

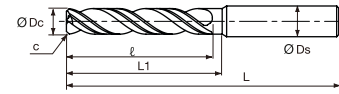
L9812

**NEW**

## AQUA Drill EX FLAT Oil-Hole 3D



double margin



Dc	ℓ	L	L1	Ds	Stock
3.0	14	68	15	3	●
3.1	15	72	17	4	●
3.2	15	72	17	4	●
3.3	15	72	17	4	●
3.4	16	72	17	4	●
3.5	16	72	18	4	●
3.6	16	72	19	4	●
3.7	18	72	19	4	●
3.8	18	72	19	4	●
3.9	18	72	19	4	●
4.0	18	72	19	4	●
4.1	19	80	22	5	●
4.2	19	80	22	5	●
4.3	19	80	22	5	●
4.4	21	80	22	5	●
4.5	21	80	23	5	●
4.6	21	80	24	5	●
4.7	22	80	24	5	●
4.8	22	80	24	5	●
4.9	22	80	24	5	●
5.0	23	80	24	5	●
5.1	24	82	26	6	●
5.2	24	82	26	6	●
5.3	24	82	26	6	●
5.4	25	82	26	6	●
5.5	25	82	27	6	●
5.6	25	82	28	6	●
5.7	27	82	28	6	●
5.8	27	82	28	6	●
5.9	27	82	28	6	●
6.0	27	82	28	6	●
6.1	28	88	31	7	●
6.2	28	88	31	7	●
6.3	28	88	31	7	●
6.4	30	88	31	7	●
6.5	30	88	32	7	●
6.6	30	88	33	7	●
6.7	31	88	33	7	●
6.8	31	88	33	7	●
6.9	31	88	33	7	●
7.0	32	88	33	7	●
7.1	33	94	35	8	●
7.2	33	94	35	8	●
7.3	33	94	35	8	●

Dc	ℓ	L	L1	Ds	Stock
7.4	34	94	35	8	●
7.5	34	94	36	8	●
7.6	34	94	37	8	●
7.7	36	94	37	8	●
7.8	36	94	37	8	●
7.9	36	94	37	8	●
8.0	36	94	37	8	●
8.1	37	100	40	9	●
8.2	37	100	40	9	●
8.3	37	100	40	9	●
8.4	39	100	40	9	●
8.5	39	100	41	9	●
8.6	39	100	42	9	●
8.7	40	100	42	9	●
8.8	40	100	42	9	●
8.9	40	100	42	9	●
9.0	41	100	42	9	●
9.1	42	106	44	10	●
9.2	42	106	44	10	●
9.3	42	106	44	10	●
9.4	43	106	44	10	●
9.5	43	106	45	10	●
9.6	43	106	46	10	●
9.7	45	106	46	10	●
9.8	45	106	46	10	●
9.9	45	106	46	10	●
10.0	45	106	46	10	●
10.3	46	116	49	11	●
10.4	48	116	49	11	●
10.5	48	116	50	11	○
10.8	49	116	51	11	○
11.0	50	116	51	11	○
11.5	52	122	54	12	○
12.0	54	122	55	12	○
12.5	57	128	59	13	○
13.0	59	128	60	13	○
13.5	61	134	63	14	○
14.0	63	134	64	14	○
14.5	66	140	68	15	○
15.0	68	140	69	15	○
15.5	70	146	72	16	○
16.0	72	146	73	16	○

●: Stocked Items in Germany  
○: Stocked Items in Japan

## Standard Drilling Conditions

Work material	Structural Steel, Carbon Steel, Grey Cast Iron SS400 S55C FC250		Alloy Steel, Pre-Hardened SCM SKT SKS SKD		Mold Steel SKT SKD NAK55 HPM1		Hardened Steel		Ductile Cast Iron FCD400		Stainless Steel SUS304		Aluminum Alloy A7075	
	-200HB		20-30HRC		30-40HRC		40-50HRC				38-45HRC			
	mm	min <sup>-1</sup>	mm/min	min <sup>-1</sup>	mm/min	min <sup>-1</sup>	mm/min	min <sup>-1</sup>	mm/min	min <sup>-1</sup>	mm/min	min <sup>-1</sup>	mm/min	min <sup>-1</sup>
3	12700	950	10600	635	7400	330	6370	285	10600	480	10600	635	14800	1330
4	9500	950	7900	635	5550	330	4780	285	7900	480	7900	635	11100	1330
5	7600	950	6300	635	4450	330	3820	285	6300	480	6300	635	8900	1330
6	6370	950	5300	635	3700	330	3180	285	5300	480	5300	635	7400	1330
8	4780	950	3950	635	2790	330	2390	285	3950	480	3950	635	5570	1330
10	3820	950	3150	635	2230	330	1900	285	3150	480	3150	635	4460	1330
12	3180	950	2650	635	1860	330	1590	285	2650	480	2650	635	3710	1330
16	2390	950	1990	635	1390	330	1190	285	1990	480	1990	635	2790	1330

### Warnings on using the drilling condition tables

- Adjust drilling condition according to the rigidity of machine or work clamp state.
- This table values are for drilling with water soluble cutting fluid. When using non-water soluble cutting fluid, reduce the RPM and feed speeds by 20 %.
- Use the table values for drilling depths under 3×D.
- Guide holes is not necessary when for hole on surfaces angled between 5 and 15°, reduce the RPM by under 50 %, the feed by under 40 %.
- Side milling is not possible.



## Features and Specifications



Tool	Depth	Feature				Drill Feature		
		deep position	efficiency	slope	hole accuracy	Guide hole	Double margin	Internal coolant
AQUA FLAT 2D	2D		⊙	⊙		no		
AQUA FLAT Oil Hole 3D	3D		⊙	⊙	⊙	no	○	○

## Applicable work materials

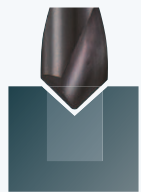
Tool	Structural Steels	Carbon Steels	Pre-Hardened Steels Alloy Steels	Hardened Steels Mold Steels	Hardened Steels		Stainless Steels		Titanium Alloys Nickel Alloys	Cast Irons	Aluminum Alloys	Copper Alloys
	SS400	S45C	SCM/NAK	30~40HRC	40~50HRC	50~60HRC	SUS304/SUS316	SUS420		FC/FCD	AC/ADC	CU
AQUA FLAT 2D	⊙	⊙	⊙	⊙	○			⊙		⊙	○	○
AQUA FLAT Oil Hole 3D	⊙	⊙	⊙	⊙	○		○	⊙	○	⊙	⊙	⊙

## User Guide

### Prevention of hole enlargement and vibration by AQUA EX Flat(2D) and Oil Hole 3D



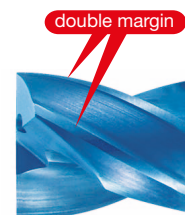
- For flat surface, maintain the guide hole by small steps(G73)
- For slope surface, reduce the feed rate



When chamfer required larger than drill diameter such as tap holes, make the chamfer 1<sup>st</sup>.

## Reduction of hole enlargement

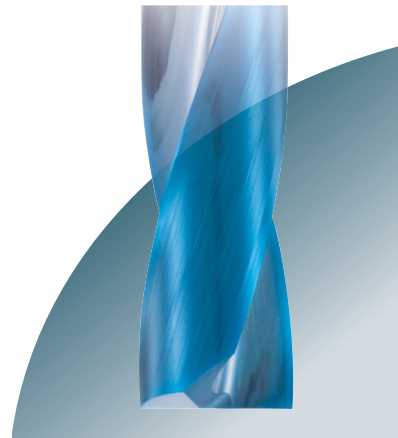
Double margin and 2step cutting edge point geometry reduce the hole enlargement. With Oil hole, excellent chip evacuation



### Cutting condition of slope drilling

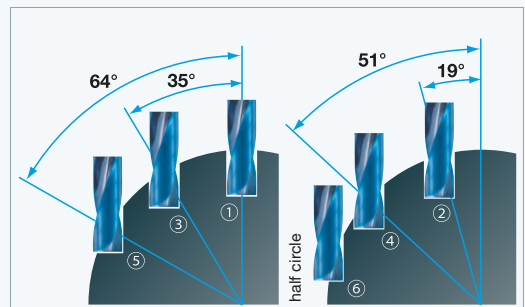


- a Reduce the cutting speed and feed rate
- b Normal cutting condition
- c Same as a or reduce the feed rate



### Cutting condition comparison on slope drilling

Position	angle	Cutting Speed			Feed		
		m/min	min <sup>-1</sup>	ratio	mm/min	mm/rev	ratio
①	0	75	2400	100%	420	0.18	100%
②	19°				210	0.09	50%
③	35°	52	1650	70%	120	0.07	40%
④	51°				120	0.07	40%
⑤	64°				90	0.06	33%
⑥	half circle				60	0.04	20%



AQUA EX Flat Drill Ø 10 / Material C45 carbon steel / Cutting depth 15 mm / Water soluble