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ADVANCED TECHNOLOGY TOOLS

Ihr persönlicher
Werkzeugspezialist
vor Ort.



Break down the barrier of convention!

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 Drills **EX** Power Feed

AQUA Drills EX Power Feed

PF2D / PF4D

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.

Significantly reduced thrust

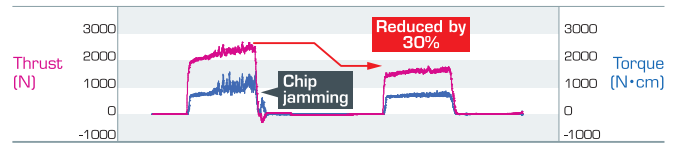
Thrust is greatly reduced, so even in the 3x ultra-high-speed feed, chip removal is also very good

Cutting resistance of Power feed 2D Is about 3x the normal feed
 Feed amount: 0.56mm/rev [Feed amount/Tool Diameter=7%]



Cutting condition	Diameter: ϕ 8mm Workpiece material: S50C	Cutting speed: 80m/min Hole depth: 16mm	Machine center Water-soluble cutting oil
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Cutting resistance of Power feed 4D Is 2x the normal feed
 Feed amount: 0.4mm/rev [Feed amount/Tool Diameter=5%]

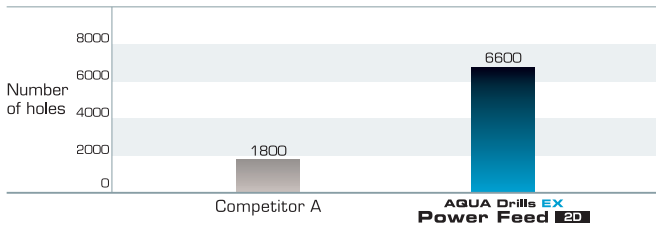


Cutting condition	Diameter: ϕ 8mm Workpiece material: S50C	Cutting speed: 80m/min Hole depth: 32mm	Machine center Water-soluble cutting oil
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Ultra-high-speed feed also has a long tool life

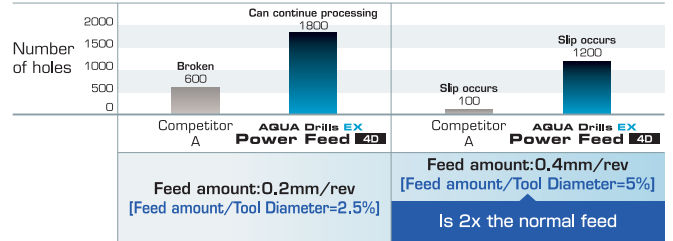
When using a machining center for ultra-high-speed feed processing, Power feed drills have an overwhelming tool life. In addition, there is a stable performance in lathe machine which is liable to cause chip clogging.

Compare the tool life of using machining center Is about 3x the normal feed
 Feed amount: 0.56mm/rev [Feed amount/Tool Diameter=7%]



Cutting condition	Diameter: ϕ 8mm Workpiece material: S50C	Cutting speed: 80m/min Hole depth: 16mm	Machine center Water-soluble cutting oil
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Compare the tool life of using lathe

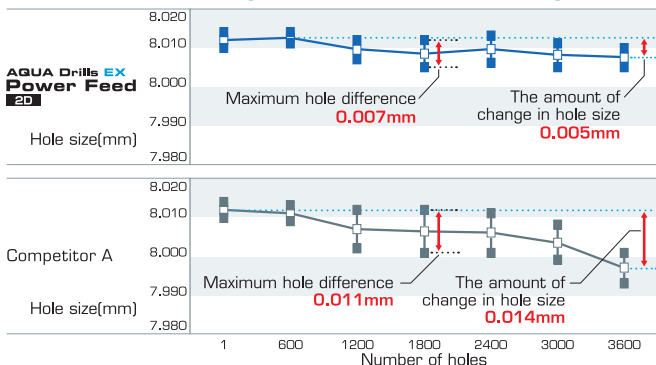


Cutting condition	Diameter: ϕ 8mm Workpiece material: S45C	Cutting speed: 64m/min Hole depth: 32mm	Automatic lathes Oily cutting oil
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Ultra-high-speed feed machining is also highly accurate

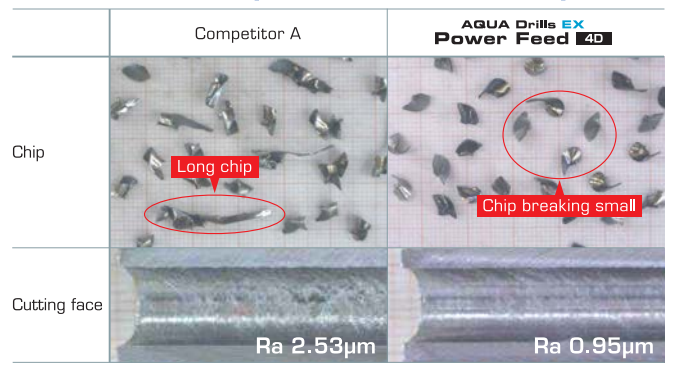
Even in the case of high feed processing, the variation of the hole expansion amount is small, and a high-quality work surface can be obtained

Compare the hole accuracy of using lathe Is 2x the normal feed
 Feed amount: 0.4mm/rev [Feed amount/Tool Diameter=5%]



Cutting condition	Diameter: ϕ 8mm Workpiece material: S45C	Cutting speed: 64m/min Hole depth: 16mm	Automatic lathes Oily cutting oil
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Compare chip, machining surface of using lathe Is 2x the normal feed
 Feed amount: 0.4mm/rev [Feed amount/Tool Diameter=5%]

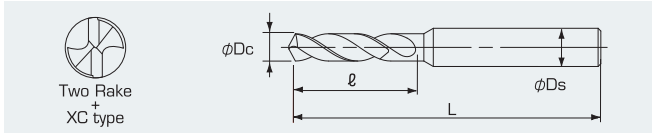


Cutting condition	Diameter: ϕ 8mm Workpiece material: S45C	Cutting speed: 64m/min Hole depth: 32mm	Automatic lathes Oily cutting oil
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PF2D

AQUA Drills EX Power Feed **2D**



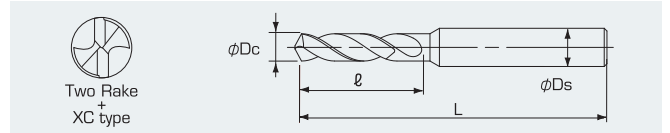
LIST 9850 **Order** **Code** Unit:mm

Code	Diameter Dc	Groove length l	Full length L	Shank diameter Ds
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 Drills EX Power Feed **4D**



LIST 9852 **Order** **Code** Unit:mm

Code	Diameter Dc	Groove length l	Full length L	Shank diameter Ds
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

PF2D

AQUA Drills^{EX} Power Feed ^{2D}

Workpiece material	Structural steel Carbon steel Gray cast iron SS400 S50C FC250		Alloy steel Heat-treated steel SCM440 NAK		Mold steel Pre-hardened steel SKD61 NAK HPM		High hardness steel		Ductile iron FCD400	
	~200HB		20~30HRC		30~40HRC		40~50HRC			
Diameter (mm)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	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	

PF4D

AQUA Drills^{EX} Power Feed ^{4D}

Workpiece material	Structural steel Carbon steel Gray cast iron SS400 S50C FC250		Alloy steel Heat-treated steel SCM440 NAK		Mold steel Pre-hardened steel SKD61 NAK HPM		High hardness steel		Ductile iron FCD400	
	~200HB		20~30HRC		30~40HRC		40~50HRC			
Diameter (mm)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	Feed (mm/min)	Rotation (min ⁻¹)	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	

Cutting conditions of the calculator

$$\text{Cutting speed}(V_c) = \frac{\text{Tool diameter} \times \pi \times \text{Rotation}}{1,000} \quad (\text{m/min})$$

$$\text{Feed amount}(f) = \frac{\text{Feed speed}}{\text{Rotation}} \quad (\text{mm/rev})$$

$$\text{Feed rate} = \frac{\text{Feed amount}}{\text{Tool diameter}} \quad (\%)$$

Example Workpiece material: S50C Rotation: 5,100min⁻¹
PF4D Diameter: φ5mm Feed: 590mm/min

$$\text{Cutting speed}(V_c) = \frac{5.0 \times \pi \times 5100}{1000} = 80\text{m/min}$$

$$\text{Feed amount}(f) = \frac{590}{5100} = 0.116\text{mm/rev}$$

$$\text{Feed rate} = \frac{0.116}{5} = 2.3\%$$

General recommendations of the processing conditions

Workpiece material	Cutting speed (mm/min)	General feed rate (%/Dc)	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

Cutting conditions of the note

- Please adjust the cutting conditions according to the mechanical rigidity and the workpiece holder and the shape of the machining place.
- 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%.
- Less suitable for processing aluminum, light metal, stainless steel.
- 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.
- Retraction of the step feed is to be returned to the top of the hole.
- Step feed is recommended to 0.5Dc to 1Dc.
- 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.
- 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.
- Please contact us about re-grinding the drill bit. Depending on the shape, the properties may be different after re-grinding.

NACHI

NACHI-FUJIKOSHI CORP.

<http://www.nachi.com>

Toyama Head Office
Tokyo Head Office

1-1-1 Fujikoshi-Honmachi, Toyama 930-8511 Tel: +81-(0)76-423-5111
 Shiodome Sumitomo Bldg. 17F, 1-9-2 Higashi-Shinbashi, Minato-ku, Tokyo 105-0021

NACHI AMERICA INC. HEAD QUARTERS
 NACHI EUROPE GmbH
 NACHI SINGAPORE PTE. LTD.
 NACHI TECHNOLOGY (THAILAND) CO., LTD.
 BANGKOK SALES OFFICE
 NACHI (SHANGHAI) CO., LTD.

715 Pushville Road, Greenwood, Indiana, 46143, U.S.A.
 Bischofstrasse 99, 47809, Krefeld, GERMANY
 No.2 Joo Koon Way, Jurong Town, Singapore 628943, SINGAPORE
 Unit 23/109(A), Fl.24th Sorachai Bldg., Sukhumvit 63 Road(Ekamail),
 Klongtonnua, Wattana, Bangkok 10110, THAILAND
 5F, Building A, 1988 Zhuguang Road, Quingpu District,
 Shanghai, 201702, CHINA

Tel: +1-317-530-1001
 Tel: +49-(0)2151-65046-0
 Tel: +65-65587393
 Tel: +66-2-714-0008
 Tel: +86-(0)21-6915-2200


reich[®]
 ADVANCED TECHNOLOGY TOOLS
 reich Tools GmbH
 Bäckergasse 5, 4707 Schlüssberg
 T +43 7248 68 537 F +43 7248 64 285
 E office@reich.at W www.reich.at