

AQUA DRILL EX FLAT

**Simple Process
Less Burr**

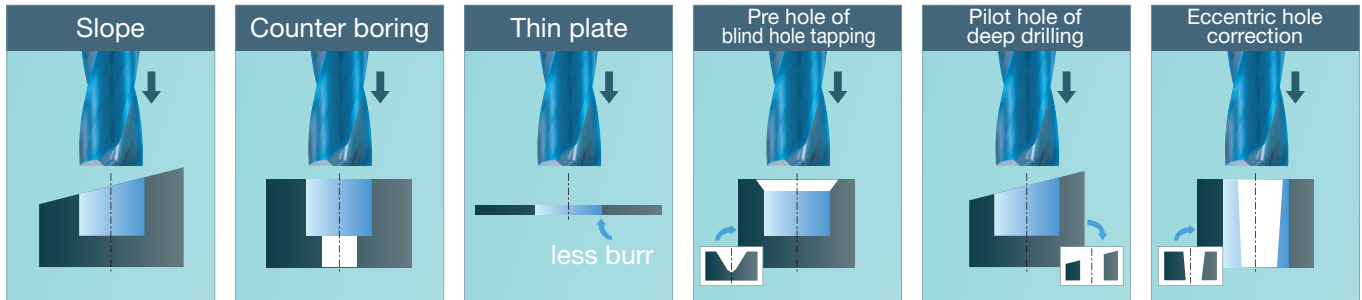


Drilling innovation with great performance

AQUA DRILL EX FLAT

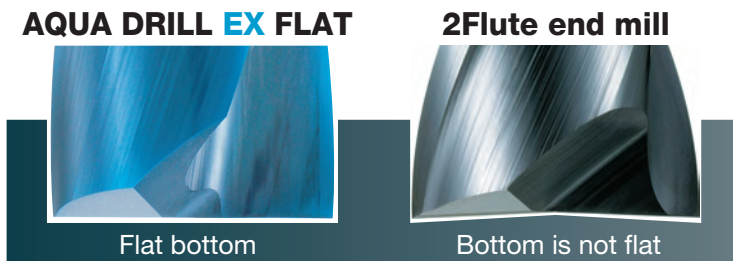
New drilling technology

Slope, counter boring, thin plate, blind tap hole, hole correction in one drill.



180° Flat Drill

Realize high accurate counter bore surface in once.



Beautiful flute geometry which provides high rigidity and smooth chip evacuation

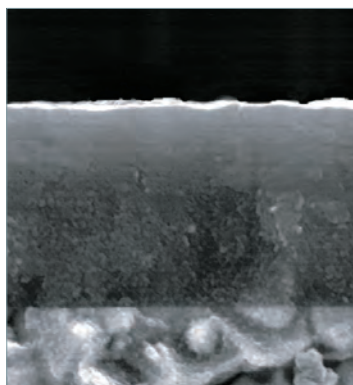


AQUA EX Coating

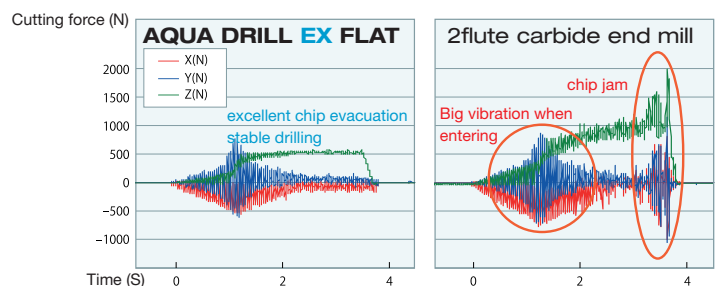
Cutting resistance on 45° slope drilling

Excellent heat and wear resistance.

Excellent drilling performance.



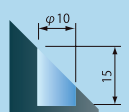
Anti-adhesion layer
AlCrTiX Anti-oxidant layer
TiAlX Anti-wear layer
High-strength carbide material



Cutting conditions

Tool: $\varnothing 10$
Speed: 75 m/min.
Feed: 240 mm/min.

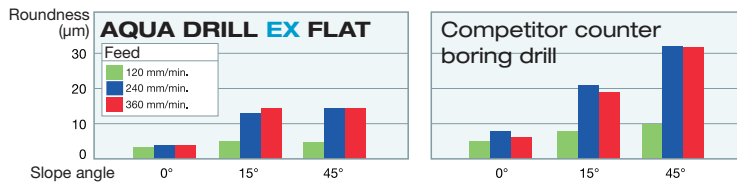
Work material: S50C
Cutting fluid: water soluble



Performance Comparison

Excellent accuracy, efficiency, tool life and performance.

Roundness during slope drilling (μm)

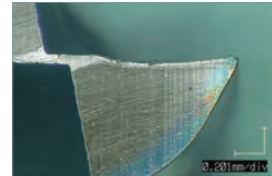
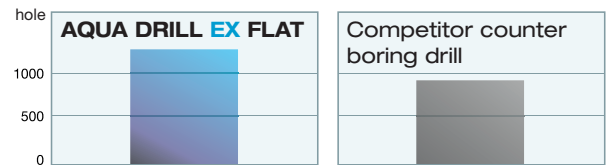


Cutting conditions

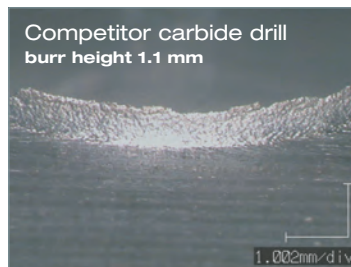
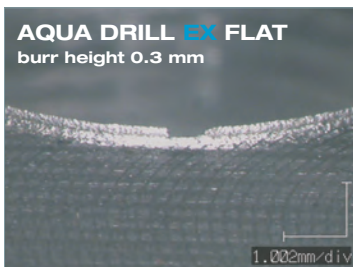
Tool: $\varnothing 3$
Speed: 75 m/min.
Feed: 240 mm/min.

Work material: SCM415
Cutting fluid: water soluble
Depth: 3 mm
Slope angle: 30°

Number of hole until 80 μm corner wear



Smaller burrs at the exit of hole on thin plate drilling

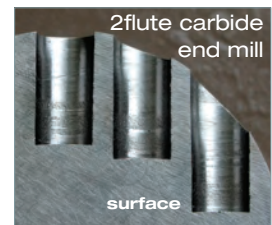
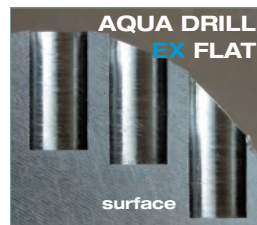


Cutting conditions

Tool: $\varnothing 10$
Speed: 75 m/min.
Feed: 420 mm/min.

(0.18 mm/rev)
Work material: SS400
Cutting fluid: Water soluble

High-efficiency. Direct drilling without pilot hole



Drilling time

19 sec.
Non-step drilling
only 19 sec to drill
2D depth slope
40 % efficiency

Drilling time

32 sec.
5 mm-step drilling

Applications

Guide holes.

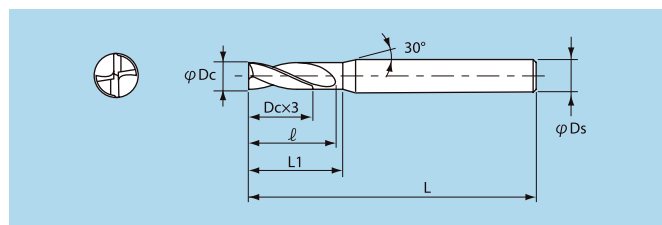
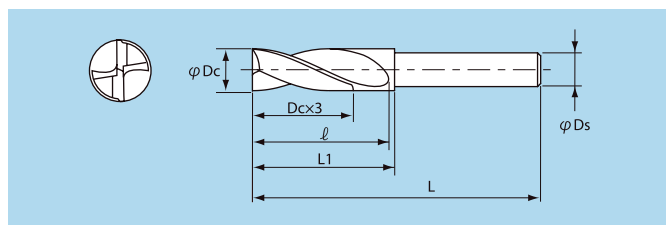
	Conventional drilling	AQUA DRILL EX FLAT
1. Counter boring	Counter boring to keep position accuracy 	
2. Guide hole drilling	1~3D guide drilling to keep hole accuracy and stable deep hole drilling 	Counter boring and Guide hole in once 
3. Deep hole drilling		

Suitable for tap pre-hole too

Blind hole in thin wall, effective thread length is kept that eliminates post-processing.



AQUA DRILL EX FLAT



List 9610

unit: mm

Dc	l	L	L1	Ds
1.0	3.3	47	3.6	3
1.1	3.5	47	3.9	3
1.2	3.9	47	4.2	3
1.3	4.2	47	4.5	3
1.4	4.6	47	4.9	3
1.5	4.9	47	5.2	3
1.6	5.2	47	5.5	3
1.7	5.5	47	5.8	3
1.8	5.8	47	6.1	3
1.9	6.2	47	6.5	3
2.0	9	50	9.8	4
2.1	11	50	11.4	4
2.2	11	50	11.4	4
2.3	11	50	11.5	4
2.4	12	50	12.6	4
2.5	12	50	12.7	4
2.6	12	50	12.8	4
2.7	14	50	14.9	4
2.8	14	50	15.0	4
2.9	14	50	15.0	4
3.0	14	50	14.4	6
3.1	15	50	15.5	6
3.2	15	50	15.6	6
3.3	15	50	15.7	6
3.4	16	50	16.2	6
3.5	16	50	16.3	6
3.6	16	50	16.4	6
3.7	18	50	18.0	6
3.8	18	50	18.1	6
3.9	18	50	18.2	6
4.0	18	50	18.3	6
4.1	19	60	20.4	6
4.2	19	60	20.4	6
4.3	19	60	20.5	6
4.4	21	60	22.6	6
4.5	21	60	22.7	6
4.6	21	60	22.8	6
4.7	22	60	22.9	6
4.8	22	60	23.0	6
4.9	22	60	23.0	6
5.0	23	60	23.1	6
5.1	24	60	26.2	6
5.2	24	60	26.3	6
5.3	24	60	26.4	6
5.4	25	60	27.5	6
5.5	25	60	27.6	6
5.6	25	60	27.7	6
5.7	27	60	29.7	6
5.8	27	60	29.8	6
5.9	27	60	29.9	6

Dc	l	L	L1	Ds
6.0	27	60	30	6
6.1	28	70	31	6
6.2	28	70	31	6
6.3	28	70	31	6
6.4	30	70	33	6
6.5	30	70	33	6
6.6	30	70	33	6
6.7	31	70	33	6
6.8	31	70	33	6
6.9	31	70	33	6
7.0	32	70	33	6
7.1	33	70	36	6
7.2	33	70	36	6
7.3	33	70	36	6
7.4	34	70	36	6
7.5	34	70	36	6
7.6	34	70	36	6
7.7	36	70	39	6
7.8	36	70	39	6
7.9	36	70	39	6
8.0	36	70	39	8
8.1	37	80	40	8
8.2	37	80	40	8
8.3	37	80	40	8
8.4	39	80	42	8
8.5	39	80	42	8
8.6	39	80	42	8
8.7	40	80	42	8
8.8	40	80	42	8
8.9	40	80	42	8
9.0	41	80	42	8
9.1	42	80	45	8
9.2	42	80	45	8
9.3	42	80	45	8
9.4	43	80	45	8
9.5	43	80	45	8
9.6	43	80	45	8
9.7	45	80	48	8
9.8	45	80	48	8
9.9	45	80	48	8
10.0	45	80	48	10
10.1	46	90	49	10
10.2	46	90	49	10
10.3	46	90	49	10
10.4	48	90	51	10
10.5	48	90	51	10
10.6	48	90	51	10
10.7	49	90	51	10
10.8	49	90	51	10
10.9	49	90	51	10

Dc	ℓ	L	L1	Ds
11.0	50	90	51	10
11.1	51	90	54	10
11.2	51	90	54	10
11.3	51	90	54	10
11.4	52	90	54	10
11.5	52	90	54	10
11.6	52	90	54	10
11.7	54	90	57	10
11.8	54	90	57	10
11.9	54	90	57	10
12.0	54	90	57	12
12.5	57	100	60	12
13.0	59	100	60	12
13.5	61	100	63	12
14.0	63	100	66	12
14.5	66	105	69	12
15.0	68	105	69	12
15.5	70	115	72	12
16.0	72	115	75	16
16.5	75	115	78	16
17.0	77	125	79	16
17.5	79	125	81	16
18.0	81	125	84	16
18.5	84	135	87	16
19.0	86	135	87	16
19.5	88	145	91	16
20.0	90	145	93	20



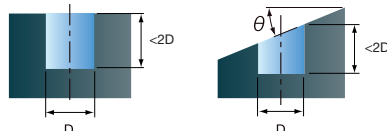
Cutting Condition

Work material	Structural Steel, Carbon Steel, Grey Cast Iron SS SC FC		Alloy Steel, Pre-Hardened SCM NAK HPM		Mold Steel SKD		Hardened Steel		Stainless Steel SUS304		Ductile Cast Iron FCD		Aluminum Alloy A7075		Cast Aluminum AC ADC	
	~200HB		20~30HRC		30~40HRC		40~50HRC									
mm	min ⁻¹	mm/min	min ⁻¹	mm/min	min ⁻¹	mm/min	min ⁻¹	mm/min	min ⁻¹	mm/min	min ⁻¹	mm/min	min ⁻²	mm/min	min ⁻²	mm/min
1	19100	290	15900	240	9550	110	6400	40	9550	50	15900	190	40000	720	28600	460
1,9	11700	360	10100	310	5900	160	4200	70	5030	50	10100	250	24300	830	17600	540
2	11100	360	9550	310	5550	160	3980	70	-	-	9550	250	23100	830	16700	530
3	7950	420	6900	360	3700	170	2650	80	-	-	6900	310	17000	1020	12500	660
4	5950	420	5150	360	2800	170	2000	80	-	-	5150	310	12500	1020	9550	660
5	4800	420	4150	360	2200	170	1600	80	-	-	4150	310	10000	1020	7650	660
6	4000	420	3450	360	1800	170	1300	80	-	-	3450	310	8500	1020	6400	660
8	3000	420	2600	360	1400	170	1000	80	-	-	2600	310	6350	1020	4750	660
10	2400	420	2050	360	1100	170	800	80	-	-	2050	310	5100	1020	3800	660
12	2000	420	1700	360	950	170	650	80	-	-	1700	310	4250	1020	3200	660
16	1500	420	1300	360	700	170	500	80	-	-	1300	310	3200	1020	2400	660
20	1200	420	1050	360	550	170	400	80	-	-	1050	310	2550	1020	1900	660

Warnings on using the drilling condition tables:

- Adjust drilling conditions according to the rigidity of machine and work clamp condition.
- Please use after the forged surface has been removed.
- Suitable for water soluble. In case of insoluble, reduce the rotation and feed 20 %.
- Recommended for drilling under 2D depth. In case of over 2D depth, the chip evacuation may become worse.
- Only under 1.9 mm are suitable for stainless steel (SUS304,316) drilling.
- When slope drilling, please adjust the cutting condition according to the slope angle (θ)
Slope angle (θ) under 30: reduce the feed rate 50 % from the cutting condition.
Slope angle (θ) over 30: reduce RPM under 70 %, and feed rate under 30 % of normal cutting condition.

Depth of cut:



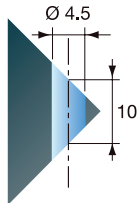
AQUA DRILL EX FLAT

Drilling example.

Entrance and exit of slope drilling

1.1201 (S50C)

Auto-motive components



Before	After
Counter boring: Carbide End mill	AQUA DRILL EX FLAT 2 in 1 process
Drilling: Carbide Drill	Curve max. 45 µm
Big curve at exit of hole max. 60 µm Burr at the exit of hole	Less burr

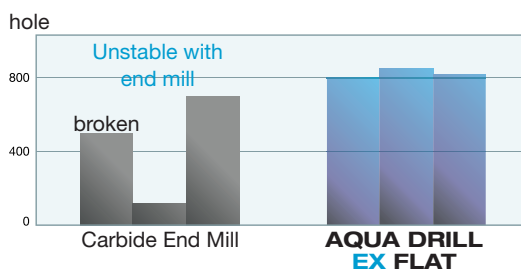
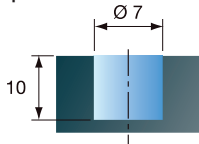
Cutting conditions

Tool:	4.5 mm
Speed:	60 m/min
Feed:	480 mm/min 0.113 mm/rev
Cutting Fluid:	Water soluble

Pre hole of blind hole tapping

1.1201 (S50C)

Electricity terminal components



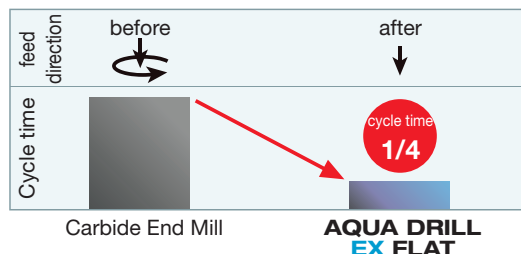
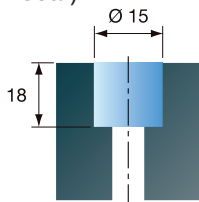
Cutting conditions

Tool:	7 mm
Speed:	60 m/min
Feed:	150 mm/min 0.056 mm/rev
Depth:	10 mm
Cutting Fluid:	Water soluble

Counter boring

Ductile Iron GGG

Hydraulic components (Bolt seat)



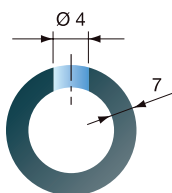
Cutting conditions

Tool:	15 mm
Speed:	66 m/min
Feed:	250 mm/min 0.18 mm/rev
Depth:	18 mm
Cutting Fluid:	Water soluble BT40 Vertical MC

3 in 1 / Less burr

1.0503 (S45C)

Hydraulic valve component



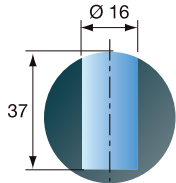
before	after
Pre-process: Carbide end mill	AQUA DRILL EX FLAT 3 in 1 process
Drilling: Carbide drill	Eliminate end mill Reduced burr Reduced deburring
Deburring	

Cutting conditions

Tool:	4 mm
Speed:	23 m/min
Feed:	70 mm/min 0.04 mm/rev
Depth:	7 mm
Cutting Fluid:	Water soluble 500 hole constant

Counter boring

Casted copper of electronic components

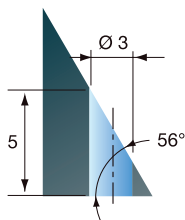


before	after
Counter boring: HSS end mill	AQUA DRILL EX FLAT 3 in 1 process
Drilling: Carbide drill	Eliminate end mill Copper alloy OK Reduced process
Bottom finish: HSS end mill	

Cutting conditions	
Tool:	16 mm
Speed:	60 m/min
Feed:	200 mm/min 0.17 mm/rev
Depth:	37 mm
Cutting Fluid:	Water soluble BT50 Vertical MC

Process reduction in Slope drilling

Ductile Iron GGG Steering component

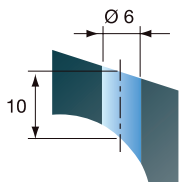


before	after
pre-process: Carbide end mill	AQUA DRILL EX FLAT 2 in 1 process
Drilling: Carbide drill	Eliminate end mill Reduced process Reduced tool cost

Cutting conditions	
Tool:	3 mm
Speed:	47 m/min
Feed:	88 mm/min 0.018 mm/rev
Depth:	5 mm
Cutting Fluid:	Water soluble

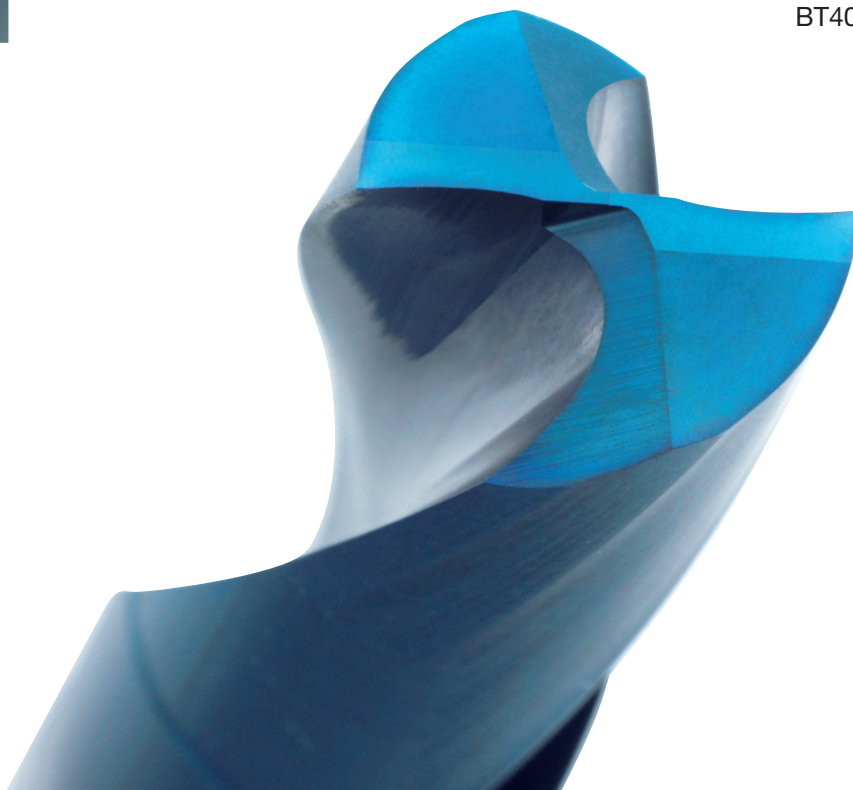
Cross hole

1.0503 (S45C) Hydraulic pump component



before	after
Counter boring: Carbide end mill	AQUA DRILL EX FLAT 2 in 1 process
Drilling: Carbide Drill Deburring cross hole is difficult	Reduced burr Reduced process

Cutting conditions	
Tool:	6 mm
Speed:	68 m/min
Feed:	250 mm/min 0.07 mm/rev
Depth:	5 mm
Cutting Fluid:	Water soluble BT40 Vertical MC





German Head Quarter

NACHI EUROPE GmbH
Bischofstraße 99
47809 Krefeld, Germany
Phone: +49 2151-65046-0
Fax: +49 2151-65046-90
<http://www.nachi.de/>

South Office Germany

NACHI EUROPE GmbH
Pleidelsheimer Straße 47
74321 Bietigheim-Bissingen, Germany
Phone: +49 7142-77418-0
Fax: +49 7142-77418-20

UK Branch

NACHI EUROPE GmbH
Unit 3, 92, Kettles Wood Drive,
Woodgate Business Park,
BIRMINGHAM, B32 3DB, UK
Phone: +44 121 423 2922
Fax: +44 121 421 7520
<http://www.nachi.co.uk/>

Spain Main Office

NACHI EUROPE GmbH
P.I. El Montalvo IIC/Segunda, 6. Portal 1-2ª,
Oficina 537188 Carbajosa de la Sagrada
SALAMANCA (Spain)
Phone: +34 923 197 837
Fax: +34 923 197 758

CZ-Office

NACHI EUROPE GmbH
Sezemicka 2757/2
VGP Park – A1
Prague 9,
193 00, Czech Republic
Phone: +420-255 734 000
Fax: +420-255 734 001

Factories

NACHI CZECH S.R.O.
PRUMYSLOVA 2732
44001 Louny, Czech Republic
Phone: +420 415 930930
Fax: +420 415 930940
<http://cz.nachi.de/czech>
e-mail: info@nachi.de

Turkey Office

NACHI EUROPE GmbH
TURKEY REPRESENTATIVE OFFICE
Karaman Ciftligi Mevkii, Agaoglu My Prestige,
k:13 D:110 Atasehir 34746 Istanbul
Phone: +90 216 688 4457
Fax: +90 216 688 4458

NACHI-FUJIKOSHI CORP.

Tokyo Head Office

Shiodome Sumitomo Bldg., 1-9-2 Higashi-shinbashi, Minato-ku Tokyo, JAPAN
Phone: +81-3-5568-5240 Fax: +81-3-5568-5236
Web Site URL <http://www.nachi-fujikoshi.co.jp/>

Toyama Head Office

1-1-1 Fujikoshi-Honmachi, Toyama, JAPAN
Phone: +81-76-423-5111 Fax: +81-76-493-5211

Purchased These Fine Products From: