



NACHI

# 击破传统观念 的壁垒！

Break down the barrier of convention!

采用了使切削阻力降低、  
大幅提升排屑性的刀刃、沟槽形状。  
在切屑容易阻塞的车床加工  
以及在需要超高速进给的  
加工中心加工  
皆打破了传统观念  
同时实现高精度及长寿命。

Adopt the optimized cutting edge and flue geometry  
to improve the reduction of cutting resistance and  
chip evacuation drastically.

Realize high accuracy and longer tool life  
in ultra high speed drilling in machining center or  
turning machine where chip jamming is easy to occur.

NEW

## AQUA EX 飞速钻

AQUA Drills EX Power Feed

# AQUA EX 飞速钻

AQUA Drills EX Power Feed

PF2D / PF4D

无论是在切屑易堵塞的车床加工,或是需要超高速进给的加工中心加工,皆发挥了高精度及长寿命。

■ 透过采用减低轴向力的刀尖形状及排屑性提升的沟槽形状,即使是传统的3倍高速进给也可稳定进行加工。

■ 断屑性提升,在排屑性差的工件旋转的车床加工中,也有优越的排屑性能

■ 在令人惊艳的超高速进给,也可以达到长加工寿命、高精度加工

Realize high accuracy and longer tool life in ultra high speed drilling in machining center or turning machine where chip jamming is easy to occur.

■ Even the traditional 3 times higher feed can also be stable processing,

by adopting good geometry of cutting edge and flutes for reducing thrust cutting force, chip breaking and evacuation.

■ Improved chip breaking performance, and realized outstanding chip evacuation in work rotation turning machine as well.

■ Even if it is stunning ultra-high-speed feed, but also can achieve long processing life, high-precision machining.

## 大幅降低轴向力

Significantly reduced thrust

加工时的轴向力大幅降低,即使进行3倍的超高速进给加工其排屑性也相当优异

Thrust is greatly reduced, so even in the 3x ultra-high-speed feed, chip removal is also very good

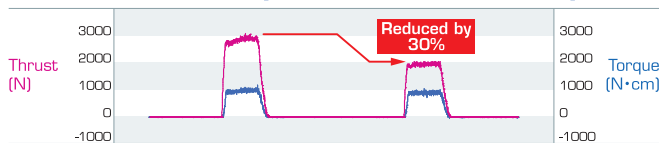
飞速钻2倍径 的切削阻力

Cutting resistance of Power feed 2D

是一般进给量的约3倍

Is about 3x the normal feed

Feed amount: 0.56mm/rev [Feed amount/Tool Diameter=7%]



Cutting condition	Diameter: $\phi$ 8mm Workpiece material: S50C	Cutting speed: 80m/min Hole depth: 16mm	Machine center Water-soluble cutting oil
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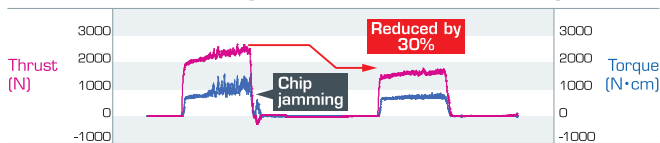
飞速钻4倍径 的切削阻力

Cutting resistance of Power feed 4D

是一般进给量的2倍

Is 2x the normal feed

Feed amount: 0.4mm/rev [Feed amount/Tool Diameter=5%]



Cutting condition	Diameter: $\phi$ 8mm Workpiece material: S50C	Cutting speed: 80m/min Hole depth: 32mm	Machine center Water-soluble cutting oil
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## 超高速进给也有长加工寿命

Ultra-high-speed feed also has a long tool life

当使用加工中心进行超高速进给加工时,比起其他品牌有着压倒性的加工寿命。另外,在容易产生切屑阻塞的车床加工,寿命也有稳定的表现。

When using a machining center for ultra-high-speed feed processing, Power feed drills have an overwhelming tool life. In addition, there is a stable performance in lathe machine which is liable to cause chip clogging.

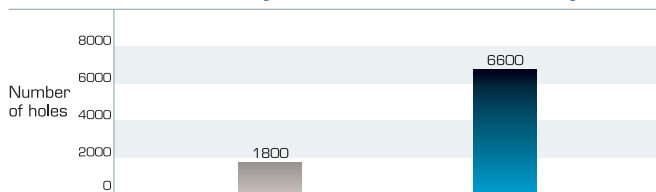
比较使用加工中心的加工寿命

Compare the tool life of using machining center

是一般进给量的约3倍

Is about 3x the normal feed

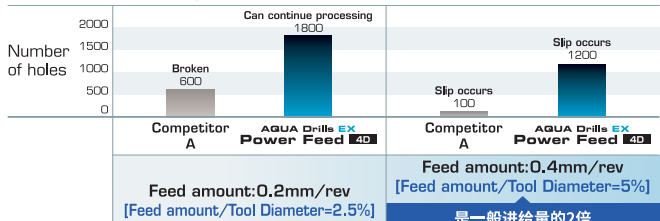
Feed amount: 0.56mm/rev [Feed amount/Tool Diameter=7%]



Cutting condition	Diameter: $\phi$ 8mm Workpiece material: S50C	Cutting speed: 80m/min Hole depth: 16mm	Machine center Water-soluble cutting oil
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比较使用车床的加工寿命

Compare the tool life of using lathe



Cutting condition	Diameter: $\phi$ 8mm Workpiece material: S45C	Cutting speed: 64m/min Hole depth: 32mm	Automatic lathes Only cutting oil
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## 超高速进给加工也有高精度

Ultra-high-speed feed machining is also highly accurate

即使是高进给加工,孔扩大量的变化幅度小,并有高品质的加工面

Even in the case of high feed processing, the variation of the hole expansion amount is small, and a high-quality work surface can be obtained

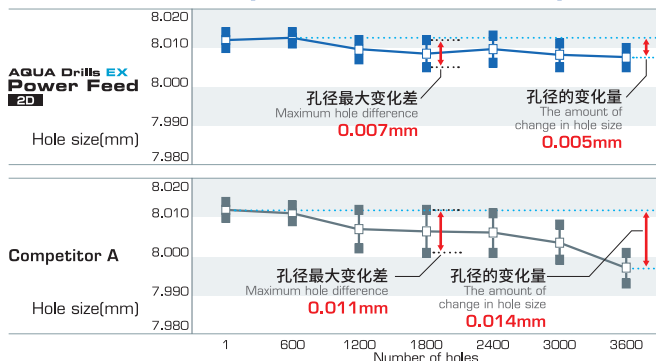
比较在车床加工的孔精度

Compare the hole accuracy of using lathe

是一般进给量的2倍

Is 2x the normal feed

Feed amount: 0.4mm/rev [Feed amount/Tool Diameter=5%]



Cutting condition	Diameter: $\phi$ 8mm Workpiece material: S45C	Cutting speed: 64m/min Hole depth: 16mm	Automatic lathes Only cutting oil
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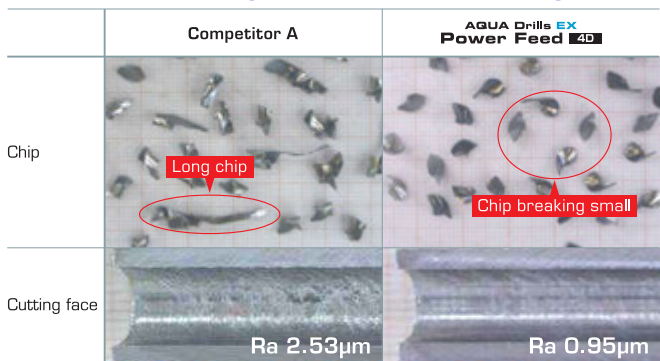
比较在车床加工所产生的切屑、加工面

Compare chip, machining surface of using lathe

是一般进给量的2倍

Is 2x the normal feed

Feed amount: 0.4mm/rev [Feed amount/Tool Diameter=5%]



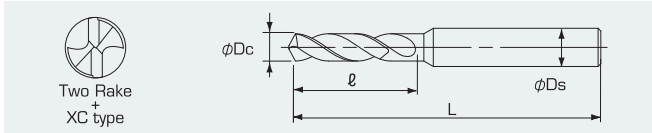
Cutting condition	Diameter: $\phi$ 8mm Workpiece material: S45C	Cutting speed: 64m/min Hole depth: 32mm	Automatic lathes Only cutting oil
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# PF2D

## AQUA EX 飞速钻 2D

AQUA Drills EX Power Feed 2D



LIST 9850 Order Code Unit:mm

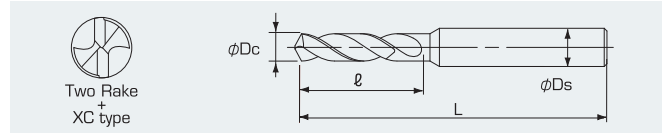
Code	Diameter $D_c$	Groove length $\ell$	Full length $L$	Shank diameter $D_s$
PF2D0200	2.0	6.0	45	3
PF2D0210	2.1	8.0	45	3
PF2D0220	2.2	8.0	45	3
PF2D0230	2.3	8.0	45	3
PF2D0240	2.4	8.0	45	3
PF2D0250	2.5	8.0	45	3
PF2D0260	2.6	10.0	45	3
PF2D0270	2.7	10.0	45	3
PF2D0280	2.8	10.0	45	3
PF2D0290	2.9	10.0	45	3
PF2D0300	3.0	10.0	45	3
PF2D0310	3.1	16.0	54	4
PF2D0320	3.2	16.0	54	4
PF2D0330	3.3	16.0	54	4
PF2D0340	3.4	16.0	54	4
PF2D0350	3.5	16.0	54	4
PF2D0360	3.6	17.0	54	4
PF2D0370	3.7	17.0	54	4
PF2D0380	3.8	17.0	54	4
PF2D0390	3.9	17.0	54	4
PF2D0400	4.0	17.0	54	4
PF2D0410	4.1	19.0	61	5
PF2D0420	4.2	19.0	61	5
PF2D0430	4.3	19.0	61	5
PF2D0440	4.4	19.0	61	5
PF2D0450	4.5	19.0	61	5
PF2D0460	4.6	20.0	61	5
PF2D0470	4.7	20.0	61	5
PF2D0480	4.8	20.0	61	5
PF2D0490	4.9	20.0	61	5
PF2D0500	5.0	20.0	61	5
PF2D0510	5.1	20.0	65	6
PF2D0520	5.2	20.0	65	6
PF2D0530	5.3	20.0	65	6
PF2D0540	5.4	20.0	65	6
PF2D0550	5.5	20.0	65	6
PF2D0560	5.6	21.0	65	6
PF2D0570	5.7	21.0	65	6
PF2D0580	5.8	21.0	65	6
PF2D0590	5.9	21.0	65	6
PF2D0600	6.0	21.0	65	6
PF2D0610	6.1	25.0	73	7
PF2D0620	6.2	25.0	73	7
PF2D0630	6.3	25.0	73	7
PF2D0640	6.4	25.0	73	7
PF2D0650	6.5	25.0	73	7
PF2D0660	6.6	26.0	73	7
PF2D0670	6.7	26.0	73	7
PF2D0680	6.8	26.0	73	7
PF2D0690	6.9	26.0	73	7
PF2D0700	7.0	26.0	73	7
PF2D0710	7.1	26.0	78	8
PF2D0720	7.2	26.0	78	8
PF2D0730	7.3	26.0	78	8
PF2D0740	7.4	26.0	78	8
PF2D0750	7.5	26.0	78	8
PF2D0760	7.6	28.0	78	8
PF2D0770	7.7	28.0	78	8
PF2D0780	7.8	28.0	78	8
PF2D0790	7.9	28.0	78	8
PF2D0800	8.0	28.0	78	8
PF2D0810	8.1	28.0	82	9
PF2D0820	8.2	28.0	82	9
PF2D0830	8.3	28.0	82	9
PF2D0840	8.4	28.0	82	9
PF2D0850	8.5	28.0	82	9
PF2D0860	8.6	29.0	82	9
PF2D0870	8.7	29.0	82	9
PF2D0880	8.8	29.0	82	9
PF2D0890	8.9	29.0	82	9
PF2D0900	9.0	29.0	82	9
PF2D0910	9.1	29.0	87	10
PF2D0920	9.2	29.0	87	10
PF2D0930	9.3	29.0	87	10
PF2D0940	9.4	29.0	87	10
PF2D0950	9.5	29.0	87	10
PF2D0960	9.6	31.0	87	10
PF2D0970	9.7	31.0	87	10
PF2D0980	9.8	31.0	87	10
PF2D0990	9.9	31.0	87	10
PF2D1000	10.0	31.0	87	10



# PF4D

## AQUA EX 飞速钻 4D

AQUA Drills EX Power Feed 4D



LIST 9852 Order Code Unit:mm

Code	Diameter $D_c$	Groove length $\ell$	Full length $L$	Shank diameter $D_s$
PF4D0200	2.0	15.0	49	3
PF4D0210	2.1	17.0	49	3
PF4D0220	2.2	17.0	49	3
PF4D0230	2.3	17.0	49	3
PF4D0240	2.4	17.0	49	3
PF4D0250	2.5	17.0	49	3
PF4D0260	2.6	19.0	49	3
PF4D0270	2.7	19.0	49	3
PF4D0280	2.8	19.0	49	3
PF4D0290	2.9	19.0	49	3
PF4D0300	3.0	19.0	49	3
PF4D0310	3.1	24.0	60	4
PF4D0320	3.2	24.0	60	4
PF4D0330	3.3	24.0	60	4
PF4D0340	3.4	24.0	60	4
PF4D0350	3.5	24.0	60	4
PF4D0360	3.6	27.0	60	4
PF4D0370	3.7	27.0	60	4
PF4D0380	3.8	27.0	60	4
PF4D0390	3.9	27.0	60	4
PF4D0400	4.0	27.0	60	4
PF4D0410	4.1	31.0	76	5
PF4D0420	4.2	31.0	76	5
PF4D0430	4.3	31.0	76	5
PF4D0440	4.4	31.0	76	5
PF4D0450	4.5	31.0	76	5
PF4D0460	4.6	38.0	76	5
PF4D0470	4.7	38.0	76	5
PF4D0480	4.8	38.0	76	5
PF4D0490	4.9	38.0	76	5
PF4D0500	5.0	38.0	76	5
PF4D0510	5.1	39.0	81	6
PF4D0520	5.2	39.0	81	6
PF4D0530	5.3	39.0	81	6
PF4D0540	5.4	39.0	81	6
PF4D0550	5.5	39.0	81	6
PF4D0560	5.6	41.0	81	6
PF4D0570	5.7	41.0	81	6
PF4D0580	5.8	41.0	81	6
PF4D0590	5.9	41.0	81	6
PF4D0600	6.0	41.0	81	6
PF4D0610	6.1	42.0	83	7
PF4D0620	6.2	42.0	83	7
PF4D0630	6.3	42.0	83	7
PF4D0640	6.4	42.0	83	7
PF4D0650	6.5	42.0	83	7
PF4D0660	6.6	43.0	83	7
PF4D0670	6.7	43.0	83	7
PF4D0680	6.8	43.0	83	7
PF4D0690	6.9	43.0	83	7
PF4D0700	7.0	43.0	83	7
PF4D0710	7.1	45.0	90	8
PF4D0720	7.2	45.0	90	8
PF4D0730	7.3	45.0	90	8
PF4D0740	7.4	45.0	90	8
PF4D0750	7.5	45.0	90	8
PF4D0760	7.6	48.0	90	8
PF4D0770	7.7	48.0	90	8
PF4D0780	7.8	48.0	90	8
PF4D0790	7.9	48.0	90	8
PF4D0800	8.0	48.0	90	8
PF4D0810	8.1	53.0	98	9
PF4D0820	8.2	53.0	98	9
PF4D0830	8.3	53.0	98	9
PF4D0840	8.4	53.0	98	9
PF4D0850	8.5	53.0	98	9
PF4D0860	8.6	55.0	98	9
PF4D0870	8.7	55.0	98	9
PF4D0880	8.8	55.0	98	9
PF4D0890	8.9	55.0	98	9
PF4D0900	9.0	55.0	98	9
PF4D0910	9.1	58.0	105	10
PF4D0920	9.2	58.0	105	10
PF4D0930	9.3	58.0	105	10
PF4D0940	9.4	58.0	105	10
PF4D0950	9.5	58.0	105	10
PF4D0960	9.6	60.0	105	10
PF4D0970	9.7	60.0	105	10
PF4D0980	9.8	60.0	105	10
PF4D0990	9.9	60.0	105	10
PF4D1000	10.0	60.0	105	10



基准切削条件  
Standard cutting conditions

AQUA EX 飞速钻 2D PF2D  
AQUA Drills EX Power Feed 2D

工件材质 Workpiece material	结构钢·碳素钢·灰口铸铁 Structural steel Carbon steel Gray cast iron		合金钢·调质钢 Alloy steel Heat-treated steel		模具钢·预硬钢 Mold steel Pre-hardened steel		高硬度钢 High hardness steel		球墨铸铁 Ductile iron	
	SS400 S50C FC250		SCM440 NAK		SKD61 NAK HPM		40~50HRC		FCD400	
		~200HB			20~30HRC					
Diameter (mm)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)
2	12700	660~1540	10500	520~1140	5600	220~460	4000	140~280	9500	500~1170
3	8500		7000		3700		2650		6400	
5	5100		4200		2200		1600		3800	
8	3200		2600		1400		1000		2400	
10	2550		2100		1100		800		1900	

AQUA EX 飞速钻 4D PF4D  
AQUA Drills EX Power Feed 4D

工件材质 Workpiece material	结构钢·碳素钢·灰口铸铁 Structural steel Carbon steel Gray cast iron		合金钢·调质钢 Alloy steel Heat-treated steel		模具钢·预硬钢 Mold steel Pre-hardened steel		高硬度钢 High hardness steel		球墨铸铁 Ductile iron	
	SS400 S50C FC250		SCM440 NAK		SKD61 NAK HPM		40~50HRC		FCD400	
		~200HB			20~30HRC					
Diameter (mm)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)	Rotation (min <sup>-1</sup> )	Feed (mm/min)
2	12700	590~1270	10500	460~930	5600	200~400	4000	115~230	9500	440~950
3	8500		7000		3700		2650		6400	
5	5100		4200		2200		1600		3800	
8	3200		2600		1400		1000		2400	
10	2550		2100		1100		800		1900	

切削条件之计算式  
Cutting conditions of the calculator

切削速度(Vc) = $\frac{\text{刀具直径(Dc)} \times \text{圆周率}(\pi) \times \text{转速(n)}}{\text{Tool diameter} \times \pi \times \text{Rotation}}$ (m/min)	
1,000	
进给量(f) = $\frac{\text{进给速度(Vf)}}{\text{转速(n)}}$ (mm/rev)	
转速(n)	
进给率 = $\frac{\text{进给量(f)}}{\text{刀具直径(Dc)}}$ (%)	
Tool diameter	
Example PF4D	Workpiece material:S50C Diameter:φ5mm Rotation:5,100min <sup>-1</sup> Feed:590mm/min
Cutting speed(Vc)=	$\frac{5.0 \times \pi \times 5100}{1000} = 80\text{m/min}$
Feed amount(f) =	$\frac{590}{5100} = 0.116\text{mm/rev}$
Feed rate=	$\frac{0.116}{5} = 2.3\%$

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建议之一般加工条件  
General recommendations of the processing conditions

工件材质 Workpiece material	切削速度 Cutting speed (mm/min)	一般进给率 General feed rate (%/Dc)	飞速钻的进给率 Feed rate of Power Feed (%/Dc)
Structural steel Carbon steel Gray cast iron	80	2.0~2.5	2.0~6.0
Alloy steel Heat-treated steel	65	2.0~2.5	2.0~5.5
Mold steel Pre-hardened steel	35	1.5~2.0	1.5~4.0
High hardness steel	25	1.3~1.8	1.3~3.5
Ductile iron	60	2.0~2.5	2.0~6.0

切削条件之注意事项

- (1)请依机械刚性及工件夹具、加工处形状调整切削条件
- (2)该表为使用水溶性切削油下的切削条件。若使用非水溶性切削油的情况下，请将转速及进给速度降低20%。
- (3)较不适合加工铝合金、轻金属、不锈钢。
- (4)此切削条件表，「飞速钻2倍径」仅适用于孔深2倍以下，「飞速钻4倍径」仅适用于孔深4倍深以下。另外，根据工件材质及加工条件的不同，有排屑性变差的可能。在这种情况下，即使是在适用范围内的加工孔深，也请使用步进式进给加工
- (5)步进式进给的退刀，请退回孔的上方。
- (6)步进式进给量建议为0.5倍~1倍径
- (7)请使用夹具将钻头的振幅控制在0.02mm以下，高速切削时控制振幅在0.01mm以下。
- (8)钻头刀尖的再研磨量建议为1倍径。若高于1倍径，排屑性有变差的可能。
- (9)关于再研磨钻头，请向本公司咨询。根据形状的不同，再研磨后的性能可能会有所差异。

Cutting conditions of the note

- (1) Please adjust the cutting conditions according to the mechanical rigidity and the workpiece holder and the shape of the machining place.
- (2) This table shows the cutting conditions under which water-soluble cutting oil is used. If using non-water-soluble cutting oil, reduce the speed and feed rate by 20%.
- (3) Less suitable for processing aluminum, light metal, stainless steel.
- (4) This cutting condition table, "PF2D" is only applicable to 2Dc of hole depth. "PF4D" is only suitable for 4Dc below of hole depth. In addition, according to the workpiece material and processing conditions, there is a possibility that the performance of discharging chips may be deteriorated. When such a situation, even within the scope of machining hole depth, please use the step-feed machining
- (5) Retraction of the step feed is to be returned to the top of the hole.
- (6) Step feed is recommended to 0.5Dc to 1Dc.
- (7) Please use the fixture to control the amplitude of the drill bit below 0.02mm, high-speed cutting control amplitude of the drill bit 0.01mm or less.
- (8) The re-grinding amount of the tip of the drill bit is recommended to be 1 Dc. If more than 1 Dc, the performance of chip discharge may be worse.
- (9) Please contact us about re-grinding the drill bit. Depending on the shape, the properties may be different after regrinding.

http://www.nachi.com

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