



End Mills for

Vol.5

Additive Manufacturing

增材制造用铣刀

AM-EBT · AM-CRE · AM-HFC · PXHF-AM

高进给圆弧角型：
追加 $\phi 4 \sim \phi 20$ 9款
High Feed Radius Type: 9 new items



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球头型 Ball Type

AM-EBT

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圆弧角型 Radius Type

AM-CRE

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高进给圆弧角型 High Feed Radius Type NEW

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AM-HFC

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PXHF-AM 可换头式铣刀PXM Exchangeable Head End Mill

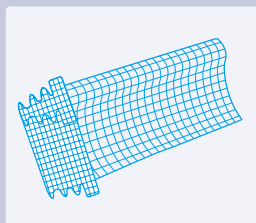
- 尺寸表 Dimension P.20
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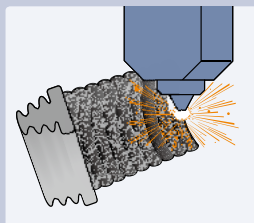
什么是增材制造? What is Additive Manufacturing?

相对于切削等将材料去除的加工方法、
像3D打印那样增加材料进行制造的制作方法称为增材制造。
灵活运用3D数据可缩短交货期，降低成本。

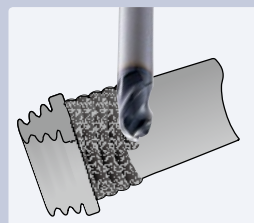
In contrast to subtractive manufacturing processes such as cutting, where an object is formed by removing excessive materials, "additive manufacturing" deposits materials layer upon layer by metal 3D printing to create an object.
By utilizing 3D data, short delivery and low production cost are made possible.



①3D数据
3D data



②激光金属增材制造
Laser additive manufacturing



③铣削加工
Milling process

※增材制造 (Additive Manufacturing) 这个名称是2009年美国试验材料协会 (ASTM) 命名的。
The name Additive Manufacturing was established in 2009 by the American Society for Testing and Materials (ASTM).



最适合高硬度钢加工的超耐热性・高韧性的 DUROREY涂层

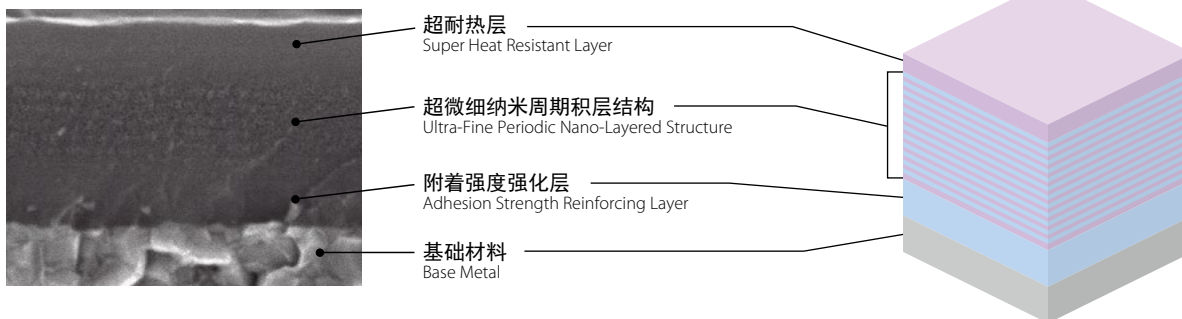
DUROREY coating enables superior heat resistance and high toughness optimized for high-hardness steel milling

PAT.P in Japan

含有SiC的超耐热层和超微细纳米周期层结构，保持高耐热性和耐磨性的同时发挥优越的韧性。
在高硬度加工中也能抑制崩刃，实现较长的刀具寿命。

Super heat resistant layer and ultra-fine periodic nano-layered structure provide superior toughness while maintaining high heat resistance and abrasion resistance. Also suppresses chipping even in high-hardness milling and achieves long tool life.

涂层结构 Coating Structure



超耐热层 Super Heat Resistant Layer

含SiC的超耐热材料和结晶细小化，实现了表面的平滑化、高硬化、高韧性及耐溶着强化
Smoothing of surface, high toughness and adhesion resistance due to the SiC containing ultra-heat-resistance material and crystal miniaturization

超微细纳米周期积层结构 Ultra-Fine Periodic Nano-Layered Structure

通过纳米周期积层和耐磨损层的积层结构，实现结晶微细化和机械特性的改善
Crystal miniaturization and improvement of mechanical properties due to the laminated structure of periodic nano-layer and wear-resistant layer

涂层色 Coating Color	涂层结构 Coating Structure	硬度 (GPa) Hardness	氧化开始 温度 (°C) Oxidation Temperature	耐热性 Heat Resistance	附着力 Adhesion Strength	表面粗糙度 Surface Roughness	耐磨损性 Wear Resistance	耐溶着性 Welding Resistance	韧性 Toughness
黑灰色 Black Gray	超微细纳米周期积层 Ultra-Fine Periodic Nano-Layered	41	1,300	☆	◎	○	☆	◎	◎

DUROREY是OSG公司的注册商标。
DUROREY is a registered trademark of OSG Corporation.

(标准) ○ → ◎ → ☆ (最佳)
Fair Best

金属增材部分的特征

Characteristics of Additive Manufacturing Part

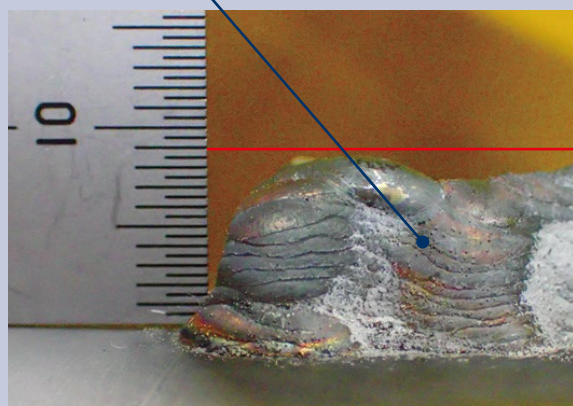
- 表层硬度非常高
The surface is very hard
- 被切削除去部分（切削余量）的变动较大
Large fluctuations in the part to be removed by cutting (cutting allowance)

所需工具的式样

Required Tool Specifications

- 能够承受表层硬度的式样
Ability to withstand the hardness of the surface
- 可对应切削余量变动的式样
Ability to respond to fluctuations in cutting allowance

金属积层部 Additive Manufacturing Part

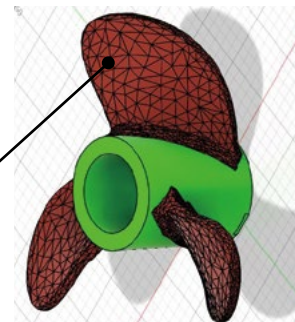


AM-EBT具有高硬度，能高效率加工不均匀的增材部分。

High efficiency milling by the AM-EBT in additive manufacturing part with high-hardness and unequal cutting allowance

螺旋桨叶片的增材部加工
Machining of propeller wing additive part

工件提供：
Workpiece provided by:



SUS630
增材部
Additive Part

加工材料 :SUS630 (34HRC)
Work Material:

使用机械：5轴加工机
Machine: Five-axis Machining Center

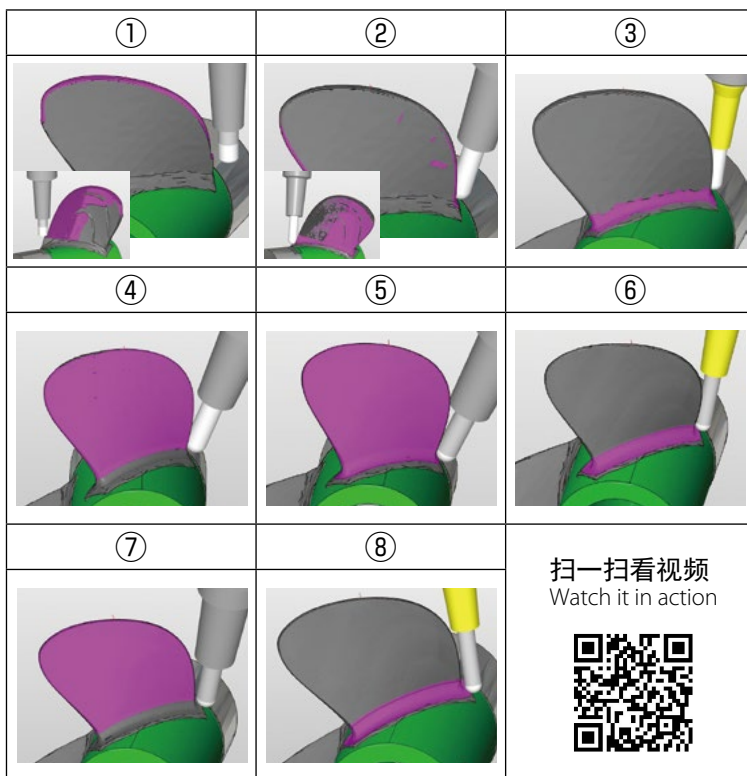
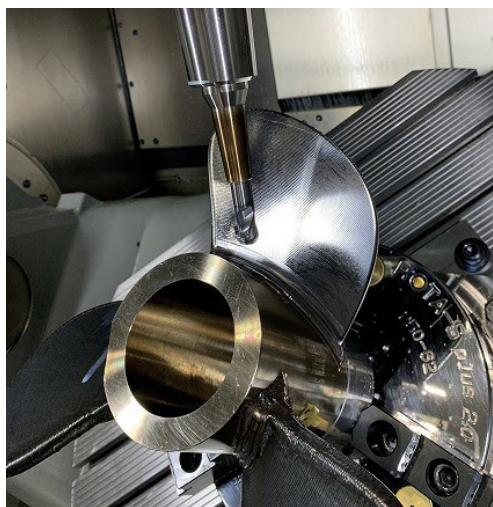
主轴类型：HSK-A63
Main Spindle:

最高转速：20,000min⁻¹
Maximum RPM:

刀柄：热缩刀柄
Holder: Shrink Fit:

切削油剂：MQL ※
Coolant:

※使用MQL拍摄视频
MQL is used for filming purposes



扫一扫看视频
Watch it in action



总加工时长：约12小时/叶片（不包括ATC工具更换时间）
Total machining time: approximately 12 hours / wing (ATC tool change time not included)

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)	a _p (mm)	a _e (mm)	加工时间 Machining Time(hr)
①	全体 Overall	粗加工 Roughing	NEO-CR-PHS φ16×R2	60 (1,194min ⁻¹)	239 (0.05mm/t)	1	3	1:40
②	叶片表面 Wing Surface	粗加工 Roughing	AM-EBT R8×16	60 (1,194min ⁻¹)	179 (0.05mm/t)	1	3.5	2:30
③	叶片表面 Wing Surface	半粗加工 Semi-roughing	AM-EBT R8×16	60 (1,194min ⁻¹)	179 (0.05mm/t)	1	1	2:30
④	叶片根部 Base of Wing	粗加工 Roughing	AM-EBT R6×12	60 (1,592min ⁻¹)	239 (0.05mm/t)	0.5	2	0:20
⑤	叶片表面 Wing Surface	半精加工 Semi-finishing	WXL-EBD R8×30	70 (1,393min ⁻¹)	334 (0.12mm/t)	0.5	1	2:20
⑥	叶片根部 Base of Wing	半精加工 Semi-finishing	WXL-EBD R6×18	60 (1,592min ⁻¹)	382 (0.12mm/t)	0.5	0.5	0:10
⑦	叶片表面 Wing Surface	精加工 Finishing	WXL-EBD R8×30	70 (1,393min ⁻¹)	334 (0.12mm/t)	0.5	0.5	2:20
⑧	叶片根部 Base of Wing	精加工 Finishing	WXL-EBD R6×18	70 (1,857min ⁻¹)	446 (0.12mm/t)	0.5	0.5	0:10



AM-HFC可高效率地加工Inconel增材的不均匀切削余量

AM-HFC enables highly efficient milling of Inconel additive material with unequal cutting allowance

叶片机翼增材部加工

Milling of blade wing additive part

工件提供：日立金属株式会社国际技术创新中心

Workpiece provided by: Hitachi Metals, Ltd. Global Research & Innovative Technology Center (GRIT)

加工材料：Inconel 718 增材

Work Material: Inconel 718 Additive Material

使用机械：5轴加工机

Machine: Five-axis Machining Center

主轴类型：BT50

Main Spindle:

最高转速：12,000min⁻¹

Maximum RPM:

刀柄：热缩刀柄

Holder: Shrink Fit:

切削油剂：水溶性切削油剂

Coolant: Water-Soluble

工件形状

Shape of Work Material

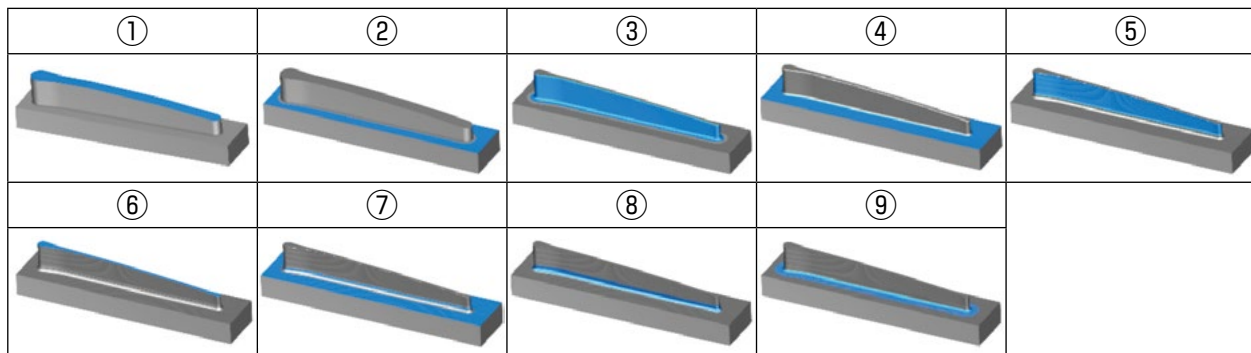
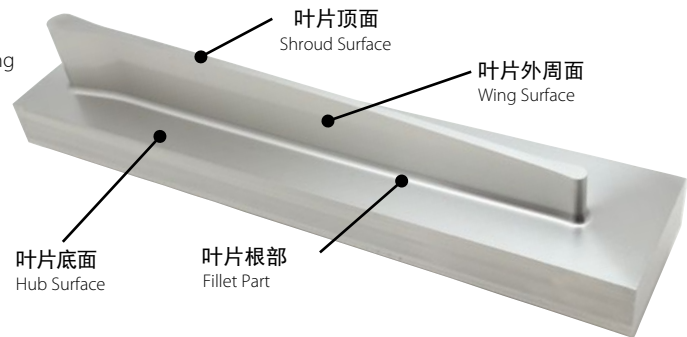
加工前

Before Machining



加工后

After Machining



总加工时长：约6小时（不包括ATC工具更换时间）

Total machining time: approximately 6 hours (ATC tool change time not included)

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)	a _p (mm)	a _e (mm)	加工时间 Machining Time(hr)
①	叶片顶面 Shroud Surface	粗加工 Roughing	AM-HFC 12×R1.5	60 (1,591min ⁻¹)	1,146 (0.12mm/t)	0.3	4.5	0:46
②	叶片底面 Hub Surface	粗加工 Roughing						0:24
③	叶片外周面 Wing Surface	粗加工 Roughing						0:54
④	叶片底面 Hub Surface	半精加工 Semi-roughing	AM-HFC 12×R1.5	60 (1,591min ⁻¹)	1,146 (0.12mm/t)	0.3	4.5	0:04
⑤	叶片外周面 Wing Surface	精加工 Finishing	AM-EBT R5×10	45 (1,432min ⁻¹)	430 (0.1mm/t)	0.1	0.45	1:37
⑥	叶片顶面 Shroud Surface	精加工 Finishing						1:16
⑦	叶片底面 Hub Surface	精加工 Finishing	AM-EBT R3×6	40 (2,068min ⁻¹)	620 (0.1mm/t)	0.1	0.45	0:15
⑧	叶片根部 Fillet Part	精加工 Finishing						0:12
⑨	叶片根部 Fillet Part	精加工 Finishing						0:25



增材制造用铣刀

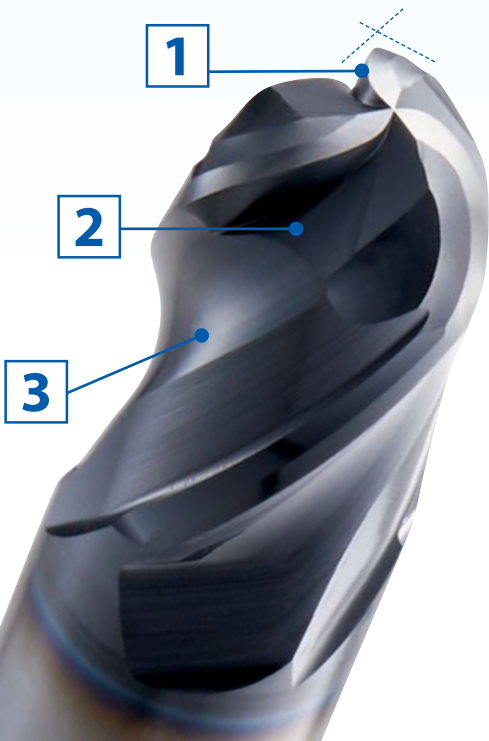
End Mills for Additive Manufacturing

球头型 Ball Type

AM-EBT

可对应切削余量变动大的球头型铣刀

Ball end mill that can accommodate large fluctuations in cutting allowance



1 刚性与锋利性兼备的三维负前角形状

Three-dimensional negative geometry that achieves both rigidity and sharpness

- 可对应高硬度的金属增材表面
Compatible with hard additive manufacturing parts
- 可对应切削余量的变动
Corresponds to fluctuations in cutting allowance

2 宽大容屑槽

Large chip pocket

- 可对应切屑量的变动
Corresponds to fluctuation in chip volume
- 良好的排屑性
Good chip evacuation

3 可进行再研磨的排屑槽式样

Flute specification that allows regrinding

4 最适合高硬度钢加工的 DUROREY涂层

DUROREY coating optimized for high-hardness steel machining

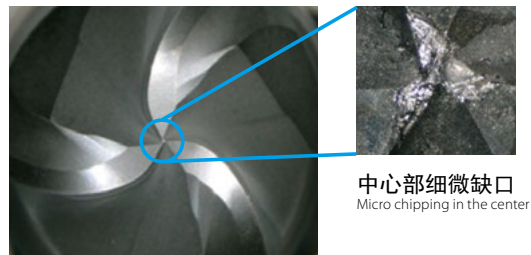
加工数据 Cutting Data

即使是堆焊部的深加工也能保持长寿命 Long tool life even in milling of built-up welding parts with large depth of cut

使用工具 Tool	AM-EBT R6×12	以往球头铣刀2刃 Conventional 2-flute Ball End Mill
加工材料 Work Material	BK-660R	
切削方法 Milling Method	走查线加工 Linear Machining	
切削速度 Cutting Speed	37m/min(1,000min ⁻¹)	
进给速度 Feed	1,000mm/min(0.33mm/t)	666mm/min(0.33mm/t)
切削深度 Depth of Cut	ap=3mm Pf=0.5mm	
切削油剂 Coolant	气冷式 Air Blow	
使用机械 Machine	立式加工中心 Vertical Machining Center	

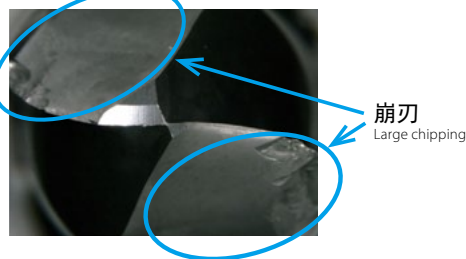
	切削距离 (m) Milling Length				
	5	10	15	20	25
AM-EBT	25m				中心部磨损 Wear in the center
以往球头铣刀 2刃 Conventional 2-flute ball end mill	0.7m 崩刃 Large chipping				

AM-EBT 加工25m后 After milling 25m



中心部细微缺口
Micro chipping in the center

以往球头铣刀2刃 加工0.7m后
Conventional 2-flute ball end mill After milling 0.7m



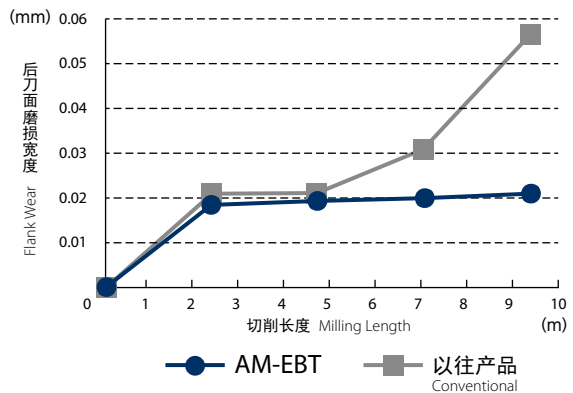
崩刃
Large chipping

高硬度增材的加工案例 Machining example with high-hardness additive material

稳定磨损和光滑的加工面 Stable wear transition and good machined surface without peeling

使用工具 Tool	AM-EBT R3×6	
加工材料 Work Material	DAP540MOD 高速钢增材 (~ 66 HRC) Additive High-speed Steel	
切削方法 Milling Method	啄铣 (与增材方向垂直) Pick milling (direction perpendicular to the deposited direction)	
切削速度 Cutting Speed	90 m/min (4,800 min ⁻¹)	
进给速度 Feed	1,340 mm/min (0.093 mm/t)	
切削深度 Depth of Cut	ap=0.3 mm Pf=0.9 mm	
切削油剂 Coolant	气冷式 Air Blow	
使用机械 Machine	卧式加工中心 (HSK63) Horizontal Machining Center	

合作：大隈株式会社 Cooperation: Okuma Corporation



加工9.38m时的情况 Condition after milling 9.38 m



使用大隈株式会社的LASER EX进行建模
Molded using the LASER EX by Okuma Corporation

	球头部磨损情况 Wear condition of ball section		加工面 Machined Surface
	后刃面 Flank	前刃面 Rake Face	
AM-EBT			
以往产品 Conventional			

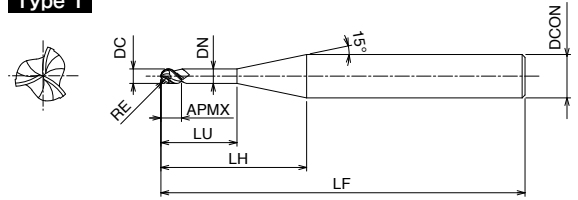
增材制造用铣刀 球头型

End Mills for Additive Manufacturing Ball Type

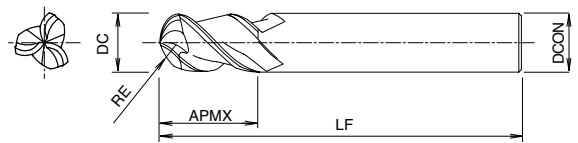
AM-EBT



Type 1



Type 2



CARBIDE
DUROREY
±0.01
SHRINK FIT
30°
SPEED FEED P8

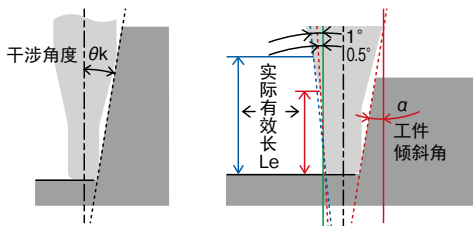
单位:mm Unit:mm

商品号 EDP No.	球半径 × 外径 × 颈长 RE × DC × LU	全长 LF	刃长 APMX	LH	柄径 DCON	颈径 DN	刃数 ZEFP	干涉角度 θ_k	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°			
3187240	R 1 × 2 × 4	60	2	11.9	6	1.95	3	10.32°	4.22	4.44	4.65	4.86	5.26	1	●	
3187280	R 1 × 2 × 8	60	2	15.9	6	1.95		7.62°	8.47	8.87	9.22	9.54	10.24			B
3187360	R 1.5 × 3 × 6	60	3	11.8	6	2.85		8.18°	6.25	6.49	6.72	6.94	7.4			
3187392	R 1.5 × 3 × 12	60	3	17.8	6	2.85		5.23°	12.53	12.98	13.4	13.85	14.85			
3187408	R 2 × 4 × 8	60	4	12	6	3.85		5.68°	8.32	8.62	8.91	9.17	9.76			
3187416	R 2 × 4 × 16	60	4	20	6	3.85		3.18°	16.68	17.23	17.78	18.37	19.71			
3187510	R 2.5 × 5 × 10	60	5	12.1	6	4.85		2.97°	10.4	10.75	11.08	11.4	—			
3187520	R 2.5 × 5 × 20	60	5	22.1	6	4.85		1.46°	20.82	21.47	—	—	—			
3188060	R 3 × 6	60	9	—	6	—		—	—	—	—	—	—	2		
3188080	R 4 × 8	70	12	—	8	—		—	—	—	—	—	—			
3188100	R 5 × 10	80	15	—	10	—		—	—	—	—	—	—			
3188120	R 6 × 12	90	18	—	12	—		—	—	—	—	—	—			
3188160	R 8 × 16	105	24	—	16	—		—	—	—	—	—	—			
3188200	R10 × 20	110	30	—	20	—		—	—	—	—	—	—			

·标识说明请参阅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)
Effective neck length (Le) depending on inclined angle (α) of workpiece



上表中实际有效长栏里无数值时意味着加工时不存在干涉。
No numerical value means no interference with workpiece.

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel		不锈钢 Stainless Steel	钴铬合金 Cobalt-Chromium Based Alloy (Stellite)	钛合金 Titanium Alloy	镍基合金 Ni-Based Alloy (Inconel 718)
	商品记号 Abbreviation	~45HRC	~62HRC	~70HRC	≤200HB			
AM-EBT	◎	◎	○	○	○	◎	◎	◎

◎=best ○=good



切削条件基准表 Cutting Condition

AM-EBT 球头型 Ball Type

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)		
	~45HRC		~65HRC		~70HRC		≤200HB								
切削速度 Cutting Speed	50~70m/min		40~60m/min		20~40m/min		60~80m/min		50~70m/min		40~60m/min		20~40m/min		
RE	颈长 LJ(mm)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)
R 1	4	9,500	940	8,000	790	4,800	480	11,100	1,100	9,500	940	8,000	790	4,800	480
	8	4,800	430	4,300	390	2,600	230	5,600	500	4,800	430	4,300	390	2,600	230
R 1.5	6	6,400	960	5,300	800	3,200	480	7,400	1,110	6,400	960	5,300	800	3,200	480
	12	3,800	510	3,300	450	2,000	270	4,400	590	3,800	510	3,300	450	2,000	270
R 2	8	4,800	930	4,000	770	2,400	470	5,600	1,080	4,800	930	4,000	770	2,400	470
	16	2,900	490	2,500	420	1,500	250	3,400	570	2,900	490	2,500	420	1,500	250
R 2.5	10	3,800	910	3,200	770	1,900	460	4,500	1,080	3,800	910	3,200	770	1,900	460
	20	2,400	550	2,000	430	1,200	280	2,800	600	2,400	520	2,000	430	1,200	280
R 3	—	3,200	960	2,700	800	1,600	480	3,700	1,120	3,200	960	2,700	800	1,600	480
R 4	—	2,400	860	2,000	720	1,200	430	2,800	1,000	2,400	860	2,000	720	1,200	430
R 5	—	1,900	860	1,600	720	960	430	2,200	1,000	1,900	860	1,600	720	960	430
R 6	—	1,600	960	1,300	800	800	480	1,900	1,120	1,600	960	1,300	800	800	480
R 8	—	1,200	790	1,000	660	600	390	1,400	920	1,200	790	1,000	660	600	390
R10	—	1,000	720	800	600	480	360	1,100	840	1,000	720	800	600	480	360

切削深度 Depth of Cut			a _p		Pf	
	R≤6	Max:0.15D			0.05D	
	8≤R	Max:3mm				

1. 推荐使用本工具进行增材加工（金属增材）、模具堆焊部表层的粗加工。
2. 请使用高刚性，高精度的机械、刀柄。
3. 上表的值为参考值。请参考上表并根据实际加工环境设置切削条件。
4. 比推荐条件切深较大的情况下，请下调进给速度。
5. 刀具悬伸长度较长的情况下，请下降转速、进给速度和切削深度。
6. 请使用适合加工材料、发烟性少的切削油剂。
7. 干式加工情况下，为了不造成切屑阻塞，请使用气冷除去切屑。
8. 推荐使用水溶性切削油剂加工不锈钢、钴铬基合金、钛合金和镍基合金。
9. 请将工具的振动精度控制在最小限度下使用。
10. 变动圆弧角部等的切削负荷时，请下降转速。

1. This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
2. Please use machines and holders that are rigid and highly accurate.
3. The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
4. Please reduce the feed rate when the depth of cut is greater than specified.
5. Please adjust the speed, feed and depth of cut accordingly when the overhang length is longer than specified.
6. Please use a suitable fluid with high smoke retardant properties.
7. During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
8. Please use water-soluble coolant when machining stainless steel, cobalt-chromium based alloy, titanium alloy, and Ni-based alloy.
9. Tool runout should be kept to a minimum for maximum accuracy.
10. When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.

标记种类 Guide for icons

1 材质 Tool Materials

CARBIDE 硬质合金
Tungsten Carbide

2 表面处理 Surface Treatment

DUROREY DUROREY涂层
DUROREY Coating

3 螺旋角 Helix Angle

30° 表示铣刀排屑槽的螺旋角度
Helix Angle of Flute for End Mills

4 R许容差 Tolerance of Radius

R ±0.01 表示铣刀的R许容差
Identifies the tolerance of the radius for end mills

5 外径的许容差 Tolerance for Milling Diameter

○ 表示铣刀的外径
Tolerance for milling diameter

6 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

7 热缩 Shrink

SHRINK FIT 推荐使用热膨胀刀柄
Suitable for the shrink holder system



增材制造用铣刀

End Mills for Additive Manufacturing

圆弧角型 Radius Type

AM-CRE

多刃式样，提高效率且稳定加工

Stable performance and enhanced efficiency with multi-flute configuration



1 刚性与锋利性兼备的三维负前角形状

Three-dimensional negative geometry that achieves both rigidity and sharpness

- 可加工高硬度金属增材表面的圆弧角部
Corner configuration that enables milling of hard additive manufacturing parts
- 可对应切削余量的变动
Corresponds to fluctuations in cutting allowance

2 可进行再研磨的排屑槽式样

Flute specification that allows regrinding

3 实现长寿命·高效率化的多刃式样

Multi-flute specification that achieves long tool life and high efficiency

外径 ϕ 10以下
6刃式样
Outer diameter
under ϕ 10
6-flute specification



外径 ϕ 12以上
8刃式样
Outer diameter
 ϕ 12 or above
8-flute specification



4 最适合高硬度钢加工的 DUROREY涂层

DUROREY coating optimized for high-hardness steel machining

加工数据 Cutting Data

■ 钴基合金的加工案例 Milling Example in Stellite Alloys

使用工具 Tool	AM-CRE $\phi 8 \times R2$ (6刃) 6FL
加工材料 Work Material	钴基合金 (48HRC) Stellite
切削方法 Milling Method	等高线加工 Contour Line Operation
切削速度 Cutting Speed	50m/min(2,000min ⁻¹)
进给速度 Feed	600mm/min(0.05mm/t)
切削深度 Depth of Cut	$a_p=0.5\text{mm}$ $a_e=0.5\text{mm}$
切削油剂 Coolant	气冷式 Air Blow
使用机械 Machine	立式加工中心 Vertical Machining Center

	切削距离 (m) Milling Length			
	50	100	150	200
AM-CRE	190m			正常磨损 Normal wear

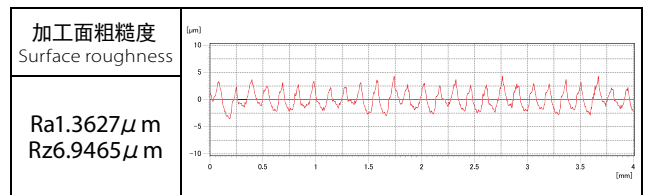
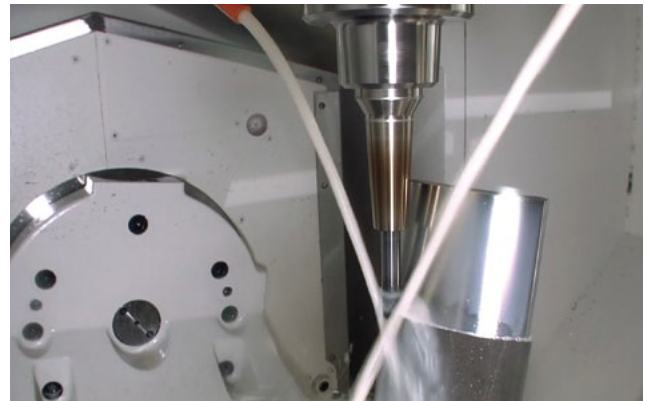


AM-CRE 加工190m后 After milling 190m



■ 析出硬化体不锈钢增材的加工案例 Machining example with precipitation hardening stainless steel additive material

使用工具 Tool	AM-CRE $\phi 8 \times R2$ (6刃) 6FL
加工材料 Work Material	SUS630(45 HRC)
切削方法 Milling Method	等高线加工 Contour Line Operation
切削速度 Cutting Speed	63 m/min (2,500 min ⁻¹)
进给速度 Feed	869 mm/min (0.058 mm/t)
切削深度 Depth of Cut	$a_p=0.1\text{ mm}$ $a_e=1.0\text{ mm}$
切削油剂 Coolant	水溶性切削油剂 Water-Soluble
使用机械 Machine	5轴加工机 (BT50) Five-axis Machining Center



增材制造用铣刀也可用于模具的堆焊件加工

End mills for additive manufacturing are also suitable for milling built-up welding parts of molds

堆焊件加工是一种对模具进行部分修补的方法。

Overlay welding is a method for partially modifying a mold.

堆焊部硬度高且切削余量变动大，加工十分困难。

Built-up weld has high-hardness and high fluctuation in cutting allowance, making machining extremely difficult.

增材制造用铣刀具有坚韧的切削刃，可对应堆焊件加工。

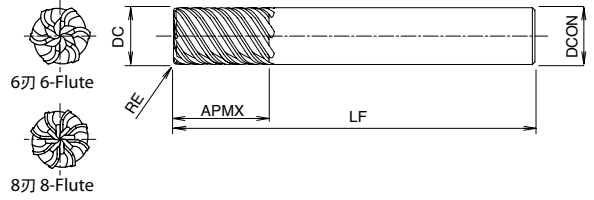
End mills for additive manufacturing can also be used for built-up welding parts due to their tough cutting edge geometry.



增材制造用铣刀 圆弧角型

End Mills for Additive Manufacturing Radius Type

AM-CRE



CARBIDE
DUROREY
±0.03
±0.01
SHRINK FIT
60°
SPEED FEED P12

单位：mm Unit:mm

商品号 EDP No.	外径×圆弧半径 DC×RE	全长 LF	刃长 APMX	柄径 DCON	刃数 ZEFP	库存 Stock
3183010	6×R1	60	9	6	6	●
3183015	6×R1.5					●
3183018	8×R1	70	12	8		●
3183020	8×R2					●
3183110	10×R1	80	15	10		●
3183120	10×R2					●
3183210	12×R1	90	18	12	8	●
3183220	12×R2					●
3183226	16×R1	105	24	16		●
3183230	16×R3					●
3183310	20×R1	110	30	20		●
3183330	20×R3					●

·标识说明请参阅p.8。· See p.8 for explanation of icons.

●=标准库存品 ●=Standard stock item

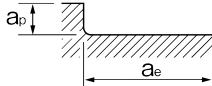
加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel		不锈钢 Stainless Steel	钴铬合金 Cobalt-Chromium Based Alloy (Stellite)	钛合金 Titanium Alloy	镍基合金 Ni-Based Alloy (Inconel 718)
	~45HRC		~62HRC	~70HRC	≤200HB			
商品记号 Abbreviation	AM-CRE		○	○	○	○	○	○

◎=best ○=good



切削条件基准表 Cutting Condition

AM-CRE 圆弧角型 Radius Type

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)					
	~45HRC		~60HRC		~70HRC		≤200HB											
切削速度 Cutting Speed	50~70m/min		40~60m/min		20~40m/min		60~80m/min		50~70m/min		40~60m/min		20~40m/min					
外径×圆弧半径 DC × RE	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)				
6×R1	3,700	1,330	3,200	1,150	1,910	690	4,240	1,530	3,700	1,330	3,200	1,150	1,910	690				
6×R1.5	3,200	960	2,700	800	1,600	480	3,700	1,120	3,200	960	2,700	800	1,600	480				
8×R1	2,780	1,250	2,400	1,080	1,430	640	3,180	1,430	2,780	1,250	2,400	1,080	1,430	640				
8×R2	2,400	720	2,000	600	1,200	360	2,800	840	2,400	720	2,000	600	1,200	360				
10×R1	2,220	1,600	1,900	1,370	1,150	830	2,540	1,830	2,220	1,600	1,900	1,370	1,150	830				
10×R2	1,900	920	1,600	760	960	460	2,200	1,070	1,900	920	1,600	760	960	460				
12×R1	1,850	2,220	1,600	1,920	960	1,150	2,120	2,540	1,850	2,220	1,600	1,920	960	1,150				
12×R2	1,600	1,270	1,300	1,060	800	640	1,900	1,490	1,600	1,270	1,300	1,060	800	640				
16×R1	1,380	2,430	1,200	2,110	720	1,270	1,590	2,800	1,380	2,430	1,200	2,110	720	1,270				
16×R3	1,200	1,430	1,000	1,190	600	720	1,400	1,670	1,200	1,430	1,000	1,190	600	720				
20×R1	1,110	2,490	1,000	2,240	570	1,280	1,270	2,840	1,110	2,490	1,000	2,240	570	1,280				
20×R3	1,000	1,530	800	1,270	480	760	1,100	1,780	1,000	1,530	800	1,270	480	760				
切削深度 Depth of Cut					<table border="1"> <tr><td>ap</td><td>Max:0.2R</td></tr> <tr><td>ae</td><td>Max:0.5D</td></tr> </table>		ap	Max:0.2R	ae	Max:0.5D								
ap	Max:0.2R																	
ae	Max:0.5D																	

1. 推荐使用本工具进行增材加工（金属增材）、模具堆焊部表面的粗加工。
2. 请使用高刚性，高精度的机械、刀柄。
3. 上表的值为参考值。请参考上表并根据实际加工环境设置切削条件。
4. 比推荐条件切深量大的情况下，请下调进给速度。
5. 刀具悬伸长度较长的情况下，请下降转速、进给速度和切削深度。
6. 请使用适合加工材料、发烟性少的切削油剂。
7. 干式加工情况下，为了不造成切屑阻塞，请使用气冷除去切屑。
8. 推荐使用水溶性切削油剂加工不锈钢、钴铬基合金、钛合金和镍基合金。
9. 请将工具的振动精度控制在最小限度下使用。
10. 变动圆弧角部等的切削负荷时，请下降转速。

1. This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
2. Please use machines and holders that are rigid and highly accurate.
3. The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
4. Please reduce the feed rate when the depth of cut is greater than specified.
5. Please adjust the speed, feed and depth of cut accordingly when the overhang length is longer than specified.
6. Please use a suitable fluid with high smoke retardant properties.
7. During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
8. Please use water-soluble coolant when machining stainless steel, cobalt-chromium based alloy, titanium alloy, and Ni-based alloy.
9. Tool runout should be kept to a minimum for maximum accuracy.
10. When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.



Cutting Data 加工数据
 Ball Type 球头型 AM-EBT
 Radius Type 圆弧角型 AM-CRE
 High Feed Radius Type 高速给圆弧角型 AM-HFC
 Exchangeable Head 可换头式 PXHF-AM

增材制造用铣刀

End Mills for Additive Manufacturing

高进给圆弧角型 High Feed Radius Type

AM-HFC / PXHF-AM

实现高硬度金属增材部的高进给加工

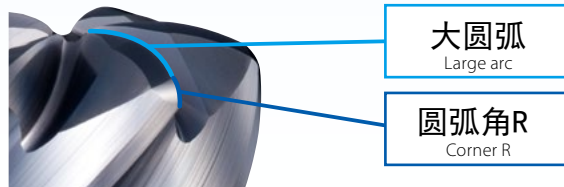
Enables high feed milling of high-hardness additive manufacturing parts

AM-HFC

1 最适合平面加工的复合圆弧刃型

Composite radius cutting edge optimized for flat surface milling

- 可承受切削深度不稳定形状的坚韧切削刃
A robust cutting edge that can withstand shapes with unstable depth of cut



2 修光刃式样

Flat cutting edge

- 抑制底刃崩刃
Suppresses chipping of the end cutting edge
- 实现良好的加工面品质
Achieves good machined surface quality

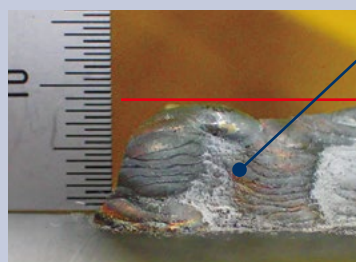


3 内冷油孔式样

Specification with coolant hole

增材制造的造形面

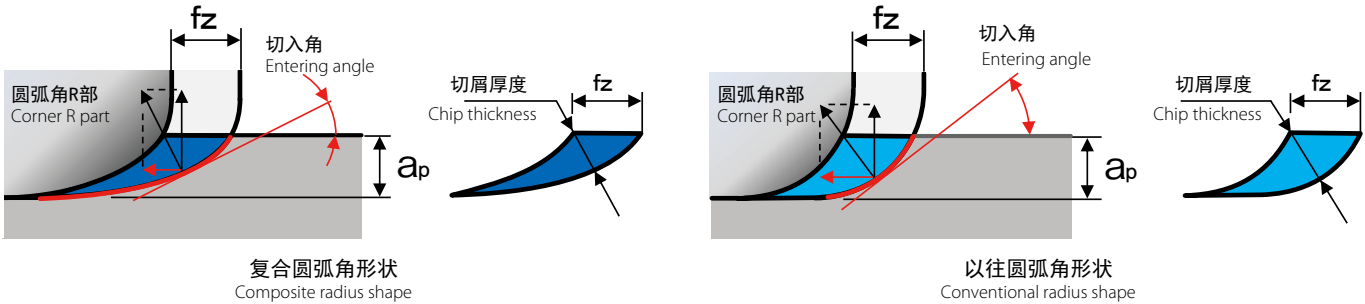
Mold surface by additive manufacturing



- 即使在切削深度突然变大的情况下, 也难以崩刃的刃尖式样
Cutting edge specification that minimizes chipping even if the amount of cut suddenly increases
- 加工时间的缩短
Reduction of machining time

复合圆弧角刃形 Composite radius cutting edge

- 由于切入角较小，进给方向的切削阻力减小，抑制了刀具的振动和偏移。
Since the depth of cut is small, cutting resistance in the feed direction is reduced, suppressing tool vibration and deflection.
- 切屑厚度变薄，使切削热更容易转移到切屑上，热量不易残留在刀具刃尖或加工材料上。
By reducing the chip thickness, cutting heat is easily transferred to the chip, making it more difficult for heat to remain on the tool cutting edge and work material.

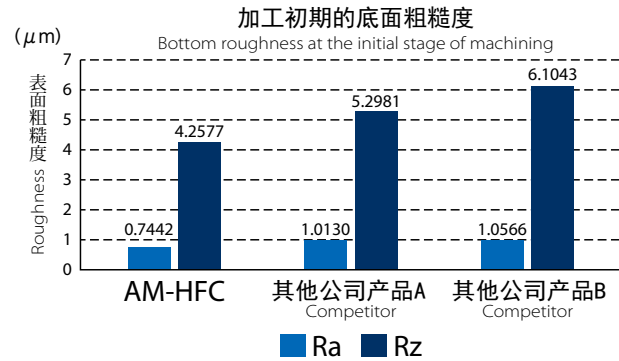


良好的加工表面 Good machined surface

修光刃实现良好的加工表面

Wiper edge enables good machined surface

使用工具 Tool	AM-HFC $\phi 4 \times R0.5$	其他公司产品A 6刃 Competitor 6FL	其他公司产品B 4刃 Competitor 4FL
加工材料 Work Material	SKD61 积层材(50HRC) Additive Material		
切削方法 Milling Method	正面切削 Frontal Milling		
切削速度 Cutting Speed	60 m/min (4,775 mim^{-1})		
进给速度 Feed	4,300 mm/min		
	0.15 mm/t	0.225 mm/t	
切削深度 Depth of Cut	$a_p=0.16 \text{ mm}$ $a_e=2 \text{ mm}$		
切削油剂 Coolant	气冷式 Air Blow		
使用机械 Machine	立式加工中心(BT40) Vertical Machining Center		



良好的排屑性 Good chip evacuation

内冷油孔式样提高排屑性，防止切屑卷曲缠绕。

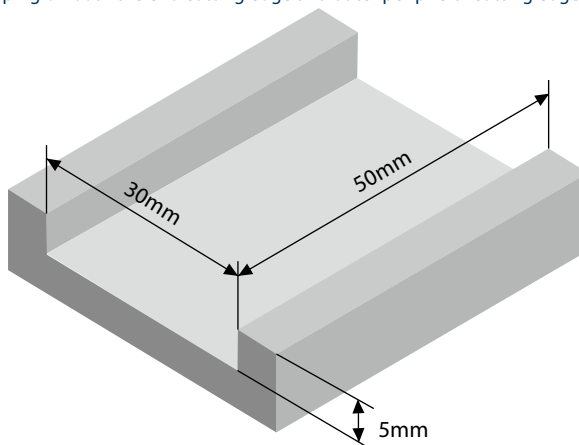
Specification with coolant hole improves chip evacuation and prevents chips from getting tangled.

最适合高硬度钢加工的DUREOREY涂层

DUREOREY coating optimized for high-hardness steel machining

■ 底刃·外周刃均无崩刃的稳定加工 Stable machining with no chipping on both the end cutting edge and outer peripheral cutting edge

使用工具 Tool	AM-HFC $\phi 10 \times R1.2$	
加工材料 Work Material	S600 (SKH51相当) 65HRC (Equivalent to SKH51)	
切削方法 Milling Method	正面切削 Frontal Milling	余摆线加工 Trochoidal Milling
切削速度 Cutting Speed	100 m/min (3,200 mim^{-1})	
进给速度 Feed	1,536 mm/min (0.08 mm/t)	900 mm/min (0.046 mm/t)
切削深度 Depth of Cut	$a_p=0.1\text{mm}$ $a_e=4\text{mm}$	$a_p=5\text{mm}$ $a_e=0.2\text{mm}$
切削油剂 Coolant	气冷式 Air Blow	
使用机械 Machine	立式加工中心(BT40) Vertical Machining Center	



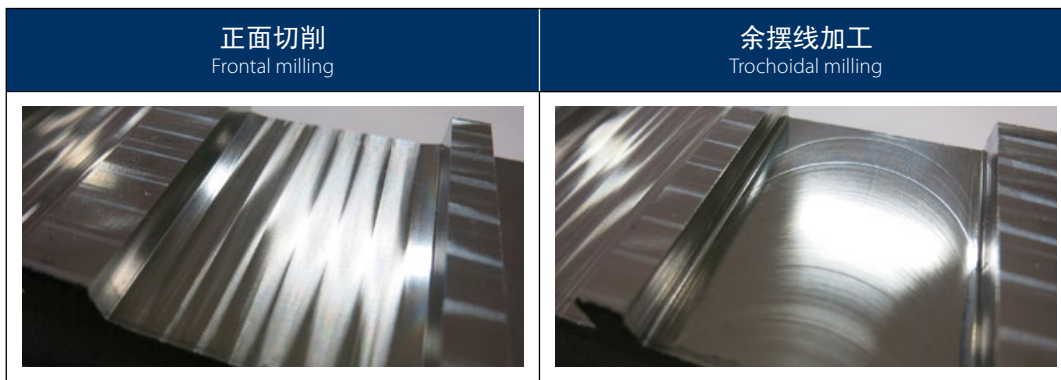
加工形状
Shape of work material

正面切削3槽、余摆线加工2槽后的磨损情况 Worn state after frontal milling 3 slots and trochoidal milling 2 slots

底刃 End cutting edge		外周刃 Peripheral cutting edge	
AM-HFC	其他公司产品 Competitor	AM-HFC	其他公司产品 Competitor

· AM-HFC底刃和外周刃均无崩刃，可继续使用。
The AM-HFC exhibits no chipping on the end cutting edge and outer peripheral cutting edge, and can continued to be used.

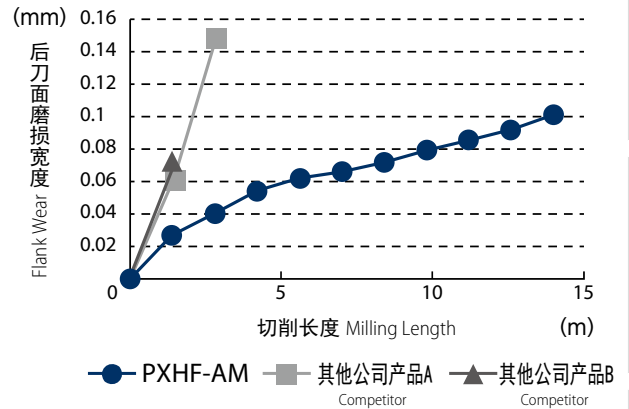
使用AM-HFC加工的底面情况 Condition of the bottom surface machined by AM-HFC



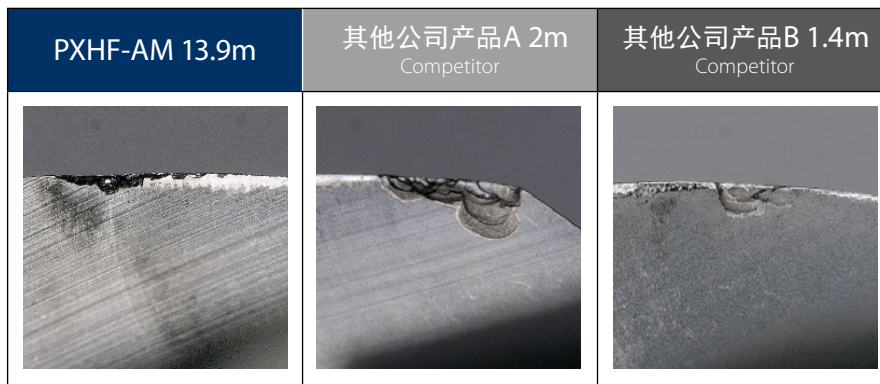
加工数据 Cutting Data

SKH51 (65HRC) 的加工案例 Machining example in SKH51 (65 HRC)

使用工具 Tool	刀头 Head :PXHF-AM160C16-06R200-O 刀杆 Holder :PXMZ-C16SS16-S100-O	其他公司产品A,B Competitor
尺寸 Size	$\phi 16$ 6刃 6FL	$\phi 16$ 4刃 4FL
加工材料 Work Material	SKH51(65HRC)	
切削方法 Milling Method	正面切削 Frontal Milling	
切削速度 Cutting Speed	60 m/min(1,200 m ^{im} ⁻¹)	
进给速度 Feed	1,440 mm/min(0.2 mm/t)	1,440 mm/min(0.3 mm/t)
切削深度 Depth of Cut	$a_p=0.3\text{mm}$ $a_e=8\text{mm}$	
切削油剂 Coolant	气冷式 Air Blow	
使用机械 Machine	立式加工中心 (BT40) Vertical Machining Center	



圆弧角R部的磨损情况 Worn state of corner R



· 在SKH51(65HRC) 的加工中，耐久性比其他公司产品高4倍以上。
Four times the durability was achieved versus the competitor products in the machining of SKH51 (65 HRC).

Inconel 718(积层材)的加工案例 Machining example in Inconel 718 (additive material)

合作：大隈株式会社
Cooperation: Okuma Corporation

使用工具 Tool	AM-HFC $\phi 10 \times R1.2$
加工材料 Work Material	Inconel 718(积层材) Inconel 718(Additive Material)
切削方法 Milling Method	正面切削 Frontal Milling
切削速度 Cutting Speed	50 m/min (1,592 m ^{im} ⁻¹)
进给速度 Feed	478 mm/min (0.05 mm/t)
切削深度 Depth of Cut	$a_p=0.5\text{mm}$ $a_e=2\text{mm}$
切削油剂 Coolant	气冷式 Air Blow
使用机械 Machine	5轴加工机 Five-axis Maching Center



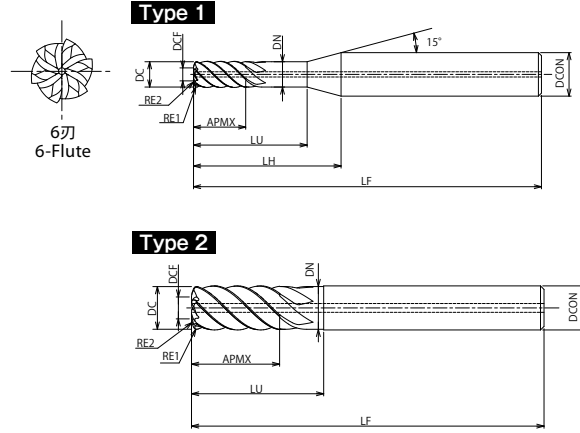
使用大隈株式会社的LASER EX进行建模·加工

Molded and machined with the LASER EX manufactured by Okuma Corporation

对于Inconel 718 (积层材) 可加工至8个工件 (总切削量: 188.8cm³以上)。

The machining of up to 8 workpieces (total cutting amount: 188.8 cm³ and more) in Inconel 718 (additive material) was made possible.

AM-HFC



CARBIDE DUROREY ±0.03 SHRINK FIT 45° SPEED FEED P18

±0.01

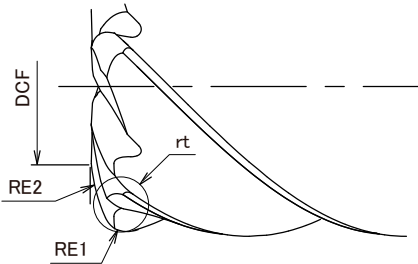
单位:mm Unit:mm

商品号 EDP No.	外径×模拟R DC×rt	有效径 DCF	圆弧角R RE1	底刃R RE2	全长 LF	刃长 APMX	颈长 LU	LH	柄径 DCON	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					刃数 ZEFP	形状 Type	库存 Stock	
												0.5°	1°	1.5°	2°	3°				
3188204	4×R0.5	2	0.4	2.5	50	8	12	15.9	6	3.8	3.73°	12.53	12.98	13.43	13.91	15	6	1	●	
3188205	5×R0.6	2.5	0.5	3	60	10	15	17	6	4.8	1.76°	15.64	16.18	16.74	-	-				
3188206	6×R0.8	3	0.6	3.5	60	12	18	-	6	5.8	-	-	-	-	-	-		2		●
3188208	8×R1	4	0.8	5	70	16	24	-	8	7.7	-	-	-	-	-					
3188210	10×R1.2	5	1	6	80	20	30	-	10	9.7	-	-	-	-	-	-		●		
3188212	12×R1.5	6	1.2	7	90	24	36	-	12	11.7	-	-	-	-	-	-				●

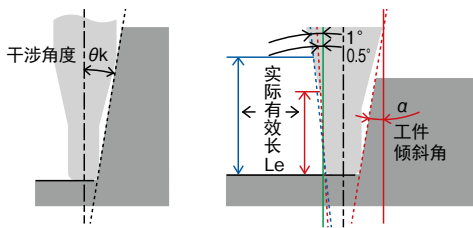
·表示说明请参阅p.8。· See p.8 for explanation of icons.

●=标准库存品 ●=Standard stock item

·圆弧角R部详情 Details of corner R



注1: 相对于工件倾斜角 α 的实际有效长 (Le)
Effective neck length (Le) depending on inclined angle (α) of workpiece



上表中实际有效长栏里无数值时
意味着加工时不存在干涉。
No numerical value means no
interference with workpiece.

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel		不锈钢 Stainless Steel	钴铬合金 Cobalt-Chromium Based Alloy (Stellite)	钛合金 Titanium Alloy	镍基合金 Ni-Based Alloy (Inconel 718)
	商品记号 Abbreviation	~45HRC	~62HRC	~70HRC	≤200HB			
AM-HFC	○	○	○	○	○	○	○	○

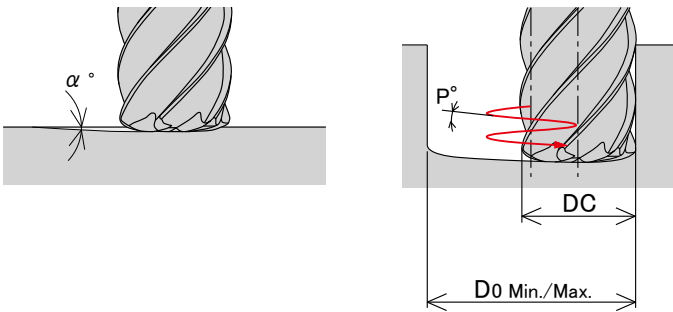
○=best

切削条件基准表 Cutting Condition

AM-HFC 高进给圆弧角型 High Feed Radius Type

· 斜面加工时的最大倾斜角 (E°) Maximum Ramping Angle(E°)

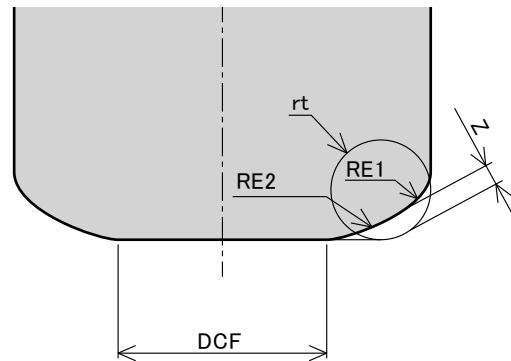
外径×模拟R DC×rt	倾斜角度 Ramping Angle E°	螺旋铣孔 Helical Milling (mm)		螺旋角度 Helical Angle P°
		最小径 D0 Min.	最大径 D0 Max.	
4×R0.5	3°	6	7	1.5°
5×R0.6		7.5	9	
6×R0.8		9	11	
8×R1		12	15	
10×R1.2		15	19	
12×R1.5		18	23	



· 程序创建上的刃尖形状定义 Edge shape definitions for the purpose of creating a program

外径 DC	模拟R rt	切削残余量 Remainder Z
4	R0.5	0.11
5	R0.6	0.15
6	R0.8	0.17
8	R1	0.22
10	R1.2	0.31
12	R1.5	0.36

加工时, 请以各模拟R的圆弧角铣刀来创建加工程序。
During machining, please program the milling paths according to the recommended simulated R (rt) respective to the individual end mill diameter.



切削条件基准表 Cutting Condition

AM-HFC 高进给圆弧角型 High Feed Radius Type

加工时, 请以各模拟R的圆弧角铣刀来创建加工程序。

During machining, please program the milling paths according to the recommended simulated R (rt) respective to the individual end mill diameter.

正面铣削 Frontal Milling

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)					
	~45HRC		~62HRC		~70HRC		≤200HB											
切削速度 Cutting Speed	90~110m/min		70~90m/min		50~70m/min		100~120m/min		90~110m/min		70~90m/min		30~50m/min					
外径×模拟R DC × rt	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)				
4 × R0.5	7,960	5,730	6,370	4,590	4,780	1,720	8,760	6,310	7,960	5,730	6,370	4,590	3,180	760				
5 × R0.6	6,370	5,730	5,100	4,590	3,820	1,720	7,010	6,310	6,370	5,730	5,100	4,590	2,550	770				
6 × R0.8	5,310	5,730	4,250	4,590	3,180	1,720	5,840	6,310	5,310	5,730	4,250	4,590	2,120	760				
8 × R1	3,980	5,730	3,180	4,580	2,390	1,720	4,380	6,310	3,980	5,730	3,180	4,580	1,590	760				
10 × R1.2	3,180	5,720	2,550	4,590	1,910	1,720	3,500	6,300	3,180	5,720	2,550	4,590	1,270	760				
12 × R1.5	2,650	5,720	2,120	4,580	1,590	1,720	2,920	6,310	2,650	5,720	2,120	4,580	1,060	760				
切削深度 Depth of Cut	<table border="1"> <tr> <td>ap</td> <td>Max:0.04D</td> </tr> <tr> <td>ae</td> <td>Max:0.5D</td> </tr> </table>														ap	Max:0.04D	ae	Max:0.5D
ap	Max:0.04D																	
ae	Max:0.5D																	

※ 啄量为0.5D以上时, 加工表面可能会产生尖端。

If the pick amount is 0.5 x D or more, cusp may occur on the machined surface.

侧铣 Side Milling

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)	
	~45HRC		~62HRC		~70HRC		≤200HB							
切削速度 Cutting Speed	80~100m/min		50~70m/min		30~50m/min		90~110m/min		80~100m/min		50~70m/min		20~40m/min	
外径×模拟R DC × rt	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)
4 × R0.5	7,170	1,200	4,780	570	3,180	230	7,960	1,340	7,170	1,200	4,780	570	2,390	230
5 × R0.6	5,730	1,200	3,820	570	2,550	230	6,370	1,340	5,730	1,200	3,820	570	1,910	230
6 × R0.8	4,780	1,200	3,180	570	2,120	230	5,310	1,340	4,780	1,200	3,180	570	1,590	230
8 × R1	3,580	1,720	2,390	800	1,590	380	3,980	1,910	3,580	1,720	2,390	800	1,190	230
10 × R1.2	2,870	1,720	1,910	800	1,270	380	3,180	1,910	2,870	1,720	1,910	800	960	230
12 × R1.5	2,390	1,720	1,590	800	1,060	380	2,650	1,910	2,390	1,720	1,590	800	800	230
切削深度 Depth of Cut	ap Max:1.5D ae Max:0.05D		ap Max:1.5D ae Max:0.02D		ap Max:1.0D ae Max:0.02D		ap Max:1.5D ae Max:0.05D				ap Max:1.5D ae Max:0.02D			

1. 推荐使用本工具进行增材加工(金属增材)、模具堆焊部表层的粗加工。
2. 请使用高刚性, 高精度的机械、刀柄。
3. 上表的值为参考值。请参考上表并根据实际加工环境设置切削条件。
4. 比推荐条件切深大的情况下, 请下调进给速度。
5. 上表为刀具悬伸量为4D以下的参考值。刀具悬伸长度较长的情况下, 易产生振动, 请参考系数, 适当调整转速、进给速度和切削深度。
6. 请使用适合加工材料、发烟性少的切削油剂。
7. 干式加工情况下, 为了不造成切屑阻塞, 请使用气冷除去切屑。
8. 推荐使用水溶性切削油剂加工不锈钢、钴铬基合金、钛合金和镍基合金。
9. 请将工具的振动精度控制在最小限度下使用。
10. 变动圆弧角部等的切削负荷时, 请下降转速。

1. This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
2. Please use machines and holders that are rigid and highly accurate.
3. The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
4. Please reduce the feed rate when the depth of cut is greater than specified.
5. The above table is a guide when the amount of protrusion of the tool is 4 x D or less. If the amount of protrusion is large, chattering is likely to occur, so adjust the rotation speed, feed rate and depth of cut with reference to the coefficients.
6. Please use a suitable fluid with high smoke retardant properties.
7. During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
8. Please use water-soluble coolant when machining stainless steel, cobalt-chromium alloy, titanium alloy, and Ni-based alloy.
9. Tool runout should be kept to a minimum for maximum accuracy.
10. When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.

刀具悬伸量系数(%) Tool extension coefficients

刀具悬伸量 Overhang Length	切削速度 Cutting Speed	轴向切入量 ap	每刃进给量 fz
L/D ≤ 4	100%	100%	100%
4 < L/D ≤ 5	90%	75%	80%
5 < L/D ≤ 6	80%	50%	60%

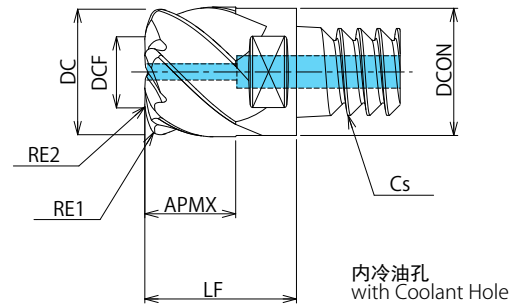
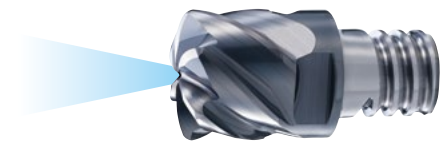


增材制造用可换头式铣刀PXM

Exchangeable Head End Mill PXM for Additive Manufacturing

NEW

PXHF-AM



SPEED FEED
P25

内冷油孔 with Coolant Hole

PXHF-AM高进给圆弧角型 High Feed Radius Type

商品号 EDP No.	名称 Designation	外径 DC	模拟R rt	有效径 DCF	刃数 ZEPF	圆弧角 R RE1	底刃R RE2	刃长 APMX	全长 LF	颈径 DCON	螺旋角 FHA	安装规格 Cs	材质 Grades
7830377	PXHF-AM120C12-06R150-0	12	1.5	6	6	1.2	7	8.4	14.4	11.7	45°	C12	XP6703
7830378	PXHF-AM160C16-06R200-0	16	2	8		1.6	9.5	11.2	18.7	15.7	45°	C16	XP6703
7830379	PXHF-AM200C20-06R250-0	20	2.5	10		2	12	14	21.5	19.6	45°	C20	XP6703

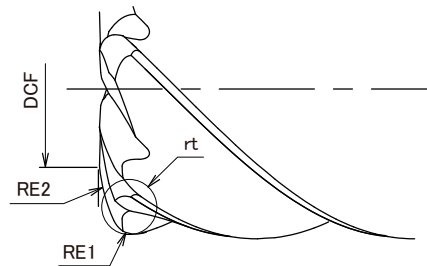
·标识说明请参阅p.8。·See p.8 for explanation of icons.

库存种类全部为C（标准库存品）。 Stock are categorized as C (Standard stock item)

1.使用内部给油时，请使用带内冷油孔的刀头和刀杆。
有关刀杆的详细信息，请参阅p.21· p.22。

1. For the use of internal coolant, please use the appropriate head and shank holders with oil hole. Refer to pages 21 and 22 for details on shank holders.

·圆弧角R详情 Details of corner R



加工数据
球头型 Ball Type
AM-EBT
圆弧角型 Radius Type
AM-CRE
高进给圆弧角型 High Feed Radius Type
AM-HFC
可换头式 Exchangeable Head
PXHF-AM



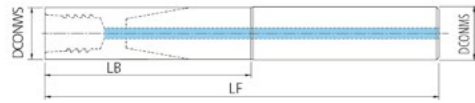
PXM用 直柄刀杆

Straight Shank Holder for PXM

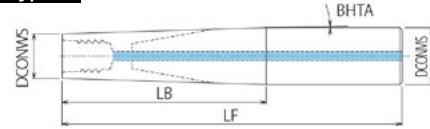
PXMZ



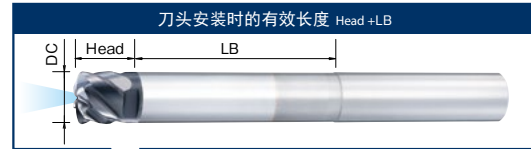
Type 3 内冷油孔 with Coolant Hole



Type 4 内冷油孔 with Coolant Hole



内冷油孔 with Coolant Hole
硬质合金刀杆 Carbide Shank



单位 :mm Unit:mm

商品号 EDP No.	名称 Designation	颈径 DCONWS	柄径 DCONMS	角度 BHTA	全长 LF	颈长 LB	刀头安装时的有效长度 Head + LB	安装规格 Cs	形状 Type	
7803511	PXMZ-C12SS12-S075CS-O	11.7	12	0°	75	25	39.4	C12	3	35,300
7803512	PXMZ-C12SS12-L100CS-O		12	0°	100	46.3	60.7		3	39,300
7803513	PXMZ-C12SS12-L115CS-O		12	0°	115	65	79.4		3	45,000
7803514	PXMZ-C12TP16-LL135CS-O		16	1.3°	135	85	99.4		4	68,400
7803515	PXMZ-C12TP16-LL150CS-O		16	1°	150	85.6	100		4	69,500
7803521	PXMZ-C16SS16-S090CS-O	15.7	16	0°	90	40	58.7	C16	3	48,600
7803522	PXMZ-C16SS16-L130CS-O		16	0°	130	62	80.7		3	60,500
7803523	PXMZ-C16SS16-L135CS-O		16	0°	135	85	103.7		3	61,600
7803524	PXMZ-C16TP20-LL165CS-O		20	1°	165	115	133.7		4	92,500
7803525	PXMZ-C16TP20-LL180CS-O		20	1°	180	116.6	135.3		4	94,200
7803531	PXMZ-C20SS20-S090CS-O	19.6	20	0°	90	40	61.5	C20	3	59,300
7803532	PXMZ-C20SS20-L150CS-O		20	0°	150	79.3	100.8		3	88,000
7803533	PXMZ-C20SS20-L180CS-O		20	0°	180	110	131.5		3	89,900
7803534	PXMZ-C20TP25-LL200CS-O		25	1°	200	140	161.5		4	115,000
7803535	PXMZ-C20TP25-LL210CS-O		25	1°	210	145	166.5		4	116,000

- 1.使用内部给油时, 请使用带内冷油孔的刀头和刀杆。
- 2.请适当调整冷却喷嘴的位置, 以免切屑卷曲缠绕。

库存种类全部为C (标准库存品)。 Stock are categorized as C (Standard stock item).

1. For the use of internal coolant, please use the appropriate head and shank holders with oil hole.
2. Adjust the position of the coolant nozzles accordingly so that the chips do not get tangled.



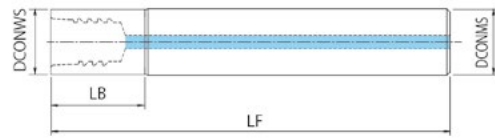
PXM用 直柄刀杆

Straight Shank Holder for PXM

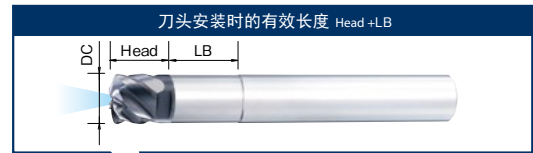
PXMZ



Type 3 内冷油孔 with Coolant Hole



内冷油孔 with Coolant Hole
钢制刀杆 Steel Shank



单位 :mm Unit:mm

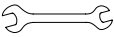
商品号 EDP No.	名称 Designation	颈径 DCONWS	柄径 DCONMS	角度 BHTA	全长 LF	颈长 LB	刀头安装时的有效长度 Head + LB	安装规格 Cs	形状 Type
7803501	PXMZ-C12SS12-S100-O	11.7	12	0°	100	18	32.4	C12	3
7803502	PXMZ-C16SS16-S100-O	15.7	16	0°	100	23	41.7	C16	3
7803503	PXMZ-C20SS20-S120-O	19.6	20	0°	120	28	49.5	C20	3

库存种类全部为C（标准库存品）。 Stock are categorized as C (Standard stock item).

1. 使用内部给油时，请使用带内冷油孔的刀头和刀杆。
2. 请适当调整冷却喷嘴的位置，以免切屑卷曲缠绕。

1. For the use of internal coolant, please use the appropriate head and shank holders with oil hole.
2. Adjust the position of the coolant nozzles accordingly so that the chips do not get tangled.

零件 Accessories

	商品号 EDP No.	名称 Designation	适用刀头外径 Applicable Head Dia.	安装规格 Cs	推荐安装扭矩 Recommended Tightening Torque
 扳手 Spanner	7801890	PXMP8-10	φ12	C12	12N·m
	7801891	PXMP13-16	φ16	C16	30N·m
			φ20	C20	50N·m

PXM 专用扳手，扳手请另购。

These spanner are specifically for PXM, and sold separately from the cutters.

1. 使用注意事项请参阅p.28。
2. 安装扭矩请参考上表。
3. 专用扭矩扳手请咨询本公司销售人员。

1. Please refer to p.28 for cautions during use.
2. Please refer to the table above for tightening torque.
3. Contact your nearest OSG sales representative for details of our dedicated adjustable torque wrench for tightening inserts.

PXMC

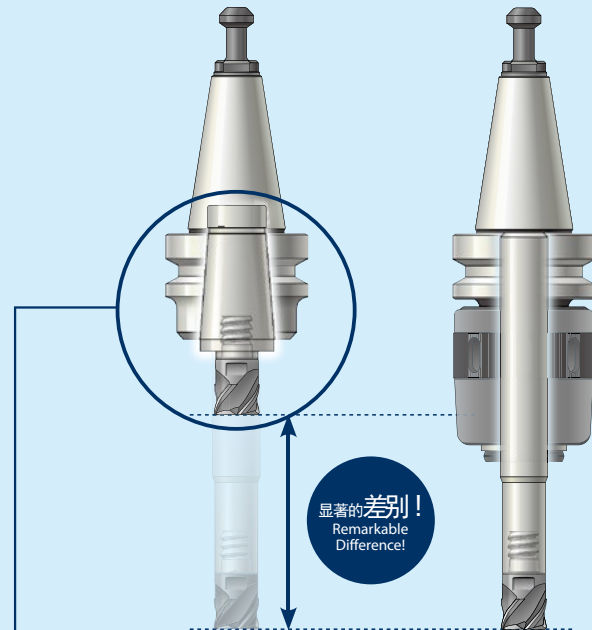
PXMC 夹具特点

PXMC Collet Features

- 即使是小型加工中心也能取得惊人的排屑性
Powerful chip evacuation even on small machining center
- 实现短悬长，刚性UP与理想的回转平衡性
The reduction of overhang length improves rigidity and rotational balance
- 丰富的刀头品种
 - 适用于钢、不锈钢、铝
 - 从粗加工至精加工的广泛加工范围

A wide variety of exchangeable heads
· Suitable for steel, stainless steel and aluminum
· Wide processing range from roughing to finishing
- 与一体式刀柄相比，发生问题时只需更换夹具，具有超高性价比
Greater cost performance compared to monoblock type holders, only need to change the collet in case of trouble.

PXMC 超短型 PXMC Collet Extra Short Type 以往的组合 Conventional Combination

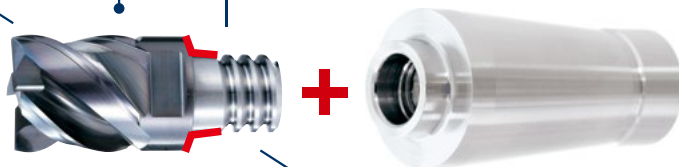


PXM 刀头特点

PXM Exchangeable Head Features

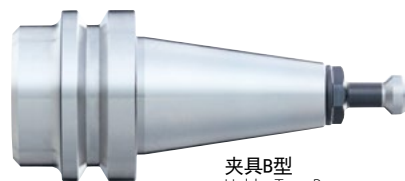
活用整体铣刀的设计·实绩·专业技术的刃形
·可对应各式各样的加工
All the knowledge and know-how acquired by designing solid carbide end mills are found in these exchangeable heads.
·Various types are available to meet various machining methods.

端面+锥形=双面固定
·确保高刚性与精度
·外周刃的振动精度：0.015mm以下
·刀头交换精度（轴向）：±0.03mm
End Face + Taper = Double Face Clamping
·High rigidity and accuracy of tightening
·High precision of run out ≤ 0.015mm
·High head replacing accuracy = ± 0.03mm

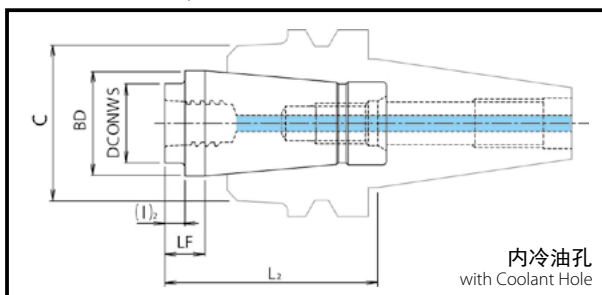


采用偏梯形螺纹
·刀头的装卸更方便
·刀具交换时间缩短
Applying buttress screw makes easy and reduces time to desorb heads



短型
Short超短型
Extra Short夹具B型
Holder Type B

形状尺寸表 Specification



单位:mm Unit:mm

类型 Type	商品号 EDP No.	名称 Designation	颈径 DCONWS	BD	LF	颈长 ℓ2	刀头安装时的有效长度 Head+ℓ2	安装规格 Cs
超短型 Extra Short	7834001	PXMC-C1205	11.7	26	10.5	5	19.4	C12
	7834002	PXMC-C1605	15.7	26	10.5	5	23.7	C16
	7834003	PXMC-C2005	19.6	26	10.5	5	26.5	C20
短型 Short	7834011	PXMC-C1230	11.7	26	35.5	30	44.4	C12
	7834012	PXMC-C1630	15.7	26	35.5	30	48.7	C16
	7834013	PXMC-C2030	19.6	26	35.5	30	51.5	C20

1. PXMC是「OSG PHOENIX PXM系列」刀头专用夹具。

库存种类全部为C(标准库存品)。 Stock are categorized as C (Standard stock item).

1. The PXMC exchangeable head is designed specially for the "OSG PHOENIX PXM" series.

PXMC 对应HYPRO热胀刀柄 产品一览 Product Listing of PXMC corresponding to the HYPRO Shrink System

单位:mm Unit:mm

类型 Type	商品号 EDP No.	名称 Designation	C	L2	
				超短型 Extra Short	短型 Short
夹具B型 Holder Type B	8910000	BT30-SLK12-35 P30T-1(MAS1)*	38	45.5	70.5
	8910001	BT30-SLK12-35 P30T-2(MAS2)*	38	45.5	70.5
	8910002	BT40-SLK12-45	38	55.5	80.5
	8910003	BT40-SLK12-75	38	85.5	110.5
	8910005	A63-SLK12-75	38	85.5	110.5
	8910006	A63-SLK12-135	38	145.5	170.5

1. 价格请咨询我司销售人员。

2. PXMC 夹具可与HYPRO 热胀刀柄互换。*仅BT30刀柄带有牵引螺栓。

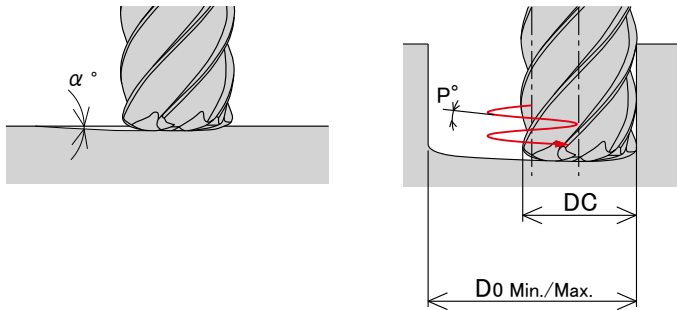
1. Contact your local OSG sales representative for information regarding pricing.
2. The PXMC collet is compatible with the HYPRO Shrink Collet System.
* Only BT30 holders come with a pull stud bolt.

切削条件基准表 Cutting Condition

■ PXHF-AM 高进给圆弧角型 Exchangeable Head End Mill High Feed Radius Type PXMZ直柄刀杆/PXMC夹具通用 For both PXMZ straight shank holder / PXMC collet

· 斜面加工时的最大倾斜角 (E°) Maximum Ramping Angle(E°)

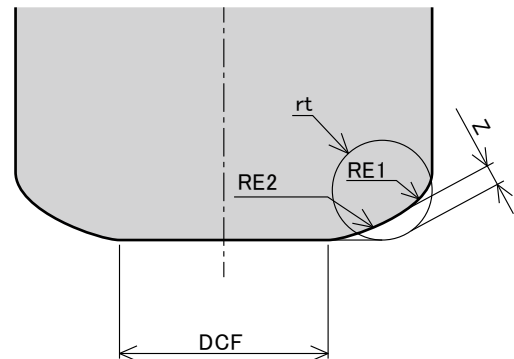
名称 Designation	倾斜角度 Ramping Angle E°	螺旋铣孔 Helical Milling (mm)		螺旋角度 Helical Angle P°
		最小径 D0 Min.	最大径 D0 Max.	
PXHF-AM120C12-06R150-O	3°	18	23	1.5°
PXHF-AM160C16-06R200-O		24	31	
PXHF-AM200C20-06R250-O		30	39	



· 程序创建上的刃尖形状定义 Edge shape definitions for the purpose of creating a program

名称 Designation	模拟R rt	切削残余量 Remainder Z
PXHF-AM120C12-06R150-O	R1.5	0.36
PXHF-AM160C16-06R200-O	R2	0.47
PXHF-AM200C20-06R250-O	R2.5	0.59

加工时，请以各模拟R的圆弧角铣刀来创建加工程序。
 During machining, please program the milling paths according to the recommended simulated R (rt) respective to the individual end mill diameter.



切削条件基准表 Cutting Condition

PXHF-AM 高进给圆弧角型 Exchangeable Head End Mill High Feed Radius Type PXMZ直柄刀杆/PXMC夹具通用 For both PXMZ straight shank holder / PXMC collet

加工时, 请以各模拟R的圆弧角铣刀来创建加工程序。
During machining, please program the milling paths according to the recommended simulated R (rt) respective to the individual end mill diameter.

正面铣削 Frontal Milling

$L/D \leq 4$

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)	
	~45HRC		~62HRC		~70HRC		≤200HB							
切削速度 Cutting Speed	110~130m/min		90~110m/min		65~85m/min		125~145m/min		110~130m/min		90~110m/min		30~50m/min	
外径 DC	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)
12	3,180	5,270	2,650	4,390	1,990	1,580	3,580	5,930	3,180	5,270	2,650	4,390	1,060	760
16	2,390	5,280	1,990	4,390	1,490	1,570	2,690	5,940	2,390	5,280	1,990	4,390	800	770
20	1,910	5,270	1,590	4,390	1,190	1,570	2,150	5,930	1,910	5,270	1,590	4,390	640	770
切削深度 Depth of Cut							a_p Max:0.04D a_e Max:0.5D							

$4 < L/D \leq 5$

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)	
	~45HRC		~62HRC		~70HRC		≤200HB							
切削速度 Cutting Speed	100~120m/min		80~100m/min		60~80m/min		115~135m/min		100~120m/min		80~100m/min		25~45m/min	
外径 DC	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)
12	2,920	3,780	2,390	3,100	1,860	1,210	3,320	4,300	2,920	3,780	2,390	3,100	930	540
16	2,190	3,780	1,790	3,090	1,390	1,200	2,490	4,300	2,190	3,780	1,790	3,090	700	540
20	1,750	3,780	1,430	3,090	1,110	1,200	1,990	4,300	1,750	3,780	1,430	3,090	560	540
切削深度 Depth of Cut							a_p Max:0.03D a_e Max:0.5D							

$5 < L/D \leq 6$

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)	
	~45HRC		~62HRC		~70HRC		≤200HB							
切削速度 Cutting Speed	90~110m/min		70~90m/min		50~70m/min		100~120m/min		90~110m/min		70~90m/min		20~40m/min	
外径 DC	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)
12	2,650	2,670	2,120	2,140	1,590	800	2,920	2,940	2,650	2,670	2,120	2,140	800	350
16	1,990	2,670	1,590	2,140	1,190	800	2,190	2,940	1,990	2,670	1,590	2,140	600	350
20	1,590	2,670	1,270	2,130	960	810	1,750	2,940	1,590	2,670	1,270	2,130	480	350
切削深度 Depth of Cut							a_p Max:0.02D a_e Max:0.5D							

1. 推荐使用本工具进行增材加工(金属增材)、模具堆焊部表层的粗加工。
2. 请使用高刚性, 高精度的机械、刀柄。
3. 上表的值为参考值。请参考上表并根据实际加工环境设置切削条件。
4. 比推荐条件切深量大的情况下, 请下调进给速度。
5. 刀具悬伸长度较长的情况下, 易产生振动, 请适当调整转速、进给速度和切削深度。
6. 请使用适合加工材料、发烟性少的切削油剂。
7. 干式加工情况下, 为了不造成屑阻塞, 请使用气冷除去切屑。
8. 推荐使用水溶性切削油剂加工不锈钢、钴铬基合金、钛合金和镍基合金。
9. 请将工具的振动精度控制在最小限度下使用。
10. 变动圆弧角部等的切削负荷时, 请下降转速。
11. 啄铣量为0.5D以上时, 加工表面可能会产生尖端。

1. This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
2. Please use machines and holders that are rigid and highly accurate.
3. The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
4. Please reduce the feed rate when the depth of cut is greater than specified.
5. Please adjust the cutting condition when the overhang length is longer.
6. Please use a suitable fluid with high smoke retardant properties.
7. During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
8. Please use water-soluble coolant when machining stainless steel, cobalt-chromium alloy, titanium alloy, and Ni-based alloy.
9. Tool runout should be kept to a minimum for maximum accuracy.
10. When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.
11. If the pick amount is 0.5 x D or more, cusp may occur on the machined surface.



切削条件基准表 Cutting Condition

PXHF-AM 高进给圆弧角型 Exchangeable Head End Mill High Feed Radius Type PXMZ直柄刀杆/PXMC夹具通用 For both PXMZ straight shank holder / PXMC collet

加工时，请以各模拟R的圆弧角铣刀来创建加工程序。

During machining, please program the milling paths according to the recommended simulated R (rt) respective to the individual end mill diameter.

侧铣 Side Milling

加工材料 Work Material	调质钢·预硬钢 Hardened Steel·Prehardened Steel		调质钢 Hardened Steel				不锈钢 Stainless Steel		钴铬基合金 Cobalt-Chromium Based Alloy (Stellite)		钛合金 Titanium Alloy		镍基合金 Ni-Based Alloy (Inconel 718)	
	~45HRC		~62HRC		~70HRC		≤200HB							
切削速度 Cutting Speed	80~100m/min		50~70m/min		50~70m/min		100~120m/min		90~110m/min		70~90m/min		30~50m/min	
外径 DC	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)	转速 Speed(min ⁻¹)	进给速度 Feed(mm/min)
12	2,390	1,200	1,590	570	1,060	230	2,650	1,340	2,390	1,200	1,590	570	800	230
16	1,790	1,200	1,190	570	800	230	1,990	1,340	1,790	1,200	1,190	570	600	230
20	1,430	1,200	960	580	640	230	1,590	1,340	1,430	1,200	960	580	480	230
切削深度 Depth of Cut	ap Max:0.5D ae Max:0.05D		ap Max:0.5D ae Max:0.02D				ap Max:0.5D ae Max:0.05D				ap Max:0.5D ae Max:0.02D			

1. 推荐使用本工具进行增材加工（金属增材）、模具堆焊部表层的粗加工。
2. 请使用高刚性，高精度的机械、刀柄。
3. 上表的值为参考值。请参考上表并根据实际加工环境设置切削条件。
4. 比推荐条件切深大的情况下，请下调进给速度。
5. 上表为刀具悬伸量为4D以下时的参考值。刀具悬伸长度较长的情况下，易产生振动，请适当调整转速、进给速度和切削深度。
6. 请使用适合加工材料、发烟性少的切削油剂。
7. 干式加工情况下，为了不造成切屑阻塞，请使用气冷除去切屑。
8. 推荐使用水溶性切削油剂加工不锈钢、钴铬基合金、钛合金和镍基合金。
9. 请将工具的振动精度控制在最小限度下使用。
10. 变动圆弧角部等的切削负荷时，请下降转速。

1. This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
2. Please use machines and holders that are rigid and highly accurate.
3. The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
4. Please reduce the feed rate when the depth of cut is greater than specified.
5. The above table is a guide when the amount of protrusion of the tool is 4 x D or less. If the amount of protrusion is large, chattering is likely to occur, so adjust the rotation speed, feed rate and depth of cut.
6. Please use a suitable fluid with high smoke retardant properties.
7. During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
8. Please use water-soluble coolant when machining stainless steel, cobalt-chromium alloy, titanium alloy, and Ni-based alloy.
9. Tool runout should be kept to a minimum for maximum accuracy.
10. When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.





① 清扫

Cleaning

清除刀头、刀杆安装部的垃圾及污垢。
Remove dirt and chips from the connecting thread and shank



② 临时拧紧

Initial Tightening

用手拧紧
Tighten by hand



隙間あり
With gap



③ 最终拧紧

Final Tightening

用专用扳手拧紧
Tighten with a spanner wrench



隙間なし◎
Without gap

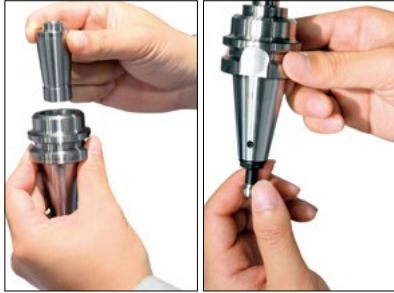
④ 确认

Confirmation

确认没有间隙
Confirm that there is no gap

使用上的注意
Cautions during use

- 安装刀头时请使用PXM 专用扳手。（非专用扳手不能使用）。
- 推荐安装扭矩请参考p.22。
- 刀头与刀杆端面安装时，请确认无间隙。
- 安装部脱油会使得安装更加困难，有可能达不到端面。所以请勿脱油。
- 请将扳手插入刀头凹槽处，慢慢回转。
- Only use the spanner wrenches that are designed specifically for the PXM (p.22) for attaching PXM heads .
- Please do not use alternative spanner wrenches sold on the market as a replacement.
- Please refer to p.22 for tightening torque.
- Please tighten until the head and the shank holder faces meet. Confirm that there is no gap.
- Degreasing the connecting thread may result in over tightening or a possible separation of the faces. Please do not degrease.
- Please make sure that the spanner wrench is inserted properly and turn it slowly during use.



①临时拧紧 (BT30) Initial Tightening

清扫刀柄的安装部分，并插入。
转动牵引螺栓，使其临时拧紧。
※BT30以外的请参考下面。
Make sure the fastening portion of the collet is clean then insert it into the holder. Turn the pull stud to tighten.
*For models other than BT30 please refer to the instructions below.



②最终拧紧 Final Tightening

用扳手拧紧。
Tighten with a spanner wrench



③清扫 Cleaning

清除刀头、夹头安装部的垃圾及污垢。
Remove dirt and chips from the connecting thread and collet



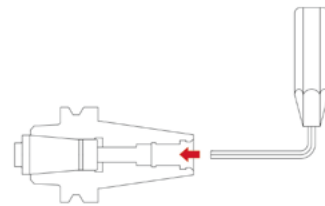
④安装刀头 Mounting the Head

用手拧紧后，再用PXM 专用扳手拧紧。
After screwing the head in by hand, use the PXM spanner wrench to tighten.

※BT30以外的安装顺序 Mounting procedure for holders other than BT30

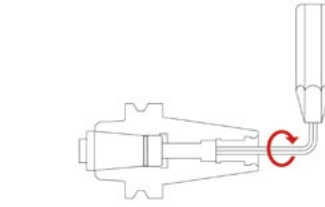
①在螺纹六角部插入六角扳手。

※有孔的牵引螺栓 (φ6以上) 时，可将牵引螺栓安装着进行操作。
Insert the hexagon socket wrench into the pull screw hexagonal section.
*For pull studs with holes (φ 6 or above), it is operational with the stud being attached.



②为防止夹头旋转，用手握住夹头顶端处，将扳手向右旋转，按指定扭矩拧紧。

※推荐安装扭矩：18N·m
To prevent the collet from rotating, support the tip of the collet by hand, tighten with the wrench by turning to the right, then fastening to the required torque.
*Recommended tightening torque: 18N·m



使用上的注意
Cautions during use

- 安装刀头时请使用PXM 专用扳手。(非专用扳手不能使用)。
- 推荐安装扭矩请参考p.22。
- 刀头与夹头端面安装时，请确认无间隙。
- 安装部脱油金使得安装更加困难，有可能达不到端面。所以请勿脱油。
- 请将扳手插入刀头凹槽处，慢慢回转。

- Only use the spanner wrenches that are designed specifically for the PXM (p.22) for attaching PXM heads . Please do not use alternative spanner wrenches sold on the market as a replacement.
- Please refer to p.22 for tightening torque.
- Please tighten until the head and the collet faces meet. Confirm that there is no gap.
- Degreasing the connecting thread may result in over tightening or a possible separation of the faces. Please do not degrease.
- Please make sure that the spanner wrench is inserted properly and turn it slowly during use.

丰富的刀头品种！可换头式铣刀PXM

Abundant exchangeable milling heads! Exchangeable head end mill PXM

通过发挥与整体型相同加工性能的刀头部和刀头部的更换，实现刀体部的通用性，从而降低加工成本。
丰富的刀头品种对应多种多样的加工场景。

The PXM is an exchangeable head end mill series with the same high performance of a solid tool and the cost efficiency of an indexable tool. A single exchangeable head body is able to accommodate a wide range of exchangeable heads to meet various application needs.

形状类型
Available shapes

- 平头型
Square Type
- 粗加工型
Roughing Type
- 圆弧角型
Corner Radius Type
- 球头型
Ball Type

详情请参阅OSG PHOENIX 样本。

Please see OSG PHOENIX Catalog for details.





DUROCESS

DURO

针对高硬度加工

PROCESS

使用一切工具·工序

SUCCESS

提供成功的整体解决方案





shaping your dreams

欧士机（上海）精密工具有限公司

OSG Corporation

欧士机（上海）本部

地址：上海市长宁区长宁路1133号 长宁来福士广场T1办公楼10层1003-07单元
电话：021-52552588； 传真：021-58883300； 邮编：200051

欧士机（上海）无锡事务所

地址：无锡市湖滨壹号花园1-2鑫湖大厦1004室
电话：0510-82739271； 传真：0510-82739220； 邮编：214074

欧士机（上海）芜湖事务所

地址：芜湖市镜湖区汇金广场B座1801室
电话：0553-5868160； 传真：0553-5868190； 邮编：241000

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电话：0512-62388327； 传真：0512-62388320； 邮编：215028

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电话：0571-82757757； 传真：0571-82757767； 邮编：311215

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地址：北京市朝阳区建国门外大街19号国际大厦A座18-05C
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电话：186-3092-1318； 邮编：450016

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地址：西安市未央区凤城四路西安国际企业中心A座2002室
电话：029-88860594； 传真：029-86182003； 邮编：710018

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电话：0411-87655185； 传真：0411-87655186； 邮编：116600

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电话：0532-66775787 传真：0532-66775797 邮编：266034

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地址：沈阳市铁西区 兴华北街55号 华润置地广场南N号楼32-04
电话：024-22852762 传真：024-22852763 邮编：110021

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地址：长春市高新区荷园路安联国际A座804号
电话：0431-89388499； 传真：0431-89230366； 邮编：130012

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地址：成都市武侯区人民南路四段27号商鼎国际2栋1单元803号
电话：028-65783992； 传真：028-85005292； 邮编：610042

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地址：重庆市渝北区龙溪街道金山路18号中渝都会首站4幢12-1
电话：023-67136872； 邮编：401120

欧士机（上海）武汉事务所

地址：武汉市江岸区三阳路新长江国际B1座2505室
电话：027-85557360； 传真：027-85557350； 邮编：430010

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