

ADVANCED
COMPOSITE
SOLUTION

[复合材料加工用工具]

Vol.4



OSG



分层状态的孔
Delamination

Our Advantage

复合材料是指以两种以上的成分构成材料的总称。其成分分为母材和强化基础材料。将这些材料组合起来，能做成重量很轻、强度很高等具有优异特征的复合材料。在母材上用的是金属陶瓷、铝、纯钛以及镁等金属或环氧树脂、石炭酸(酚)、树脂板等高分子材料。在强化基础材料上用的主要材料也是同样的，以纤维形状、球形状或薄片形状嵌入在母材料里。这些复合材料以单层或重叠层(铺层)状态，用于航空产业等各种各样的行业里使用。一般来说，复合材料具有着优异特征，可另一方面，在切削加工时存在的问题也不少，比如工具磨损很快、容易发生毛刺、重叠层的剥离等，存在着与原来的金属材料的加工不同的难度。OSG作为复合材料加工工具的龙头公司，拥有着金刚石涂层、PCD工具、金刚石电着工具等丰富的生产销售的经验，这些丰富经验能满足顾客的需求。

"Composite materials" is the general term for material made from two or more components. The components are basically a base material and a reinforcing material, and combining these creates a composite material with superior characteristics such as light weight and high strength. Ceramics or metals such as aluminum, titanium or magnesium, or possibly polymers such as epoxy, phenol or polycarbonate are used as base materials. The same materials are typically used as reinforcing materials, and are added to the base material in fiber, globular or sometimes flake form. Composite material comes in both single-layer and multi-layer. What started in the aerospace industry is now used in a wide variety of applications. Generally composite materials have excellent characteristics, but on the other hand they present difficulties when machining that traditional metals do not, such as accelerated tool wear, occurrence of burrs and delamination of the multi-layered structure. At OSG, as the leading company making cutting tools for composite materials, from diamond coated tools to PCD tools to diamond electro-deposition tools, we put our know how and experience in a wide variety of fields to use to satisfy the demands of our customers.

铣削加工 Milling

**高能率型：
中(精)加工用交叉形刃
铣刀**

High efficient type:
Fine-cross-nick router

电镀金刚石铣刀

Electro-deposition
diamond router

**金刚石涂层
人字形刃铣刀**

Diamond coated
herringbone cutter

交叉形刃铣刀

Cross-flute router

可转位球头铣刀&金刚石涂层刀片

Indexable ball end mill & Diamond coated insert

人字形刃铣刀 Herringbone Cutter

PCD铣刀

PCD End mill

6刃

Flute

2刃

Flute

通用型精加工用铣刀

Multiple flutes finishing router

面铣刀 & PCD刀片

Face milling cutter & PCD insert

高能率型 精加工用交叉型刃铣刀

High efficient type: Fine-cross-nick router

世界领先! 金刚石涂层也能进行脱膜和再涂层。

Even the Ultra Fine Crystal Diamond Coating can be removed and recoated.

超微结晶金刚石涂层

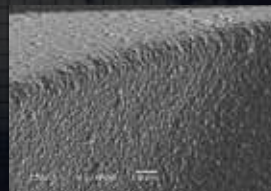
Ultra Fine Crystal Diamond Coating

OSG的金刚石涂层由于独家技术来实现超微结晶化，以此同时能进行脱膜。

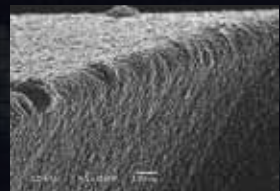
我们能接受再研磨以及再涂层。

OSG's original diamond coating technology achieves ultra-fine crystallization.

It is also able to be removed, allowing us to offer regrinding and recoating services.



超微结晶金刚石涂层
Ultra Fine Crystal Diamond Coating



其他公司金刚石涂层
Competitor's Diamond Coating

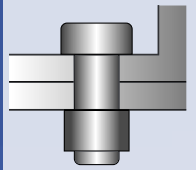
钻孔加工 Drilling

入口、出口两用:

三角钻头

D-STAD (PAT.P.)

For outlets and inlets: triple-angle drill



螺旋槽PCD双锋角钻头

PCD-DAD

For outlets: high helix, double-angle drill

理想状态的孔型

A good quality hole

施有金刚石涂层, 刃角锋利, 有效防止分层现象。

The diamond coating and sharp cutting edges prevent delamination.



其他公司产品加工出的不符合要求的孔形

A poor quality hole, drilled by a competitor

由于钻头选型及加工条件不符合导致的加工孔发生分层剥落现象。

Delamination is present around the drilled hole.



电镀金刚石钻头

Electroplated Diamond Drill

可交换刀头式铰刀

Head exchange reamer

出口用: 强力形双角钻头 (PAT.P)

D-DAD

For Outlets: high helix, Double-angle drill

硬质合金扩孔钻

Carbide tipped core drill

焊接式PCD倒角刀

PCD brazed Countersink

组合式 钻倒角刀

Combination type: drill countersink

铣圆 Circular Interpolation

在加工中心及轨道式专机中使用, 采用行星式加工或螺旋式切削孔加工的专用工具。在CFRP/Ti、CFRP/Al等多层复合材料的加工中, 可抑制金属材料部分的扩孔, 溶屑, 毛刺以及CFRP材料部分的缩孔, 空的圆筒度得以保证。

This is a dedicated tool for hole machining using circular interpolation on machining centers or specialized machines for circular milling. On stacked materials such as CFRP/Ti or CFRP/Al, a higher level of hole cylindricity is achieved by eliminating hole expansion, chipping and burr formation in both the metallic and CFRP portions, and hole shrinkage in the CFRP portions.

CFRP β -Ti 的多层复合材料
Stacked Material (CFRP/ β -Ti)



铣圆刀

Circular milling cutter

铣削加工 Milling

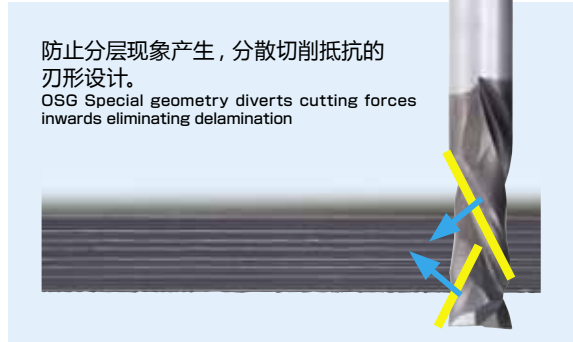
人字形刃铣刀 2刃

Herringbone Cutter Two Flutes

为了防止分层现象，采用能够分散加工时产生的作用力的人字形刃设计的CFRP专用新型铣刀。表面施有OSG专利技术的超微结晶金刚石涂层，保证刀具刃口锋利，加工面粗糙度良好，延长了工具的使用寿命。

Our new end mill series for CFRP incorporates a herringbone flute design which diverts cutting forces inwards eliminating delamination. In addition our patented diamond coating with it's finer grain structure allows for a sharper cutting edge which in turn helps prolong tool life and produce a superb surface finish.

工具径 Tool Dia	3/8" (φ9.525mm)
加工材料 Work Material	CFRP
切削方法 Milling Method	Routing
切削速度 Milling Speed	96m/min(3,200min ⁻¹)
进给速度 Feed	348mm/min(0.1mm/rev)
切削油剂 Coolant	干式 Dry
使用设备 Machine	立式加工中心 Vertical Machining Center
工具寿命 Tool Life	溶着 Resin Welding



	切削长度 Milling Length (m)		
	5	10	15
人字形刃铣刀 Herringbone Cutter	11.2m		
其他公司产品 Competitor	3.8m		

钻孔加工 Drilling

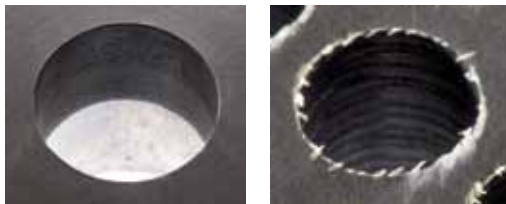
大螺旋形双角钻头(PAT.P.)

High Helix, Double-angle Drill

复合材料的孔加工今后会逐渐增多。，锋利、低抵抗的钻头形状设计配合最新的超微结晶金刚石涂层，OSG 针对 CFRP 材料提供了最佳的刀具。

The drilling of composite materials is becoming more common. Our CFRP drills' combination of sharpness, low-resistance design, and outstanding diamond coating offers maximum performance.

孔出口比较 Comparison with drill hole



金刚石涂层钻头
Diamond Coated Drill

其他公司
Competitor

工具径 Tool Dia	.2510" (φ6.375mm)
加工材料 Work Material	CFRP
切削方法 Milling Method	60m/min(3,000min ⁻¹)
切削速度 Milling Speed	228mm/min(0.076mm/rev)
进给速度 Feed	17.1mm(5.7mm的三张复合)(通孔) 5.7mm Depth Three-layer Stack(Through)
切削油剂 Coolant	干式 Dry
使用设备 Machine	孔加工专用机 Special Machine for Drilling
工具寿命 Tool Life	分层 Delamination



受注品对应
Special Order Item

客户事例 Customer Data

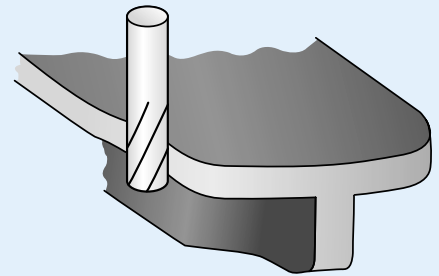
	加工孔数 Number of holes (holes)							
	50	100	150	200	250	300	350	400
硬质合金 金刚石涂层钻头 Diamond Coated Drill	平均303孔 Average holes							
其他公司A PCD钻头 Competitor A PCD Drill	平均184孔 Average holes							
其他公司B PCD钻头 Competitor B PCD Drill	140孔 holes							
其他公司C 金刚石涂层钻头 Competitor C Diamond Coated Drill	平均26孔 Average holes							



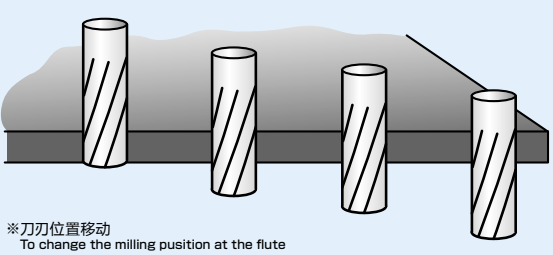
飞机制造业B公司的案例 Example at aircraft manufacturer B

即使加工参数等详情为非公开，能实现其他公司金刚石涂层产品的大约4倍的使用寿命。
Although details such as machining conditions have not been disclosed, our products have achieved approximately four times the durability of the conventional product (from company A)!

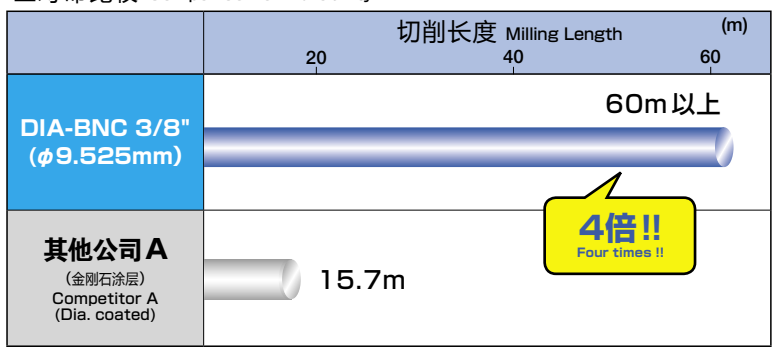
CFRP板桁修边加工
CFRP Stringer end trim



由于刃刀位置移动，能实现更多倍（刃长/板厚度）的使用寿命。
By the flute position management, tool life can be few times longer. (So is ED-EM, DIA-DCR)



寿命比较 Comparison of Durability



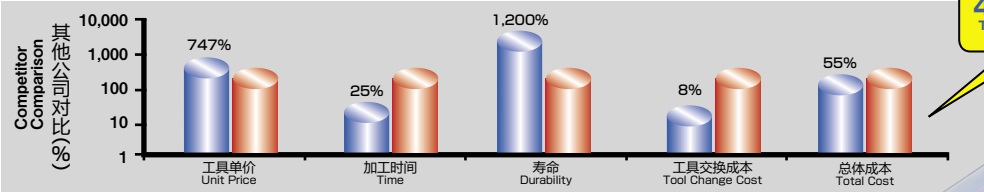
初期投资费用 D-STAD > 其他公司硬质合金钻头 总体费用 D-STAD < 其他公司硬质合金钻头

Initial Cost Competitor's Carbide Drill Total Cost Competitor's Carbide Drill

案例1 其他公司硬质合金钻头的比较 Comparison with competitor's carbide drill

柄径 D_c : .2510"
($\phi 6.375\text{mm}$)

- D-STAD
- 其他公司硬质合金钻头
Competitor's Carbide Drill



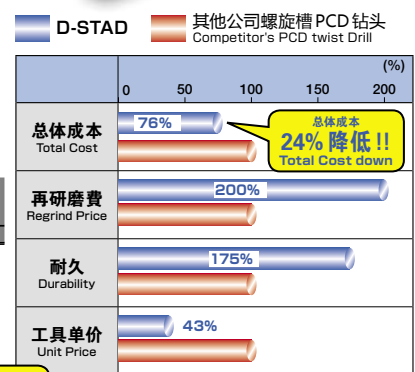
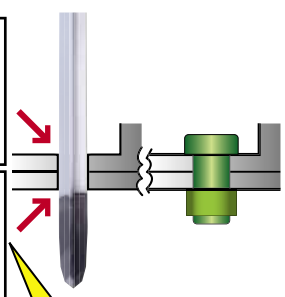
工具寿命 D-STAD > 其他公司螺旋槽PCD钻头

Tool life Competitor's PCD twist Drill

案例2 其他公司螺旋槽PCD钻头 Comparison with competitor's PCD twist drill

柄径 D_c : $\phi 6.375$ 切削条件 : $V=100\text{m/min}$, $f=0.06\text{mm/rev}$ 水溶性切削油剂 厚度 19mm
Drilling Conditions Water Soluble Thickness

		1孔 (Holes)	200孔 (Holes)	400孔 (Holes)	600孔 (Holes)	800孔 (Holes)
入口	其他公司螺旋槽PCD钻头 Competitor's PCD twist Drill	[Image]	[Image]	[Image]	[Image]	[Image]
	D-STAD	[Image]	[Image]	[Image]	[Image]	[Image]
出口	其他公司螺旋槽PCD钻头 Competitor's PCD twist Drill	[Image]	[Image]	[Image]	[Image]	[Image]
	D-STAD	[Image]	[Image]	[Image]	[Image]	[Image]



工具寿命：分层现象发生
Tool life Delamination

复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层交叉形刃铣刀
Diamond coated with fine pitch nicked

DIA-BNC



● 材质 硬质合金
Tool Material Carbide

多刃带断屑槽。能对应高分子系、金属系以及金属陶瓷系等各种复合材料的修型以及修边加工，实现高效率、长寿命。
Nicks are added to the multiple flutes, making high efficiency, long tool life machining from trimming to routing possible.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		刃数 Z	底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion			
NEW	1/8	3.175	10	60	1/8	3.175	6	2	<input type="checkbox"/>
8809001	—	4	12	62	—	4	6	2	A
8809002	—	6	18	68	—	6	8	2	A
NEW	1/4	6.35	19	69	1/4	6.35	8	2	<input type="checkbox"/>
8809003	—	8	24	74	—	8	10	2	A
NEW	3/8	9.525	28	80	3/8	9.525	12	2	<input type="checkbox"/>
8809004	—	10	30	80	—	10	12	2	A
8809005	—	12	36	86	—	12	14	2	A
NEW	1/2	12.7	38	88	1/2	12.7	14	2	<input type="checkbox"/>

A = 标准库存品 A = Standard stock item

= 特定代理店库存品 = Stocked by specific distributors. Contact us for price & availability.

复合材料加工用铣刀 Router for composite materials

■ 高能率型：中(精)加工用交叉形刃铣刀
High efficient type: Fine-cross-nick router

DIA-CNC



● 材质 硬质合金
Tool Material Carbide

NEW

因为多刃带断屑槽，所以能进行修型以及修边加工，能实现高效率、长寿命。能防止加工软质复合材料时加工材料对切削刃的压着。

This multi-flute tool with nicks can achieve high-efficiency and long tool life in applications from trimming to routing. In soft composite material workpieces, the galling of the cutting edge is prevented.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		刃数 Z	底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion			
	1/8	3.175	10	60	1/8	3.175	4	2	<input type="checkbox"/>
	—	4	12	62	—	4	4	2	<input type="checkbox"/>
	—	6	18	68	—	6	6	2	<input type="checkbox"/>
	1/4	6.35	19	69	1/4	6.35	6	2	<input type="checkbox"/>
	—	8	24	74	—	8	6	2	<input type="checkbox"/>
	3/8	9.525	28	78	3/8	9.525	6	2	<input type="checkbox"/>
	—	10	30	80	—	10	6	2	<input type="checkbox"/>
	—	12	36	86	—	12	8	2	<input type="checkbox"/>
	1/2	12.7	38	88	1/2	12.7	8	2	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层人字形刃4刃铣刀
Diamond coated herringbone 4flute cutter

DIA-HBC4

● 材质 硬质合金
Tool Material Carbide



切削刃以右螺旋刃和左螺旋刃构成，能防止加工厚板时在双面发生的毛刺。
The deep flute, low resistance design is well suited for machining thick plates.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		刃数 Z	底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion			
NEW	1/8	3.175	10	60	1/8	3.175	4	4	<input type="checkbox"/>
NEW	—	4	12	62	—	4	4	4	<input type="checkbox"/>
8809022	—	6	15	65	—	6	4	4	A
NEW	—	6	18	68	—	6	4	4	<input type="checkbox"/>
NEW	1/4	6.35	19	69	1/4	6.35	4	4	<input type="checkbox"/>
8809023	—	8	20	70	—	8	4	4	A
NEW	—	8	24	74	—	8	4	4	<input type="checkbox"/>
NEW	3/8	9.525	28	78	3/8	9.525	4	4	<input type="checkbox"/>
8809024	—	10	25	75	—	10	4	4	A
NEW	—	10	30	80	—	10	4	4	<input type="checkbox"/>
NEW	—	12	36	86	—	12	4	4	<input type="checkbox"/>
NEW	1/2	12.7	38	88	1/2	12.7	4	4	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层交叉形刃铣刀 带有底刃
Diamond coated with Cross flute router

DIA-DCR



是通用交叉形刃铣刀的英寸系列。底刃为铣刀式样。
Because of the shallow flutes, it is effective in light cutting such as laminate chamfering in honeycomb materials. Furthermore, by applying flute management, running costs can be reduced.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion		
8809061	1/8	3.175	11	38.1	—	3.175	2	A
8809062	1/4	6.35	19	50.8	—	6.35	2	A
NEW	3/8	9.525	25	63.5	3/8	9.525	2	<input type="checkbox"/>
NEW	1/2	12.7	25	76.2	1/2	12.7	2	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层交叉形刃铣刀 不带底刃
Diamond coated with Cross flute router

DIA-DCR-N



● 材质 硬质合金
Tool Material Carbide



是通用交叉纹铣刀的英寸系列。
Inch size series general purpose cross-flute routers.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion		
	1/8	3.175	11	38.1	1/8	3.175	无	<input type="checkbox"/>
	1/4	6.35	19	50.8	1/4	6.35	无	<input type="checkbox"/>
	3/8	9.525	25	63.5	3/8	9.525	无	<input type="checkbox"/>
	1/2	12.7	25	76.2	1/2	12.7	无	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层交叉形刃铣刀 带有底刃
Diamond coated with Cross flute router

DIA-DCE



● 材质 硬质合金
Tool Material Carbide



能用于高分子系、金属系、金属陶瓷系的复合材料上的交叉纹铣刀的公制尺寸系列。底刃为铣刀的式样。

These metric size series cross-flute routers are ideal for a wide variety of polymer-base, metal-base, and ceramic-base composite materials. The end cutting teeth are for end milling.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	底刃 End cutting teeth	库存 Stock
	2	8	45	4	2	<input type="checkbox"/>
	2.5	10	45	4	2	<input type="checkbox"/>
	3	10	60	6	2	<input type="checkbox"/>
	3.5	12	60	6	2	<input type="checkbox"/>
	4	16	60	6	2	<input type="checkbox"/>
	4.5	16	60	6	2	<input type="checkbox"/>
	5	19	60	6	2	<input type="checkbox"/>
	6	19	60	6	2	<input type="checkbox"/>
	7	22	65	8	2	<input type="checkbox"/>
	8	26	70	8	2	<input type="checkbox"/>
	9	26	75	10	2	<input type="checkbox"/>
	10	32	80	10	2	<input type="checkbox"/>
	12	38	90	12	2	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层交叉形刃铣刀 不带底刃
Diamond coated with Cross flute router

DIA-DCE-N



● 材质 硬质合金
Tool Material Carbide



能用于高分子系、金属系、金属陶瓷系的复合材料上的交叉纹铣刀的公制尺寸系列。交叉纹切削刃能防止毛刺的发生以及加工脆性材料时的崩刃。

These metric size series cross-flute routers are ideal for a wide variety of polymer-base, metal-base, and ceramic-base composite materials. The cross-flute shape of the cutting edges suppresses the occurrence of burrs and edge chipping.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	底刃 End cutting teeth	库存 Stock
	2	8	45	4	无	<input type="checkbox"/>
	2.5	10	45	4	无	<input type="checkbox"/>
	3	10	60	6	无	<input type="checkbox"/>
	3.5	12	60	6	无	<input type="checkbox"/>
	4	16	60	6	无	<input type="checkbox"/>
	4.5	16	60	6	无	<input type="checkbox"/>
	5	19	60	6	无	<input type="checkbox"/>
	6	19	60	6	无	<input type="checkbox"/>
	7	22	65	8	无	<input type="checkbox"/>
	8	26	70	8	无	<input type="checkbox"/>
	9	26	75	10	无	<input type="checkbox"/>
	10	32	80	10	无	<input type="checkbox"/>
	12	38	90	12	无	<input type="checkbox"/>

= 特定代理店库存品 = Stocked by specific distributors. Contact us for price & availability.

复合材料加工用铣刀 Router for composite materials

■ 金刚石涂层交叉形刃铣刀 底刃钻头式样
Diamond coated with Cross flute router

DIA-DCE-D



● 材质 硬质合金
Tool Material Carbide



能用于高分子系、金属系、金属陶瓷系的复合材料上的交叉形刃铣刀的公制尺寸系列。底刃为钻头式样。

These metric size series cross-flute routers are ideal for a wide variety of polymer-base, metal-base, and ceramic-base composite materials. The end cutting teeth are for drilling.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	底刃 End cutting teeth	库存 Stock
	2	8	45	4	2刃钻头 (135°)	<input type="checkbox"/>
	2.5	10	45	4	2刃钻头 (135°)	<input type="checkbox"/>
	3	10	60	6	2刃钻头 (135°)	<input type="checkbox"/>
	3.5	12	60	6	2刃钻头 (135°)	<input type="checkbox"/>
	4	16	60	6	2刃钻头 (135°)	<input type="checkbox"/>
	4.5	16	60	6	2刃钻头 (135°)	<input type="checkbox"/>
	5	19	60	6	2刃钻头 (135°)	<input type="checkbox"/>
	6	19	60	6	2刃钻头 (135°)	<input type="checkbox"/>
	7	22	65	8	2刃钻头 (135°)	<input type="checkbox"/>
	8	26	70	8	2刃钻头 (135°)	<input type="checkbox"/>
	9	26	75	10	2刃钻头 (135°)	<input type="checkbox"/>
	10	32	80	10	2刃钻头 (135°)	<input type="checkbox"/>
	12	38	90	12	2刃钻头 (135°)	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■ 薄板修型用：交叉形刃铣刀
For trimming laminates: Cross flute router

DIA-TRE



● 材质 硬质合金
Tool Material Carbide



薄板修型用。交叉形切削刃抑制毛刺的发生。

This is for trimming laminates. The cross-flute shape of the cutting edges suppresses the occurrence of burrs.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	底刃 End cutting teeth	库存 Stock
	1.5	3	45	4	无	<input type="checkbox"/>
	1.8	3.6	45	4	无	<input type="checkbox"/>
	2	4	45	4	无	<input type="checkbox"/>
	2.5	5	45	4	无	<input type="checkbox"/>
	3	6	45	4	无	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■薄板修型用：交叉形刃铣刀底刃为钻头式样
For trimming laminates: Cross flute router

●材质 硬质合金
Tool Material Carbide



DIA-TRE-D



薄板修型用。为了能连续进行孔加工和铣加工，底刃为钻头式样。
This is for trimming laminates. The end cutting teeth are designed as a drill to perform plunging and repeated side thrust machining.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	底刃 End cutting teeth	库存 Stock
	1.5	3	45	4	2刃钻头 (135°)	<input type="checkbox"/>
	1.8	3.6	45	4	2刃钻头 (135°)	<input type="checkbox"/>
	2	4	45	4	2刃钻头 (135°)	<input type="checkbox"/>
	2.5	5	45	4	2刃钻头 (135°)	<input type="checkbox"/>
	3	6	45	4	2刃钻头 (135°)	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■多刃精加工铣刀
Multi-flute finishing router

●材质 硬质合金
Tool Material Carbide



DIA-MFC



高分子系、金属系、金属陶瓷系的各种复合材料的普通精加工时能使用。也能用于快削性金属陶瓷的精加工。
Can be used for the general finishing of a wide variety of composite materials.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		刃数 Z	底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion			
	1/8	3.175	10	60	1/8	3.175	6	无	<input type="checkbox"/>
	—	4	12	62	—	4	6	无	<input type="checkbox"/>
	—	6	18	68	—	6	8	无	<input type="checkbox"/>
	1/4	6.35	19	69	1/4	6.35	8	无	<input type="checkbox"/>
	—	8	24	74	—	8	10	无	<input type="checkbox"/>
	3/8	9.525	28	78	3/8	9.525	12	无	<input type="checkbox"/>
	—	10	30	80	—	10	12	无	<input type="checkbox"/>
	—	12	36	86	—	12	14	无	<input type="checkbox"/>
	1/2	12.7	38	88	1/2	12.7	14	无	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■通用铣刀 底刃带有圆弧角

General purpose routers: with corner radius

DIA-MRC



●材质 硬质合金
Tool Material Carbide



能用于高分子系、金属系、金属陶瓷系的各种复合材料以及快削性金属陶瓷的加工。底刃带有圆弧角。圆弧角的尺寸也准备多种, 请根据需求选择。

Ideal for a wide variety of machining in a wide variety of polymer-base, metal-base, and ceramic-base composite materials. The end cutting teeth have corner radius, and a large range of radius sizes are available.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		半径 r	刃长 ℓ	全长 L	柄径 Ds		刃数 Z	底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion				英寸 Inch	毫米换算 Millimeter conversion			
	1/8	3.175	R0.4	10	60	1/8	3.175	4	4	<input type="checkbox"/>
	—	4	R0.4	12	62	—	4	4	4	<input type="checkbox"/>
	—	4	R0.7	12	62	—	4	4	4	<input type="checkbox"/>
	—	6	R0.4	18	68	—	6	4	4	<input type="checkbox"/>
	—	6	R0.7	18	68	—	6	4	4	<input type="checkbox"/>
	—	6	R1	18	68	—	6	4	4	<input type="checkbox"/>
	1/4	6.35	R0.4	19	69	1/4	6.35	4	4	<input type="checkbox"/>
	1/4	6.35	R0.7	19	69	1/4	6.35	4	4	<input type="checkbox"/>
	1/4	6.35	R1	19	69	1/4	6.35	4	4	<input type="checkbox"/>
	—	8	R0.4	24	74	—	8	4	4	<input type="checkbox"/>
	—	8	R0.7	24	74	—	8	4	4	<input type="checkbox"/>
	—	8	R1	24	74	—	8	4	4	<input type="checkbox"/>
	3/8	9.525	R0.4	28	78	3/8	9.525	4	4	<input type="checkbox"/>
	3/8	9.525	R0.7	28	78	3/8	9.525	4	4	<input type="checkbox"/>
	3/8	9.525	R1	28	78	3/8	9.525	4	4	<input type="checkbox"/>
	—	10	R0.4	30	80	—	10	4	4	<input type="checkbox"/>
	—	10	R0.7	30	80	—	10	4	4	<input type="checkbox"/>
	—	10	R1	30	80	—	10	4	4	<input type="checkbox"/>
	—	12	R0.4	36	86	—	12	4	4	<input type="checkbox"/>
	—	12	R0.7	36	86	—	12	4	4	<input type="checkbox"/>
	—	12	R1	36	86	—	12	4	4	<input type="checkbox"/>
	1/2	12.7	R0.4	38	88	1/2	12.7	4	4	<input type="checkbox"/>
	1/2	12.7	R0.7	38	88	1/2	12.7	4	4	<input type="checkbox"/>
	1/2	12.7	R1	38	88	1/2	12.7	4	4	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■粗加工用铣刀

Roughing routers: roughing type

DIA-REC



●材质 硬质合金
Tool Material Carbide



粗加工专用的工具。对各种复合材料能进行高效率粗加工。由于圆周的波形切削刃能减轻切削抵抗, 能防止加工工件的振动。

A tool specifically for roughing. Achieves high efficiency roughing in a wide variety of composite materials. The wave-shaped outer cutting edge reduces cutting force, preventing vibration of the workpiece.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		刃数 Z	底刃 End cutting teeth	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion			
	1/8	3.175	10	60	1/8	3.175	3	3	<input type="checkbox"/>
	—	4	12	62	—	4	3	3	<input type="checkbox"/>
	—	6	18	68	—	6	4	4	<input type="checkbox"/>
	1/4	6.35	19	69	1/4	6.35	4	4	<input type="checkbox"/>
	—	8	24	74	—	8	4	4	<input type="checkbox"/>
	3/8	9.525	28	78	3/8	9.525	4	4	<input type="checkbox"/>
	—	10	30	80	—	10	4	4	<input type="checkbox"/>
	—	12	36	86	—	12	4	4	<input type="checkbox"/>
	1/2	12.7	38	88	1/2	12.7	4	4	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■小螺旋角单刃铣刀

Slow spiral, one flute routers

DIA-COE



●材质 硬质合金
Tool Material Carbide



适合于弹性复合材料的加工。由于是单刃，且切削刃长度较短，容屑槽很大，能防止加工中的工件的弯曲现象。排屑性良好。

Ideal for machining elastic composite materials. Simultaneously reducing the cutting edge length and increasing the chip pocket prevents movement and deflection of the workpiece and provides excellent chip evacuation.

单位:mm Unit:mm

商品号 EDP No.	外径 Dc	刃长 ℓ	全长 L	柄径 Ds	刃数 Z	底刃 End cutting teeth	库存 Stock
	2	8	45	4	1	有	<input type="checkbox"/>
	2.5	10	45	4	1	有	<input type="checkbox"/>
	3	10	60	6	1	有	<input type="checkbox"/>
	3.5	12	60	6	1	有	<input type="checkbox"/>
	4	16	60	6	1	有	<input type="checkbox"/>
	4.5	16	60	6	1	有	<input type="checkbox"/>
	5	19	60	6	1	有	<input type="checkbox"/>
	6	19	60	6	1	有	<input type="checkbox"/>
	7	22	65	8	1	有	<input type="checkbox"/>
	8	26	70	8	1	有	<input type="checkbox"/>
	9	26	75	10	1	有	<input type="checkbox"/>
	10	32	80	10	1	有	<input type="checkbox"/>
	12	38	90	12	1	有	<input type="checkbox"/>

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复合材料加工用铣刀 Router for composite materials

■电镀金刚石铣刀

Electric deposition diamond router

ED-EM



●材质 钢制刀体 + 电镀金刚石
Tool Material Steel body + Electric deposition diamond

适合于切深量少或脆性复合材料的加工。也能对应快削性金属陶瓷的加工。
For machining composite brittle material (machinable ceramics).

单位:mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		粒度 Granularity	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion		
NEW	1/8	3.175	10	55	1/8	3.175	#60	<input type="checkbox"/>
NEW	—	4	12	57	—	4	#60	<input type="checkbox"/>
8809042	—	6	18	63	—	6	#60	C
NEW	1/4	6.35	19	64	1/4	6.35	#60	<input type="checkbox"/>
8809043	—	8	24	70	—	8	#60	C
NEW	3/8	9.525	28	73	3/8	9.525	#60	<input type="checkbox"/>
8809044	—	10	30	75	—	10	#60	C
NEW	—	12	36	81	—	12	#60	<input type="checkbox"/>
NEW	1/2	12.7	38	83	1/2	12.7	#60	<input type="checkbox"/>

C = 标准库存品 C = Standard stock item

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复合材料用钻头 Drill for composite materials

■ 金刚石涂层三角钻头
Diamond coated triple angle drill



D-STAD

最适合于以CFRP为主的复合材料。能抑制在孔的入口和出口双面的毛刺。外径尺寸的设定考虑了加工结束时的反作用力。
The best choice for CFRP and other composite materials. It minimize the delaminations at an entrance and an exit of the hole. Diameter selction is considered the spring back at the machining.

● 材质 Tool Material 硬质合金 Carbide

单位 :mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		先端部长度 Tip Length	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion		
8809081	.1915	4.864	39	89	.1910	4.851	8.2	C
8809082	.2510	6.375	51	101	.2500	6.35	10.8	C
8809083	.3760	9.550	76	126	.3750	9.525	16.1	C

C = 标准库存品 C = Standard stock item

复合材料用钻头 Drill for composite materials

■ 强力形PCD双角钻头
Helical PCD double angle drill



PCD-DAD

加工以CFRP为主的复合材料时，能抑制在孔的出口处发生毛刺。其切削刃为锋利的PCD，所以切削性很好。外径尺寸的设定考虑了加工结束时的反作用力。
Controls delaminations of composite materials as CFRP at the entrance and exit of the hole. Sharpened cutting edge of PCD (sintered diamond) will show smooth cuttings. O/D size ranges are considered spring back at the machining.

● 材质 Tool Material PCD

单位 :mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		先端部长度 Tip Length	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion		
8809101	.1915	4.864	39	73	—	6	—	C
8809102	.2510	6.375	47	87	—	8	—	C
8809103	.3760	9.550	61	105	—	10	—	C

C = 标准库存品 C = Standard stock item

复合材料加工用铣刀 Electroplated Diamond Drill for composite materials

■ 电镀金刚石钻头
Electroplated Diamond Drills



ED-DS

适用于金属陶瓷系复合材料以及脆性材料(快削性金属陶瓷等)的加工。
For machining ceramics base composite materials and brittle material (machinable ceramics).

单位 :mm Unit:mm

商品号 EDP No.	外径 Dc		刃长 ℓ	全长 L	柄径 Ds		首下长 ℓn	首径 d2	电镀长度 Length of Electroplating	粒度 Grid Size	库存 Stock
	英寸 Inch	毫米换算 Millimeter conversion			英寸 Inch	毫米换算 Millimeter conversion					
8599720	—	2	7	39	—	3	8.5	1.6	8.5	#100	C
8599725	—	2.5	9	41	—	3	10.5	2.1	10.5	#100	C
8599730	—	3	11	43	—	3	12.5	2.6	12.5	#100	C
8599735	—	3.5	15	47	—	4	16.5	3.1	10	#100	C
8599740	—	4	17	49	—	4	18.5	3.6	10	#100	C
8599745	—	4.5	19	63	—	6	21	4.1	10	#100	C
NEW 8599750	.191	4.851	21	65	.191	4.851	23	4.45	10	#100	□
8599755	—	5.5	23	67	—	6	25	5.1	10	#100	C
8599760	—	6	25	69	—	6	27.4	5.6	10	#100	C
NEW 8599765	.25	6.35	28	72	.25	6.35	30	5.95	10	#100	□
8599770	—	6.5	28	72	—	8	30	6.1	10	#100	C
8599775	—	7.5	31	75	—	8	33	7.1	10	#100	C
8599780	—	8	34	78	—	8	36.4	7.6	10	#100	C
8599785	—	8.5	34	84	—	10	36	8.1	10	#100	C
8599790	—	9	37	87	—	10	39	8.6	10	#100	C
8599795	—	9.5	37	87	—	10	39	9.1	10	#100	C
NEW 8599800	.375	9.525	40	90	.375	9.525	42	9.13	10	#100	□
8599805	—	10	40	90	—	10	42.4	9.6	10	#100	C
8599810	—	10.5	40	97	—	12	42	10.1	10	#100	C
8599815	—	11	40	97	—	12	42	10.6	10	#100	C
8599820	—	11.5	44	101	—	12	46	11.1	10	#100	C
8599825	—	12	44	101	—	12	46.4	11.6	10	#100	C
8599830	—	12.5	48	105	—	12	51	12.1	10	#100	C
8599830	—	13	48	105	—	12	51	12.6	10	#100	C

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□ = 特定代理店库存品 □ = Stocked by specific distributors. Contact us for price & availability.

外径 Dc		切削速度 SPEED (m/min)	回转速度 RPM (min ⁻¹)	进给量 FEED RATE (mm/rev)
英寸 Inch	毫米换算 Millimeter conversion			
-	1.5	40 ~ 200	20,000	0.01 ~ 0.2
-	2		20,000	0.02 ~ 0.25
-	3	80 ~ 200	20,000	0.05 ~ 0.3
1/8	3.175		20,000	0.05 ~ 0.3
-	4	100 ~ 200	15,000	0.05 ~ 0.4
-	5		12,000	0.05 ~ 0.4
-	6		10,000	0.08 ~ 0.5
1/4	6.35		10,000	0.08 ~ 0.5
-	8		7,500	0.08 ~ 0.5
3/8	9.525		6,500	0.12 ~ 0.6
-	10		6,000	0.12 ~ 0.6
-	12		5,000	0.15 ~ 1
1/2	12.7		5,000	0.15 ~ 1



开始加工前, 请务必采取防粉尘措施。
Be sure to have a dust removal plan before machining.

- 即使不需要切削油剂, 也请采用充分的措施, 防止发生粉尘问题。请针对被切削材质进行防火防爆措施。
- 所对应的切削参数根据加工件的刚性以及其夹具刚性不同而变化。
- 由于加工件的厚度、形状、保持状态等原因, 加工件上会有振动。如发生振动, 减少切深量, 减慢回转速度以及进给量。
- CFRP等加工件根据树脂砂的性质以及其含量的不同, 受到很大的影响。
- 使用单刃铣刀的话, 进给量要设定为左图的50%左右。
- 如切深量变大的话, 以左图为准, 进给量设定得较低。
- 槽加工以及修边加工那样, 工具的径方向的切深量等于工具径的时候, 以左图的70%左右为基准设定进给量。

- Coolant use is not necessary, but be sure to provide appropriate measures against dust (Such as vacuum dust collection). Be sure to enforce fire and explosion prevention plans appropriate for the workpiece.
- The appropriate cutting conditions vary widely depending on the rigidity of the workpiece and system.
- Depending on the workpiece thickness and form as well as the workholding, there may be vibrations in the workpiece. When vibrations occur, decrease the depth of cut and reduce the RPM and feed rate.
- The resin properties and content have a large effect on the machinability of CFRP. Refer to the chart on the left and adjust RPM and feed rates.
- When using a single flute router, adjust the feed rate to approximately 50% of the values in the chart on the left.
- When the depth of cut is larger, refer to the chart on the left and set a lower feed rate.
- When performing machining operations such as grooving or trimming where the tool diameter is similar to the radial depth of cut, set the feed rate to approximately 70% of the values indicated in the chart on the left.

外径 Dc		切削速度 SPEED (m/min)	回转速度 RPM (min ⁻¹)	进给量 FEED RATE (mm/rev)
英寸 Inch	毫米换算 Millimeter conversion			
1/8	3.175	200 ~ 300	20,000	0.003 ~ 0.012
-	4		20,000	0.005 ~ 0.015
-	6		13,000	0.005 ~ 0.025
1/4	6.35		13,000	0.005 ~ 0.025
-	8		10,000	0.005 ~ 0.032
3/8	9.525		8,500	0.005 ~ 0.035
-	10		8,000	0.005 ~ 0.04
-	12		7,000	0.005 ~ 0.045
1/2	12.7		6,500	0.005 ~ 0.045



开始加工前, 请务必采取防粉尘措施。
Be sure to have a dust removal plan before machining.

- 即使不需要切削油剂, 也请采用充分的措施, 防止发生粉尘问题。请针对被切削材质进行防火防爆措施。
- 如切深量变大的话, 要降低进给量。根据切深量的适合进给量请参照左图。
- 所对应的加工参数根据加工件的刚性以及其夹具刚性的不同而变化。
- 由于加工件的厚度、形状、保持状态等原因, 加工件上会有振动。如发生振动, 减少切深量和进给量。
- 加工铝系列、氮化硅等脆性材料时, 以左图的最小值为基准设定进给量。如发生崩刃的话, 切深量和进给量设定得再小一点。

- Coolant use is not necessary, but be sure to provide appropriate measures against dust (Such as vacuum dust collection). Be sure to enforce fire and explosion prevention plans appropriate for the workpiece.
- When the depth of cut is larger, reduce the feed rate. The chart on the left indicates approximate feed rate compensation amounts.
- The appropriate cutting conditions vary widely depending on the rigidity of the workpiece and system.
- Depending on the workpiece thickness and form as well as the workholding, there may be vibrations in the workpiece. When vibration occurs, decrease the depth of cut or reduce the feed rate.
- When machining brittle material such as aluminum oxide or silicon nitride, reduce the feed rate to the minimum value in the chart on the left. If edge chipping occurs, further reduce the depth of cut and feed rate.

■ 根据切深量的进给量修正的基准 Approximate feed rate compensations according to depth of cut

径方向切深量 Radial depth of cut ar (mm)	进给量的修正 Feed rate compensation
0.1 × Dc	100%
0.2 × Dc	70%
0.5 × Dc	40%
1 × Dc	20%

D-STAD

外径 D _c		切削速度 SPEED (m/min)	回转速度 RPM (min ⁻¹)	进给量 FEED RATE (mm/rev)
英寸 Inch	毫米换算 Millimeter conversion			
.1915	4.864	50 ~ 80	3,900	0.03 ~ 0.05
.251	6.375		3,000	0.04 ~ 0.075
.376	9.55		2,000	0.05 ~ 0.075



开始加工前, 请务必采取防粉尘措施。
Be sure to have a dust removal plan before machining.

- 即使不需要切削油剂, 也请采用充分的措施, 防止发生粉尘问题。请针对被切削材质进行防火防爆措施。
- 孔深度3D (D为钻头的径数) 以下时, 不需要采用阶梯式加工。超过3D的话, 建议先观察好排屑情况, 然后在超过3D的部分采用阶梯式加工。
- 加工厚板时, 如加工件一直带有加工热的话, 切削速度要设定得低一点。
- 所对应的切削参数根据加工件的刚性以及其夹具刚性不同而变化。
- 由于加工件的厚度、形状、保持状态等原因, 加工件上会有振动。如发生振动, 减少进给量。尤其是加工薄板快贯通的时候要降低进给量。
- CFRP材料切削性能由其树脂特性及其含有量决定, 请参照左表推荐的回转速度及进给量进行适当的调整。
- 使用切削油的话, 请使用加工订货方允许的或切削油厂家推荐的产品。
- 湿式加工时, 切削速度可提高到200m/min。

PCD-DAD

外径 D _c		切削速度 SPEED (m/min)	回转速度 RPM (min ⁻¹)	进给量 FEED RATE (mm/rev)
英寸 Inch	毫米换算 Millimeter conversion			
.1915	4.864	80 ~ 120	8,000	0.03 ~ 0.05
.251	6.375		5,000	0.04 ~ 0.075
.376	9.55		2,700	0.05 ~ 0.075

- Coolant use is not necessary, but be sure to provide appropriate measures against dust (Such as vacuum dust collection). Be sure to enforce fire and explosion prevention plans appropriate for the workpiece.
- Use non-step drilling for holes less than 3D (three times the diameter of the cutting tool). For operations over 3D, we recommend drilling non-step to 3D, and then step drilling for the remainder of the depth while carefully monitoring chip evacuation.
- When machining plates or workpieces that retain machining heat, set a lower cutting speed.
- The appropriate cutting conditions vary widely depending on the rigidity of the workpiece and system.
- Depending on the workpiece thickness and form as well as the workholding, there may be vibrations in the workpiece. When vibration occurs, reduce the feed rate. Reduce the feed rate particularly when penetrating the laminate.
- The resin properties and content have a large effect on the machinability of CFRP. Refer to the chart on the left and adjust RPM and feed rates.
- When using a cutting fluid, with the consent of the final end-user of the parts, be sure to follow the recommendations of the cutting fluid manufacturer.
- When wet machining, there are times when the cutting speed must be raised to around 200m/min.

电镀金刚石钻头切削条件基准表

外径 D _c		切削速度 SPEED (m/min)	回转速度 RPM (min ⁻¹)	进给量 FEED RATE (mm/rev)
英寸 Inch	毫米换算 Millimeter conversion			
—	2	50 ~ 200	16,000	0.0003 ~ 0.005
—	4		8,000	0.0003 ~ 0.005
.191	4.851		6,500	0.0003 ~ 0.005
—	6		5,500	0.0005 ~ 0.007
1/4	6.35		5,000	0.0005 ~ 0.007
—	8		4,000	0.0007 ~ 0.009
3/8	9.525		3,000	0.0009 ~ 0.01
—	10		2,800	0.0009 ~ 0.012
—	12		2,500	0.0009 ~ 0.012



开始加工前, 请务必采取防粉尘措施。
Be sure to have a dust removal plan before machining.

- 即使不需要切削油剂, 也请采用充分的措施, 防止发生粉尘问题。请针对被切削材质进行防火防爆措施。
 - 所对应的加工参数根据加工件的刚性以及其夹具刚性的不同而变化。
 - 请进行0.05mm ~ 0.1mm左右的阶梯式加工。
 - 加工铝系列、氮化硅等脆性材料时, 以左图的最小值为基准设定进给量。
 - 使用切削油的话, 请使用加工订货方允许的或切削油厂家推荐的产品。
- Coolant use is not necessary, but be sure to provide appropriate measures against dust (Such as vacuum dust collection). Be sure to enforce fire and explosion prevention plans appropriate for the workpiece.
 - The appropriate cutting conditions vary widely depending on the rigidity of the workpiece and system.
 - Perform step machining from around 0.05mm to 0.1mm.
 - When machining brittle material such as aluminum oxide or silicon nitride, reduce the feed rate to the minimum value in the chart on the left.
 - When using a cutting fluid, with the consent of the final end-user of the parts, be sure to follow the recommendations of the cutting fluid manufacturer.

制作标准品以外形状，请咨询我司营业人员。

Please contact our sales department regarding inquiries for non-standard items.



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