.84
	25	12,000	1,125	0.4	0.84	10,000	720	0.36	0.84
	30	10,800	938	0.4	0.84	9,000	600	0.36	0.84
R2	10	10,800	3,000	1.0	1.3	9,000	1,920	0.9	1.3
	15	10,800	2,250	1.0	1.3	9,000	1,440	0.9	1.3
	20	8,400	1,500	1.0	1.3	7,000	960	0.9	1.3
	25	8,400	1,500	1.0	1.3	7,000	960	0.9	1.3
	30	8,400	1,500	0.8	1.3	7,000	960	0.7	1.3
	40	6,000	938	0.7	1.3	5,000	600	0.6	1.3
R3	10	10,800	3,375	1.2	1.8	9,000	2,160	1.1	1.8
	15	10,800	3,375	1.2	1.8	9,000	2,160	1.1	1.8
	20	8,400	1,875	1.2	1.8	7,000	1,200	1.1	1.8
	30	7,200	1,875	1.2	1.8	6,000	1,200	1.1	1.8
	50	6,000	1,125	0.8	1.8	5,000	720	0.7	1.8

1. Use a rigid and precise machine and holder.
2. Please adjust the speed and feed when the cutting depth is large or when machines with low rigidity are used.
3. Use a water soluble fluid.
4. Use a non-water-soluble cutting fluid if the machined surface and accuracy are of critical importance.
   Adjust the depth of cut and feed rate as necessary.
5. Always use a cutting fluid recommended by the cutting fluid manufacturer as the workpiece may discolor.

高效率精加工用长颈圆弧角型
High-efficiency finishing long neck radius type

AE-CPR-N

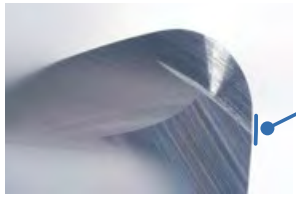
实现高效率·长寿命·高精度加工！
Achieves high efficiency, long tool life and high precision machining!

实现高效率加工的3刃式样※
Achieves high efficiency milling with 3-flute specification*

※外径1 mm以下为2刃
*2-flute specification for outer diameter less than 1 mm

修光刃式样
Flat cutting edge specification

- 实现高精度的加工面品质
  - Achieves higher precision machined surface quality



修光刃
Flat cutting edge

※部分尺寸除外
*Excluding some sizes

优良的刃径精度和圆弧角R精度
Excellent cutting edge diameter accuracy and superior corner radius precision

- 优良的刃径精度
  - Excellent cutting edge diameter accuracy

外径 (DC)　φ1以下 0～-0.006
Up to φ1
φ1以上 0～-0.01
Over φ1

- 优良的圆弧角R精度
  - Superior R precision

全尺寸 ±0.004
All sizes

丰富的产品尺寸
Abundant variations

- 外径0.2mm～6mm和丰富的颈长
  - Available from outer diameter 0.2 mm to 6 mm with a wide variety of neck lengths

Environmental Considerations
环境保护

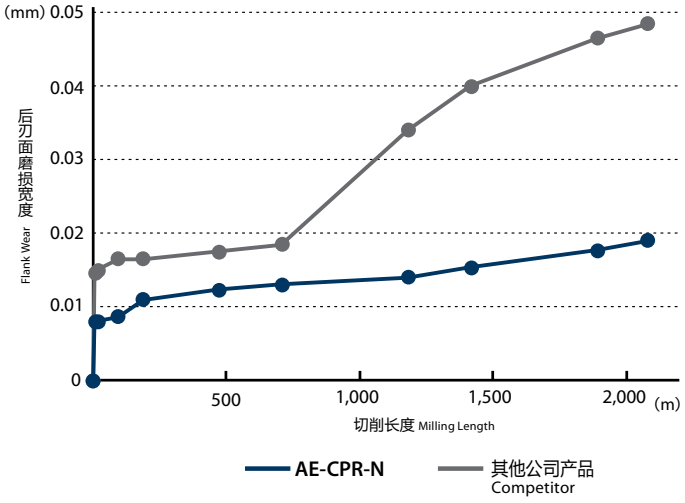
实现高效率·长寿命化
Achieves high efficiency and long tool life

工具的长寿命化可以减少废弃物，从而节约资源。
外径1mm以上为3刃式样，可提高加工效率。
高效率加工缩短了机械运转时间，实现耗电量的减少。

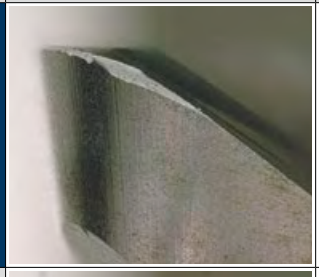
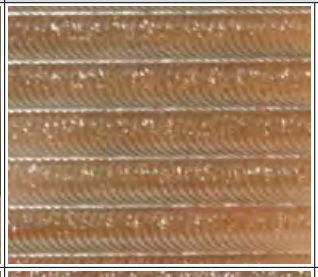
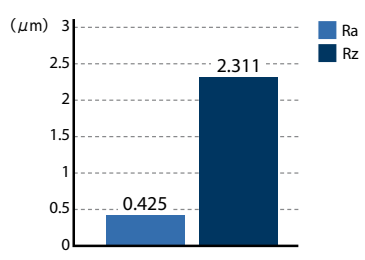
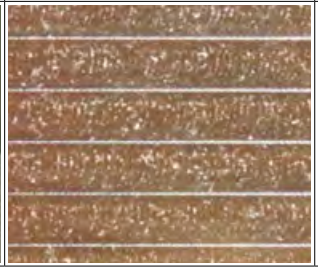
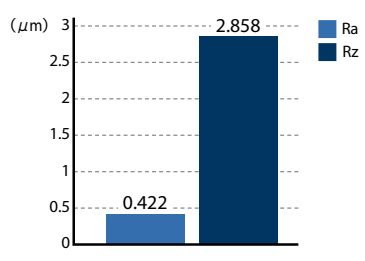
Extension of tool life leads to waste reduction and contributes to resource conservation.
Machining efficiency can be improved with the 3-flute specification for outer diameters of 1 mm or more.
High-efficiency machining shortens machine operating time and reduces power consumption.

3刃式样可高效率加工・长寿命化
3-flute specification enables high-efficiency machining and long tool life

使用工具 Tool	**AE-CPR-N** **ϕ4×R0.5×16** 3刃 3-flute	其他公司产品 2刃 Competitor 2-flute
加工材料 Work Material	**C1100**	
加工方法 Milling Method	正面切削 Frontal Milling	
切削速度 Cutting Speed	**126m/min (10,000min^{-1})**	
进给速度 Feed	**4,200mm/min (0.14mm/t)**	**2,800mm/min (0.14mm/t)**
切削深度 Depth of Cut	**ap=0.3mm ae=2.4mm**	
切削油剂 Coolant	水溶性切削油剂 Water-soluble	
使用机械 Machine	卧式加工中心 (HSK63) Horizontal Machining Center	

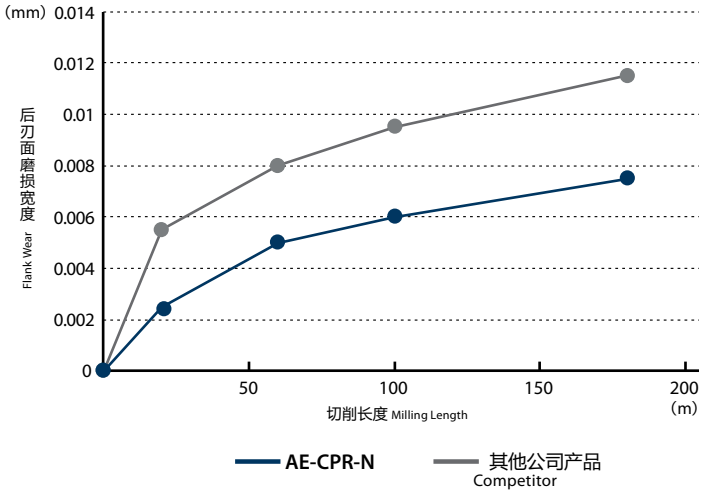


加工2,079m后的刃尖磨损・加工面状态
Wearing condition of the cutting edge after milling 2,079 m

	刃尖的磨损状态 Wearing condition	加工面状态 Machining surface condition	
AE-CPR-N			
其他公司产品 Competitor			

即使φ0.5也能稳定磨损
Stable wear transition even at φ0.5

使用工具 Tool	AE-CPR-N　0.5×R0.1×3
加工材料 Work Material	C1100
加工方法 Milling Method	正面切削 Frontal Milling
切削速度 Cutting Speed	55m/min（35,000min^{-1}）
进给速度 Feed	640mm/min（0.01mm/t）
切削深度 Depth of Cut	ap=0.05mm　ae=0.25mm
切削油剂 Coolant	水溶性切削油剂 Water-soluble
使用机械 Machine	立式加工中心（HSK-E32） Vertical Machining Center



可对应铜电极加工的非铁金属加工用DLC铣刀的介绍
DLC coated end mill lineup for non-ferrous metals compatible with copper electrode applications

扫一扫了解产品详情
Scan code for product details

标准 ー适用于非铁金属加工的标准式样ー
Standard　Standard specification suitable for non-ferrous material processing

DLC-SUPER HARD涂层 DLC-SUPER HARD coating

短刃型 Short
1.5D刃长 AE-TS-N
1.5 × D cutting length

长刃型 Long
3D/5D刃长 AE-TL-N
3 × D / 5 × D cutting length

高 性 能 ー对应多种加工的高性能型ー
High Performance　High performance type that supports a wide range of applications

DLC-IGUSS涂层 DLC-IGUSS coating

短刃型 Short
1.5D刃长 AE-VTS-N
1.5 × D cutting length

深壁加工型 For Deep Side Milling
2.5D刃长 AE-VTFE-N
2.5 × D cutting length

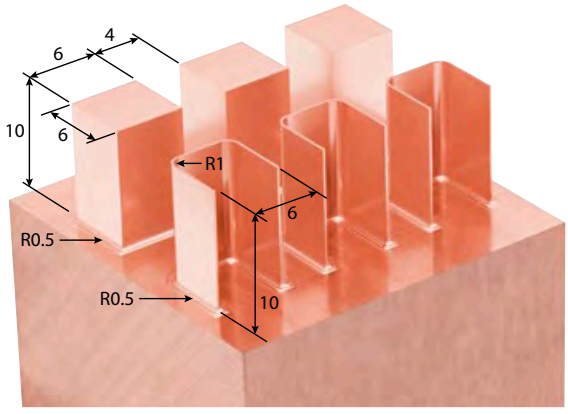
可换头式铣刀 PXM Exchangeable Head End Mill
1D刃长 PXAL
1 × D cutting length

铜电极的高效率・高精度加工
Milling copper electrodes with high efficiency and precision

扫一扫
观看加工视频
Watch it in action

使用工具 Tool	AE-CPR-N 1×R0.2×10	以往产品 2刃* Conventional 2-flute	其他公司产品 2刃 Competitor 2-flute
加工材料 Work Material	紫铜（C1100） Tough-Pitch Copper		
加工方法 Milling Method	等高线　高精度精加工 Contour and High Precision Finishing		
切削速度 Cutting Speed	56.5m/min（18,000min^{-1}）		
进给速度 Feed	660mm/min (0.012mm/t)	360mm/min (0.01mm/t)	430mm/min (0.012mm/t)
切削深度 Depth of Cut	a_p = 0.025mm　a_e = 0.03mm		
切削油剂 Coolant	水溶性切削油剂 Water-soluble		
使用机械 Machine	立式加工中心（HSK-E25） Vertical Machining Center		

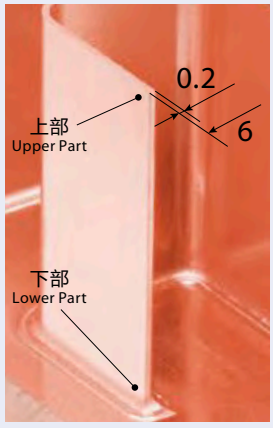
*钢用带涂层硬质合金铣刀 圆弧角型
*Coated carbide end mill for steel (radius type)



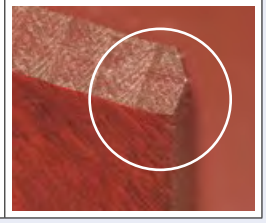
单位:mm　Unit:mm

良好的加工精度和加工形状 Good milling accuracy and good processing shape

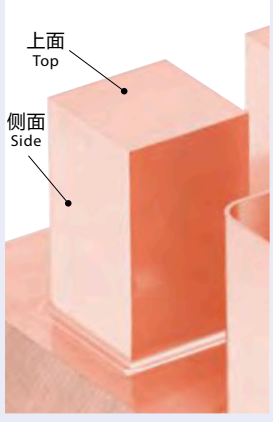
① 壁厚 Rib



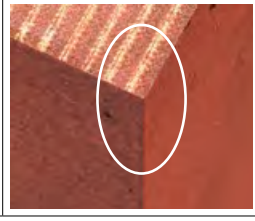
壁厚（目标值：0.2 mm） Rib width (target value: 0.2 mm)

测量位置 Measurement Position	加工面的实测值 Measured value of machined surface		
	AE-CPR-N	以往产品 Conventional	其他公司产品 Competitor
上部 Upper Part	0.2003mm	0.1946mm	0.2138mm
下部 Lower Part	0.2008mm	0.1953mm	0.2128mm
加工面状态 Condition of Machined Surface			

② 凸台 Vertex



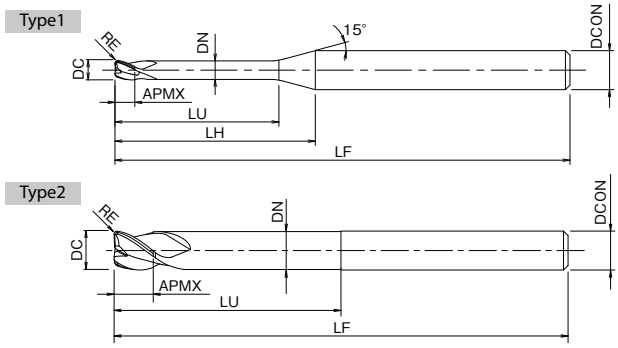
加工面粗糙度 Surface roughness

测量位置 Measurement Position	加工面的实测值 Measured value of machined surface		
	AE-CPR-N	以往产品 Conventional	其他公司产品 Competitor
上面 Top	Ra : 0.052μm Rz : 0.664μm	Ra : 0.075μm Rz : 1.390μm	Ra : 0.075μm Rz : 0.563μm
侧面 Side	Ra : 0.173μm Rz : 1.279μm	Ra : 0.164μm Rz : 1.239μm	Ra : 0.232μm Rz : 1.438μm
加工形状 Processing Shape			
	AE-CPR-N能获得变形较小的形状 The AE-CPR-N exhibited minimal collapse in shape		

AE-CPR-N

CARBIDE | DLC-IGUSS | R ± 0.004 | SHANK h4 | SHRINK FIT | 38° | SPEED FEED P19~P21

DC≦1 0~-0.006
1<DC 0~-0.01



涂层可能会有颜色不均的情况，但这并不影响刀具的性能。
End mills may have some discoloration, but it does not cause any performance problems.

单位:mm Unit:mm

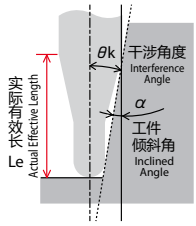
商品号 EDP No.	外径×圆弧半径×颈长 DC×RE×LU	全长 LF	刃长 APMX	LH	颈径 DN	干涉角度 θk	柄径 DCON	刃数 ZEFP	相对于工件倾斜角α的实际有效长Le 注1 Effective length by inclined angles 0.5°	1°	1.5°	2°	3°	形状 Type	库存 Stock	
8557646	0.2 × R0.05 × 0.4	45	0.2	7.5	0.175	14.28°	4	2	0.41	0.43	0.45	0.47	0.51	1	A	●
8557647	0.2 × R0.05 × 0.6			7.7		13.92°			0.62	0.65	0.68	0.7	0.75			●
8557648	0.2 × R0.05 × 1			8.1		13.26°			1.04	1.08	1.12	1.16	1.25			●
8557649	0.2 × R0.05 × 1.5			8.6		12.51°			1.56	1.62	1.68	1.74	1.87			●
8557650	0.3 × R0.05 × 0.6	45	0.3	7.5	0.275	13.9°	4	2	0.62	0.65	0.68	0.7	0.75	1	A	●
8557651	0.3 × R0.05 × 1			7.9		13.22°			1.04	1.08	1.12	1.16	1.25			●
8557652	0.3 × R0.05 × 1.5			8.4		12.45°			1.56	1.62	1.68	1.74	1.87			●
8557653	0.3 × R0.05 × 2			8.9		11.77°			2.08	2.15	2.23	2.31	2.5			●
8557654	0.4 × R0.02 × 0.8	45	0.4	7.5	0.37	13.47°	4	2	0.83	0.86	0.9	0.93	1	1	A	●
8557655	0.4 × R0.02 × 2			8.7		11.68°			2.08	2.15	2.23	2.31	2.5			●
8557656	0.4 × R0.05 × 0.8			7.5		13.52°			0.83	0.86	0.89	0.92	1			●
8557657	0.4 × R0.05 × 1.2			7.9		12.86°			1.25	1.29	1.34	1.38	1.49			●
8557658	0.4 × R0.05 × 2			8.7		11.71°			2.08	2.15	2.22	2.3	2.49			●
8557659	0.4 × R0.05 × 3			9.7		10.53°			3.11	3.22	3.33	3.45	3.73			●
8557660	0.4 × R0.05 × 4			10.7		9.57°			4.14	4.29	4.44	4.6	4.97			●
8557661	0.4 × R0.1 × 0.8			7.5		13.6°			0.83	0.86	0.89	0.92	0.98			●
8557662	0.4 × R0.1 × 1.2			7.9		12.93°			1.24	1.29	1.33	1.38	1.48			●
8557663	0.4 × R0.1 × 2			8.7		11.77°			2.07	2.14	2.22	2.3	2.48			●
8557664	0.4 × R0.1 × 3			9.7		10.58°			3.11	3.21	3.33	3.45	3.72			●
8557665	0.4 × R0.1 × 4			10.7		9.61°			4.14	4.28	4.43	4.6	4.96			●
8557666	0.5 × R0.05 × 1	45	0.5	7.5	0.45	13.16°	4	2	1.03	1.06	1.1	1.14	1.23	1	A	●
8557667	0.5 × R0.05 × 2			8.5		11.65°			2.06	2.13	2.21	2.29	2.47			●
8557668	0.5 × R0.05 × 3			9.5		10.45°			3.1	3.2	3.32	3.44	3.72			●
8557669	0.5 × R0.05 × 4			10.5		9.48°			4.13	4.27	4.43	4.59	4.96			●
8557670	0.5 × R0.05 × 5			11.5		8.67°			5.16	5.34	5.53	5.74	6.2			●
8557671	0.5 × R0.1 × 1			7.5		13.23°			1.03	1.06	1.1	1.13	1.22			●
8557672	0.5 × R0.1 × 2			8.5		11.71°			2.06	2.13	2.2	2.28	2.46			●
8557673	0.5 × R0.1 × 3			9.5		10.5°			3.1	3.2	3.31	3.43	3.7			●
8557674	0.5 × R0.1 × 4			10.5		9.52°			4.13	4.27	4.42	4.58	4.95			●
8557675	0.5 × R0.1 × 5			11.5		8.7°			5.16	5.34	5.53	5.73	6.19			●

・标识说明请参考p.8。 See p.8 for explanation of icons.

●=标准库存品 ●=Standard stock item

NEXT

注 1：相对于工件倾斜角α的实际有效长Le 栏中，如果无数值时表示加工时不存在干涉
Note：If there is no value in the actual e˜ective length (Le column) for the work gradient angle α , it indicates no interference.



FROM

单位:mm Unit:mm

商品号 EDP No.	外径×圆弧半径×颈长 DC×RE×LU	全长 LF	刃长 APMX	LH	颈径 DN	干涉角度 θk	柄径 DCON	刃数 ZEFP	相对于工件倾斜角α的实际有效长Le 注1 Effective length by inclined angles					形状 Type	库存 Stock	
									0.5°	1°	1.5°	2°	3°			
8557676	0.6 × R0.05 × 1.2	45	0.6	7.5	0.55	12.77°	4	2	1.24	1.28	1.32	1.37	1.48	1	A	●
8557677	0.6 × R0.05 × 2			8.3		11.58°			2.06	2.13	2.21	2.29	2.47			●
8557678	0.6 × R0.05 × 4			10.3		9.38°			4.13	4.27	4.43	4.59	4.96			●
8557679	0.6 × R0.05 × 6			12.3		7.87°			6.2	6.41	6.64	6.89	7.45			●
8557680	0.6 × R0.1 × 1.2			7.5		12.84°			1.23	1.27	1.32	1.36	1.47			●
8557681	0.6 × R0.1 × 2			8.3		11.64°			2.06	2.13	2.2	2.28	2.46			●
8557682	0.6 × R0.1 × 3			9.3		10.41°			3.1	3.2	3.31	3.43	3.7			●
8557683	0.6 × R0.1 × 4			10.3		9.42°			4.13	4.27	4.42	4.58	4.95			●
8557684	0.6 × R0.1 × 6			12.3		7.9°			6.2	6.41	6.64	6.88	7.43			●
8557685	0.6 × R0.2 × 1.2			7.5		12.99°			1.23	1.27	1.31	1.35	1.44			●
8557686	0.6 × R0.2 × 4			10.3		9.5°			4.13	4.26	4.41	4.57	4.92			●
8557687	0.8 × R0.05 × 1.6	45	0.8	7.6	0.75	12°	4	2	1.65	1.71	1.77	1.83	1.98	1	A	●
8557688	0.8 × R0.05 × 4			10		9.16°			4.13	4.27	4.43	4.59	4.96			●
8557689	0.8 × R0.05 × 6			12		7.65°			6.2	6.41	6.64	6.89	7.45			●
8557690	0.8 × R0.05 × 8			14		6.56°			8.27	8.55	8.86	9.19	9.93			●
8557691	0.8 × R0.1 × 1.6			7.6		12.07°			1.65	1.7	1.76	1.82	1.96			●
8557692	0.8 × R0.1 × 4			10		9.2°			4.13	4.27	4.42	4.58	4.95			●
8557693	0.8 × R0.1 × 6			12		7.67°			6.2	6.41	6.64	6.88	7.43			●
8557694	0.8 × R0.1 × 8			14		6.58°			8.26	8.55	8.85	9.18	9.92			●
8557695	1 × R0.02 × 2	45	1	7.6	0.95	11.19°	4	3	2.06	2.14	2.21	2.29	2.48	1	A	●
8557696	1 × R0.02 × 3			8.6		9.92°			3.1	3.21	3.32	3.44	3.72			●
8557697	1 × R0.1 × 2			7.6		11.3°			2.06	2.13	2.2	2.28	2.46			●
8557698	1 × R0.1 × 3			8.6		10°			3.1	3.2	3.31	3.43	3.7			●
8557699	1 × R0.1 × 4			9.6		8.97°			4.13	4.27	4.42	4.58	4.95			●
8557700	1 × R0.1 × 5			10.6		8.13°			5.16	5.34	5.53	5.73	6.19			●
8557701	1 × R0.1 × 6			11.6		7.43°			6.2	6.41	6.64	6.88	7.43			●
8557702	1 × R0.1 × 8			13.6		6.34°			8.26	8.55	8.85	9.18	9.92			●
8557703	1 × R0.1 ×10			15.6		5.53°			10.33	10.69	11.07	11.48	12.41			●
8557704	1 × R0.2 × 2			7.6		11.43°			2.06	2.12	2.19	2.27	2.44			●
8557705	1 × R0.2 × 3			8.6		10.11°			3.09	3.19	3.3	3.42	3.68			●
8557706	1 × R0.2 × 4			9.6		9.06°			4.13	4.26	4.41	4.57	4.92			●
8557707	1 × R0.2 × 5			10.6		8.2°			5.16	5.33	5.52	5.72	6.17			●
8557708	1 × R0.2 × 6			11.6		7.49°			6.19	6.4	6.63	6.87	7.41			●
8557709	1 × R0.2 × 8			13.6		6.39°			8.26	8.54	8.84	9.17	9.9			●
8557710	1 × R0.2 ×10			15.6		5.56°			10.33	10.68	11.06	11.47	12.38			●
8557711	1 × R0.3 × 2			7.6		11.57°			2.06	2.12	2.18	2.25	2.41			●
8557712	1 × R0.3 × 3			8.6		10.22°			3.09	3.19	3.29	3.4	3.66			●

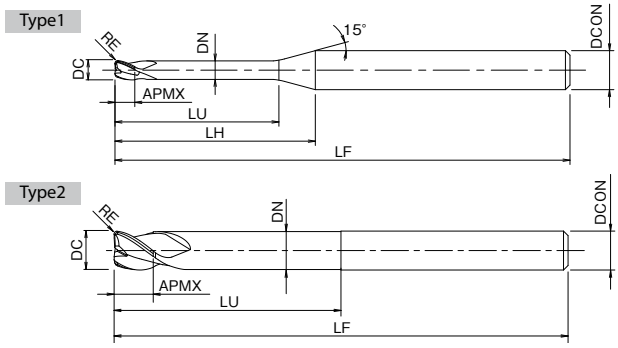
●＝标准库存品 ●=Standard stock item

NEXT

AE-CPR-N

CARBIDE | DLC-IGUSS | R ± 0.004 | SHANK h4 | SHRINK FIT | 38° | SPEED FEED P19~P21

DC≦1 0~-0.006
1<DC 0~-0.01



涂层可能会有颜色不均的情况，但这并不影响刀具的性能。
End mills may have some discoloration, but it does not cause any performance problems.

FROM

单位:mm Unit:mm

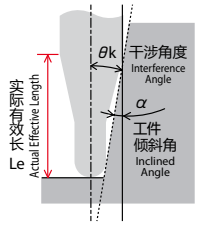
商品号 EDP No.	外径×圆弧半径×颈长 DC×RE×LU	全长 LF	刃长 APMX	LH	颈径 DN	干涉角度 θk	柄径 DCON	刃数 ZEFP	相对于工件倾斜角α的实际有效长Le 注1 Effective length by inclined angles 0.5°	1°	1.5°	2°	3°	形状 Type	库存 Stock	
8557713	1.5 × R0.3 × 3	45	1.5	7.8	1.45	9.48°	4	3	3.15	3.28	3.4	3.52	3.78	1	A	●
8557714	1.5 × R0.5 × 3			7.8		9.71°			3.14	3.27	3.38	3.49	3.73			●
8557715	1.5 × R0.5 ×10			14.8		5°			10.42	10.77	11.14	11.54	12.43			●
8557716	1.5 × R0.5 ×12	60		16.8		4.39°			12.49	12.91	13.35	13.84	14.92			●
8557717	1.5 × R0.5 ×20			24.8		2.95°			20.76	21.46	22.22	23.04	—			●
8557718	2 × R0.1 × 4	50	2	8.2	1.95	7.07°	4	3	4.28	4.55	4.79	5.03	5.48	1	A	●
8557719	2 × R0.1 × 6			10.2		5.68°			6.41	6.76	7.08	7.37	7.97			●
8557720	2 × R0.1 × 8			12.2		4.74°			8.52	8.95	9.32	9.67	10.45			●
8557721	2 × R0.1 ×10			14.2		4.07°			10.63	11.12	11.54	11.97	12.94			●
8557722	2 × R0.1 ×15			19.2		3.01°			15.87	16.49	17.09	17.72	19.15			●
8557723	2 × R0.1 ×16	60		20.2		2.86°			16.91	17.56	18.19	18.87	—			●
8557724	2 × R0.1 ×20			24.2		2.38°			21.08	21.84	22.63	23.47	—			●
8557725	2 × R0.2 × 4	50		8.2		7.15°			4.28	4.53	4.78	5.01	5.46			●
8557726	2 × R0.2 ×10			14.2		4.1°			10.62	11.11	11.53	11.96	12.91			●
8557727	2 × R0.2 ×16	60		20.2		2.87°			16.91	17.56	18.18	18.86	—			●
8557728	2 × R0.2 ×20			24.2		2.39°			21.08	21.84	22.62	23.46	—			●
8557729	2 × R0.3 × 4	50		8.2		7.24°			4.27	4.52	4.76	4.99	5.43			●
8557730	2 × R0.3 × 6			10.2		5.79°			6.39	6.74	7.05	7.34	7.92			●
8557731	2 × R0.3 × 8			12.2		4.82°			8.51	8.93	9.3	9.64	10.4			●
8557732	2 × R0.3 ×10			14.2		4.13°			10.62	11.1	11.52	11.94	12.89			●
8557733	2 × R0.3 ×15			19.2		3.04°			15.86	16.48	17.06	17.69	19.11			●
8557734	2 × R0.3 ×16	60		20.2		2.89°			16.9	17.55	18.17	18.84	—			●
8557735	2 × R0.3 ×20			24.2		2.4°			21.07	21.83	22.61	23.44	—			●
8557736	2.5 × R0.5 × 5	55	2.5	8.1	2.4	5.61°	4	3	5.28	5.54	5.79	6.03	6.49	1	A	●
8557737	2.5 × R0.5 ×20			23.1		1.9°			20.97	21.7	22.46	—	—			●
8557738	3 × R0.2 × 6	55	3	11.8	2.85	7.34°	6	3	6.31	6.6	6.88	7.14	7.7	1	A	●
8557739	3 × R0.2 ×12			17.8		4.86°			12.59	13.07	13.54	14.04	15.16			●
8557740	3 × R0.2 ×18			23.8		3.64°			18.83	19.49	20.19	20.94	22.62			●
8557741	3 × R0.2 ×21	70		26.8		3.23°			21.94	22.7	23.51	24.39	26.35			●
8557742	3 × R0.2 ×24			29.8		2.9°			25.04	25.91	26.84	27.84	—			●
8557743	3 × R0.3 × 6	55		11.8		7.4°			6.31	6.6	6.87	7.12	7.68			●
8557744	3 × R0.3 × 8			13.8		6.32°			8.4	8.77	9.09	9.42	10.17			●
8557745	3 × R0.3 ×12			17.8		4.89°			12.58	13.07	13.53	14.02	15.14			●
8557746	3 × R0.3 ×20			25.8		3.37°			20.9	21.62	22.39	23.22	25.08			●
8557747	3 × R0.5 × 6			11.8		7.52°			6.3	6.58	6.84	7.1	7.63			●
8557748	3 × R0.5 ×12			17.8		4.94°			12.57	13.05	13.51	13.99	15.09			●
8557749	3 × R0.5 ×15			20.8		4.22°			15.7	16.26	16.83	17.44	18.82			●
8557750	3 × R0.5 ×18			23.8		3.68°			18.82	19.47	20.16	20.89	22.55			●
8557751	3 × R0.5 ×21	70		26.8		3.26°			21.93	22.68	23.48	24.34	26.28			●
8557752	3 × R0.5 ×25			30.8		2.83°			26.07	26.96	27.91	28.94	—			●
8557753	3 × R0.5 ×30			35.8		2.43°			31.24	32.31	33.46	34.69	—			●

・标识说明请参考p.8。 See p.8 for explanation of icons.

● =标准库存品 ● =Standard stock item

NEXT

注 1：相对于工件倾斜角α的实际有效长Le 栏中，如果无数值时表示加工时不存在干涉
Note：If there is no value in the actual e˜ective length (Le column) for the work gradient angle α , it indicates no interference.



FROM

单位:mm　Unit:mm

商品号 EDP No.	外径×圆弧半径×颈长 DC×RE×LU	全长 LF	刃长 APMX	LH	颈径 DN	干涉角度 θk	柄径 DCON	刃数 ZEFP	相对于工件倾斜角α的实际有效长Le 注1 Effective length by inclined angles 0.5°	1°	1.5°	2°	3°	形状 Type	库存 Stock	
8557754	4 × R0.2 × 8	60	4	12	3.85	4.86°	6	3	8.41	8.77	9.11	9.44	10.19	1	A	●
8557755	4 × R0.2 ×16			20		2.9°			16.75	17.35	17.97	18.64	—			●
8557756	4 × R0.2 ×20			24		2.41°			20.9	21.63	22.4	23.24	—			●
8557757	4 × R0.2 ×24			28		2.07°			25.04	25.91	26.84	27.84	—			●
8557758	4 × R0.2 ×28	75		32		1.81°			29.18	30.19	31.27	—	—			●
8557759	4 × R0.2 ×32			36		1.61°			33.31	34.47	35.7	—	—			●
8557760	4 × R0.3 × 8	60		12		4.9°			8.4	8.77	9.09	9.42	10.17			●
8557761	4 × R0.3 ×20			24		2.42°			20.9	21.62	22.39	23.22	—			●
8557762	4 × R0.5 × 8			12		4.98°			8.39	8.75	9.07	9.4	10.12			●
8557763	4 × R0.5 ×12			16		3.7°			12.57	13.05	13.51	13.99	15.09			●
8557764	4 × R0.5 ×16			20		2.94°			16.74	17.33	17.94	18.59	—			●
8557765	4 × R0.5 ×20			24		2.44°			20.89	21.61	22.37	23.19	—			●
8557766	4 × R0.5 ×24			28		2.09°			25.03	25.89	26.81	27.79	—			●
8557767	4 × R0.5 ×25			29		2.02°			26.07	26.96	27.91	28.94	—			●
8557768	4 × R0.5 ×28	75		32		1.82°			29.17	30.17	31.24	—	—			●
8557769	4 × R0.5 ×32			36		1.62°			33.3	34.45	35.67	—	—			●
8557770	4 × R1 × 8	60		12		5.19°			8.37	8.71	9.02	9.32	10			●
8557771	4 × R1 ×16			20		3.02°			16.72	17.3	17.89	18.52	19.95			●
8557772	4 × R1 ×24			28		2.13°			25.02	25.85	26.75	27.72	—			●
8557773	4 × R1 ×28	75		32		1.85°			29.15	30.13	31.19	—	—			●
8557774	4 × R1 ×32			36		1.64°			33.29	34.41	35.62	—	—			●
8557775	6 × R0.1 ×12	60	6	—	5.85	—	6	3	—	—	—	—	—	2	A	●
8557776	6 × R0.1 ×24			—		—			—	—	—	—	—			●
8557777	6 × R0.2 ×12			—		—			—	—	—	—	—			●
8557778	6 × R0.2 ×24			—		—			—	—	—	—	—			●
8557779	6 × R0.2 ×32	80		—		—			—	—	—	—	—			●
8557780	6 × R0.2 ×48			—		—			—	—	—	—	—			●
8557781	6 × R0.5 ×12	60		—		—			—	—	—	—	—			●
8557782	6 × R0.5 ×24			—		—			—	—	—	—	—			●
8557783	6 × R0.5 ×30			—		—			—	—	—	—	—			●
8557784	6 × R0.5 ×32	80		—		—			—	—	—	—	—			●
8557785	6 × R0.5 ×48			—		—			—	—	—	—	—			●
8557786	6 × R1 ×12	60		—		—			—	—	—	—	—			●
8557787	6 × R1 ×24			—		—			—	—	—	—	—			●
8557788	6 × R1 ×32	80		—		—			—	—	—	—	—			●
8557789	6 × R1 ×48			—		—			—	—	—	—	—			●

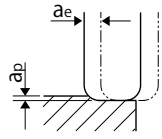
● = 标准库存品 ● =Standard stock item

AE-CPR-N 切削条件基准表 Cutting Condition

⚠ 加工时产生的火花以及破损造成的发热现象有导致火灾的危险。
请做好防火措施。

Caution : Sparks generated during operation or heat caused by tool breakage can cause fire.
Be sure to use all proper fire-prevention measures.

加工材料 Work Material			铜 Copper (C1020,C1100)				铜钨合金 Copper Tungsten (W70% - Cu30%)			
外径 DC	RE	颈长 LU (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap (mm)	ae (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap (mm)	ae (mm)
0.2	R0.05	0.4	40,000	400	0.03	0.06	40,000	360	0.024	0.06
		0.6	40,000	360	0.024	0.06	40,000	320	0.019	0.06
		1	40,000	280	0.019	0.06	40,000	250	0.015	0.06
		1.5	40,000	180	0.015	0.06	40,000	160	0.012	0.06
0.3	R0.05	0.6	40,000	480	0.03	0.12	40,000	430	0.024	0.12
		1	40,000	430	0.023	0.12	40,000	380	0.018	0.12
		1.5	40,000	360	0.019	0.12	40,000	320	0.015	0.12
		2	40,000	290	0.016	0.12	40,000	260	0.013	0.12
0.4	R0.02	0.8	40,000	640	0.01	0.22	40,000	580	0.008	0.22
		2	40,000	520	0.006	0.22	35,000	410	0.005	0.22
	R0.05	0.8	40,000	640	0.03	0.18	40,000	580	0.024	0.18
		1.2	40,000	600	0.024	0.18	40,000	540	0.019	0.18
		2	40,000	520	0.019	0.18	35,000	410	0.015	0.18
		3	30,000	370	0.015	0.18	25,000	300	0.012	0.18
		4	25,000	240	0.013	0.18	20,000	190	0.01	0.18
	R0.1	0.8	40,000	640	0.06	0.12	40,000	580	0.048	0.12
		1.2	40,000	600	0.049	0.12	40,000	540	0.039	0.12
		2	40,000	520	0.038	0.12	35,000	410	0.03	0.12
		3	30,000	370	0.031	0.12	25,000	300	0.025	0.12
		4	25,000	240	0.027	0.12	20,000	190	0.022	0.12
0.5	R0.05	1	40,000	880	0.03	0.24	40,000	790	0.024	0.24
		2	40,000	770	0.023	0.24	35,000	690	0.018	0.24
		3	35,000	650	0.019	0.24	30,000	510	0.015	0.24
		4	30,000	540	0.017	0.24	25,000	420	0.014	0.24
		5	25,000	370	0.016	0.24	20,000	300	0.013	0.24
	R0.1	1	40,000	880	0.06	0.18	40,000	790	0.048	0.18
		2	40,000	770	0.045	0.18	35,000	690	0.036	0.18
		3	35,000	650	0.039	0.18	30,000	510	0.031	0.18
		4	30,000	540	0.034	0.18	25,000	420	0.027	0.18
		5	25,000	370	0.032	0.18	20,000	300	0.026	0.18
0.6	R0.05	1.2	40,000	1,120	0.03	0.3	35,000	880	0.024	0.3
		2	37,000	1,030	0.024	0.3	35,000	810	0.019	0.3
		4	29,000	710	0.019	0.3	26,000	580	0.015	0.3
		6	22,000	440	0.016	0.3	20,000	280	0.013	0.3
	R0.1	1.2	40,000	1,120	0.06	0.24	35,000	880	0.048	0.24
		2	37,000	1,030	0.049	0.24	35,000	810	0.039	0.24
		3	33,000	800	0.042	0.24	30,000	660	0.034	0.24
		4	29,000	710	0.037	0.24	26,000	580	0.03	0.24
		6	22,000	440	0.032	0.24	20,000	280	0.026	0.24
	R0.2	1.2	40,000	1,120	0.12	0.12	35,000	880	0.096	0.12
		4	29,000	710	0.074	0.12	26,000	580	0.059	0.12
0.8	R0.05	1.6	36,000	1,580	0.03	0.42	32,000	1,270	0.024	0.42
		4	30,000	1,390	0.021	0.42	27,000	1,010	0.017	0.42
		6	25,000	1,000	0.018	0.42	23,000	800	0.014	0.42
		8	20,000	750	0.016	0.42	18,000	620	0.013	0.42
	R0.1	1.6	36,000	1,580	0.06	0.36	32,000	1,270	0.048	0.36
		4	30,000	1,240	0.042	0.36	27,000	1,010	0.034	0.36
		6	25,000	1,000	0.035	0.36	23,000	800	0.028	0.36
		8	20,000	750	0.032	0.36	18,000	620	0.026	0.36

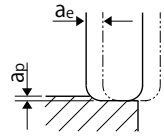


1. 请使用刚性较高的机床和刀柄。
2. 请根据切削深度、机械刚性等使用情况，适当调整转速和进给速度。
3. 请使用水溶性切削油剂。
4. 重视加工表面、精度时，请使用油性切削油剂。请根据需求调整切削深度和进给速度。
5. 请务必使用切削油剂制造商推荐的切削油剂。可能会导致加工工件变色。

NEXT

FROM

加工材料 Work Material			铜 Copper (C1020,C1100)				铜钨合金 Copper Tungsten (W70% - Cu30%)			
外径 DC	RE	颈长 LU (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap (mm)	ae (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap (mm)	ae (mm)
1	R0.02	2	32,000	2,880	0.01	0.6	29,000	2,350	0.008	0.6
		3	30,000	2,690	0.009	0.6	27,000	2,180	0.007	0.6
	R0.1	2	32,000	2,880	0.06	0.5	29,000	2,350	0.05	0.5
		3	30,000	2,690	0.053	0.5	27,000	2,180	0.042	0.5
		4	28,000	2,500	0.049	0.5	25,000	1,940	0.039	0.5
		5	27,000	2,240	0.046	0.5	24,000	1,800	0.037	0.5
		6	25,000	2,070	0.043	0.5	23,000	1,650	0.034	0.5
		8	21,000	1,740	0.04	0.5	19,000	1,440	0.032	0.5
		10	18,000	1,390	0.037	0.5	16,000	1,130	0.03	0.5
	R0.2	2	32,000	2,880	0.12	0.4	29,000	2,350	0.1	0.4
		3	30,000	2,690	0.11	0.4	27,000	2,180	0.08	0.4
		4	28,000	2,500	0.1	0.4	25,000	1,940	0.08	0.4
		5	27,000	2,240	0.09	0.4	24,000	1,800	0.07	0.4
		6	25,000	2,070	0.09	0.4	23,000	1,650	0.07	0.4
		8	21,000	1,740	0.08	0.4	19,000	1,440	0.06	0.4
		10	18,000	1,390	0.07	0.4	16,000	1,130	0.06	0.4
	R0.3	2	32,000	2,880	0.2	0.3	29,000	2,350	0.16	0.3
		3	30,000	2,690	0.18	0.3	27,000	2,180	0.14	0.3
1.5	R0.3	3	22,000	2,970	0.12	0.6	20,000	2,410	0.1	0.6
	R0.5	3	22,000	2,970	0.3	0.3	20,000	2,410	0.24	0.3
		10	16,000	2,030	0.21	0.3	14,000	1,650	0.17	0.3
		12	15,000	1,810	0.2	0.3	14,000	1,470	0.16	0.3
		20	8,000	1,060	0.17	0.3	7,000	860	0.14	0.3
2	R0.1	4	17,500	3,150	0.06	1.1	16,000	2,560	0.048	1.1
		6	16,500	2,930	0.054	1.1	15,000	2,370	0.043	1.1
		8	15,500	2,630	0.05	1.1	14,000	2,130	0.04	1.1
		10	14,500	2,420	0.048	1.1	13,000	1,970	0.038	1.1
		15	12,000	1,910	0.043	1.1	11,000	1,550	0.034	1.1
		16	11,500	1,790	0.042	1.1	10,500	1,460	0.034	1.1
		20	9,500	1,460	0.04	1.1	8,500	1,190	0.032	1.1
	R0.2	4	17,500	3,150	0.12	1	16,000	2,560	0.1	1
		10	14,500	2,420	0.1	1	13,000	1,970	0.08	1
		16	11,500	1,790	0.09	1	10,500	1,460	0.07	1
		20	9,500	1,460	0.08	1	8,500	1,190	0.06	1
	R0.3	4	17,500	3,150	0.2	0.9	16,000	2,560	0.16	0.9
		6	16,500	2,930	0.18	0.9	15,000	2,370	0.14	0.9
		8	15,500	2,630	0.17	0.9	14,000	2,130	0.13	0.9
		10	14,500	2,420	0.16	0.9	13,000	1,970	0.13	0.9
		15	12,000	1,910	0.14	0.9	11,000	1,550	0.12	0.9
		16	11,500	1,790	0.14	0.9	10,500	1,460	0.11	0.9
		20	9,500	1,460	0.13	0.9	8,500	1,190	0.11	0.9
2.5	R0.5	5	15,000	3,600	0.3	0.9	13,500	2,920	0.24	0.9
		20	11,500	2,040	0.21	0.9	10,500	1,660	0.17	0.9



1. Use a rigid and precise machine and holder.
2. Please adjust the speed and feed when the cutting depth is large or when machines with low rigidity are used.
3. Use a water soluble fluid.
4. Use a non-water-soluble cutting fluid if the machined surface and accuracy are of critical importance.
   Adjust the depth of cut and feed rate as necessary.
5. Always use a cutting fluid recommended by the cutting fluid manufacturer as the workpiece may discolor.

NEXT

AE-CPR-N 切削条件基准表 Cutting Condition

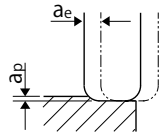
加工时产生的火花以及破损造成的发热现象有导致火灾的危险。
请做好防火措施。

Caution : Sparks generated during operation or heat caused by tool breakage can cause fire.
Be sure to use all proper fire-prevention measures.

FROM

加工材料 Work Material			铜 Copper (C1020,C1100)				铜钨合金 Copper Tungsten (W70% - Cu30%)			
外径 DC	RE	颈长 LU (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap (mm)	ae (mm)	转速 Speed (min^{-1})	进给速度 Feed (mm/min)	ap (mm)	ae (mm)
3	R0.2	6	12,500	3,750	0.12	1.6	11,500	3,050	0.1	1.6
		12	11,500	3,190	0.1	1.6	10,500	2,600	0.08	1.6
		18	10,500	2,680	0.1	1.6	9,500	2,180	0.08	1.6
		21	10,000	2,440	0.09	1.6	9,000	1,970	0.07	1.6
		24	9,500	2,210	0.09	1.6	8,500	1,800	0.07	1.6
	R0.3	6	12,500	3,750	0.2	1.5	11,500	3,050	0.16	1.5
		8	12,000	3,510	0.19	1.5	11,000	2,840	0.15	1.5
		12	11,500	3,190	0.17	1.5	10,500	2,600	0.14	1.5
		20	10,500	2,600	0.16	1.5	9,500	2,120	0.13	1.5
	R0.5	6	12,500	3,750	0.3	1.2	11,500	3,050	0.24	1.2
		12	11,500	3,190	0.26	1.2	10,500	2,600	0.21	1.2
		15	11,000	2,930	0.25	1.2	10,000	2,370	0.2	1.2
		18	10,500	2,680	0.24	1.2	9,500	2,180	0.19	1.2
		21	10,000	2,440	0.23	1.2	9,000	1,970	0.19	1.2
		25	9,500	2,170	0.23	1.2	8,500	1,770	0.18	1.2
		30	8,500	1,790	0.22	1.2	8,000	1,460	0.17	1.2
4	R0.2	8	9,500	3,710	0.12	2.2	8,600	3,020	0.1	2.2
		16	8,800	3,220	0.1	2.2	7,900	2,600	0.08	2.2
		20	8,500	3,000	0.1	2.2	7,700	2,450	0.08	2.2
		24	8,100	2,760	0.1	2.2	7,300	2,240	0.08	2.2
		28	7,700	2,530	0.09	2.2	6,900	2,040	0.07	2.2
		32	7,400	2,350	0.09	2.2	6,700	1,910	0.07	2.2
	R0.3	8	9,500	3,710	0.2	2.1	8,600	3,020	0.16	2.1
		20	8,400	2,970	0.17	2.1	7,600	2,420	0.13	2.1
	R0.5	8	9,500	3,710	0.3	1.8	8,600	3,020	0.24	1.8
		12	9,100	3,440	0.28	1.8	8,200	2,790	0.22	1.8
		16	8,800	3,220	0.26	1.8	7,900	2,600	0.21	1.8
		20	8,400	2,970	0.25	1.8	7,600	2,420	0.2	1.8
		24	8,100	2,760	0.24	1.8	7,300	2,240	0.19	1.8
		25	8,000	2,710	0.24	1.8	7,200	2,190	0.19	1.8
		28	7,700	2,530	0.23	1.8	6,900	2,040	0.19	1.8
		32	7,400	2,350	0.23	1.8	6,700	1,910	0.18	1.8
	R1	8	9,500	3,710	0.6	1.2	8,600	3,020	0.48	1.2
		16	8,800	3,220	0.52	1.2	7,900	2,600	0.42	1.2
		24	8,100	2,760	0.48	1.2	7,300	2,240	0.39	1.2
		28	7,700	2,530	0.47	1.2	6,900	2,040	0.37	1.2
		32	7,400	2,350	0.46	1.2	6,700	1,910	0.36	1.2
6	R0.1	12	6,500	3,900	0.06	3.5	5,900	3,190	0.05	3.5
		24	6,000	3,380	0.05	3.5	5,400	2,730	0.04	3.5
	R0.2	12	6,500	3,900	0.12	3.4	5,900	3,190	0.1	3.4
		24	6,000	3,380	0.1	3.4	5,400	2,730	0.08	3.4
		32	5,700	3,060	0.1	3.4	5,100	2,470	0.08	3.4
		48	5,000	2,440	0.09	3.4	4,500	1,980	0.07	3.4
	R0.5	12	6,500	3,900	0.3	3	5,900	3,190	0.24	3
		24	6,000	3,380	0.26	3	5,400	2,730	0.21	3
		30	5,800	3,150	0.25	3	5,200	2,550	0.2	3
		32	5,700	3,060	0.25	3	5,100	2,470	0.2	3
		48	5,000	2,440	0.23	3	4,500	1,980	0.18	3
	R1	12	6,500	3,900	0.6	2.4	5,900	3,190	0.48	2.4
		24	6,000	3,380	0.52	2.4	5,400	2,730	0.42	2.4
		32	5,700	3,060	0.49	2.4	5,100	2,470	0.39	2.4
		48	5,000	2,440	0.46	2.4	4,500	1,980	0.36	2.4

1. 请使用刚性较高的机床和刀柄。
2. 请根据切削深度、机械刚性等使用情况，适当调整转速和进给速度。
3. 请使用水溶性切削油剂。
4. 重视加工表面、精度时，请使用油性切削油剂。请根据需求调整切削深度和进给速度。
5. 请务必使用切削油剂制造商推荐的切削油剂。可能会导致加工工件变色。



1. Use a rigid and precise machine and holder.
2. Please adjust the speed and feed when the cutting depth is large or when machines with low rigidity are used.
3. Use a water soluble fluid.
4. Use a non-water-soluble cutting fluid if the machined surface and accuracy are of critical importance.
   Adjust the depth of cut and feed rate as necessary.
5. Always use a cutting fluid recommended by the cutting fluid manufacturer as the workpiece may discolor.

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