A&M INDUSTRIAL

PRODUCTS | SERVICES | SOLUTIONS

NACHI

AQUA DRILL EX FLAT

THE #1 SELLING FLAT BOTTOM DRILL

Metric & Fractional Sizes

800.864.2660 | WWW.AM-IND.COM

AQUA DRILL EX FLAT

- One Drill does it all - Eliminates the need to use a “center drill” or “end mill” on inclined or curved surfaces
- True 180° flat cutting edges creates minimal exit burr in Tubing & Thin Plates
- Ideally suited for flat bottom applications in the Oil and Gas, Automotive as well as General Industries
- “Double Margin” for stable and precision Drilling

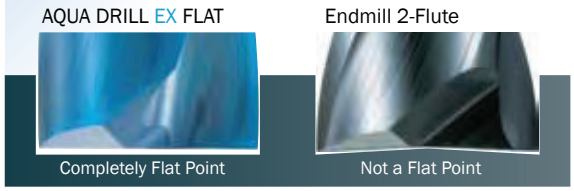
AQUA DRILL EX FLAT

New Features:

New Features on 3D/5D/Extd. Length:
1) Double Margin
2) Corner Chamfer
3) Added Stability & Tool Life

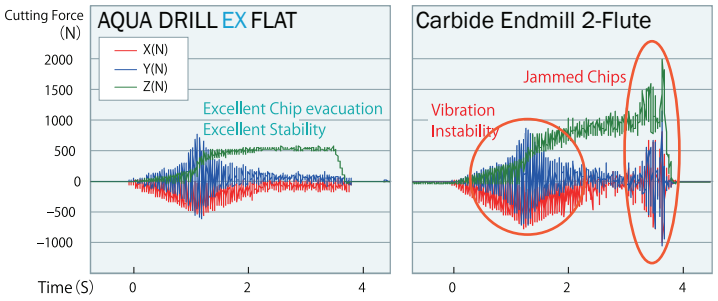
180° TRUE FLAT FACE

One cut to produce accurate counter bore surface



Cutting Resistance on 45° angled surface

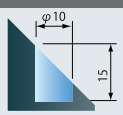
Excellent Hole Drilling Performance



AQDEXZ 10.0 TEST DATA

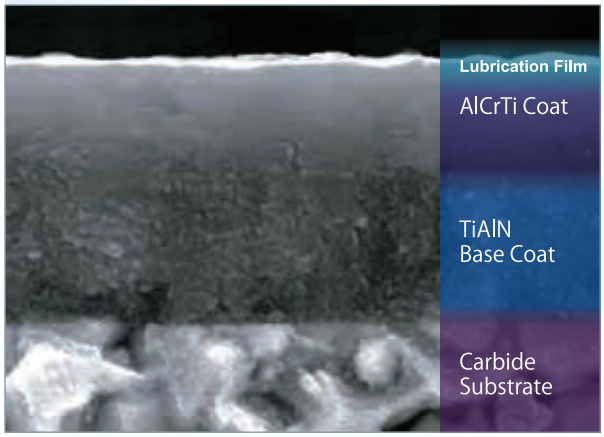
Cutting conditions

Tool:	AQDEXZ 10.0
(SFM)RPM:	(250)2400
(IPR)IPM:	(.002)6.0
Material:	Carbon Steel
Coolant:	Water Soluble



AQUA EX COATING

Improved Heat & Wear Resistance



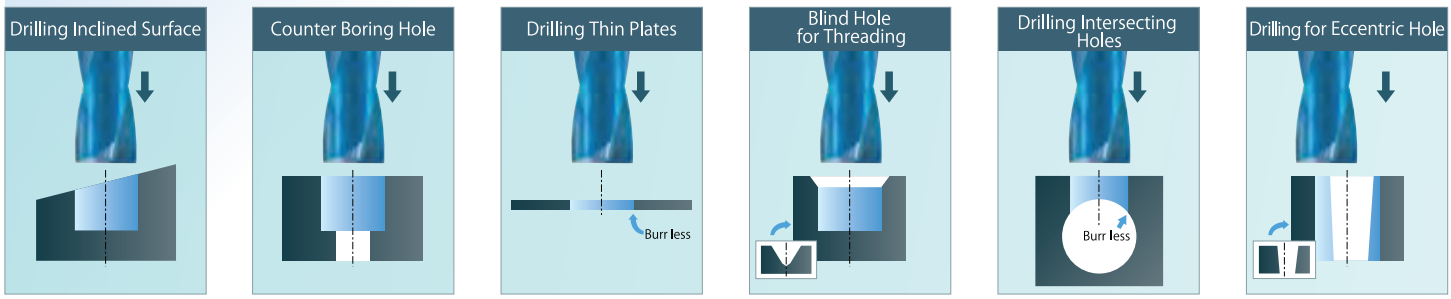
AQUA DRILL EX FLAT

Unique and Versatile High Performance Carbide Drill

One Step Drilling with Minimal Burr

Eliminate the need for “Center Drill” & “End mill”

● Not recommended for milling



New AQUA Drill EX Flat Series

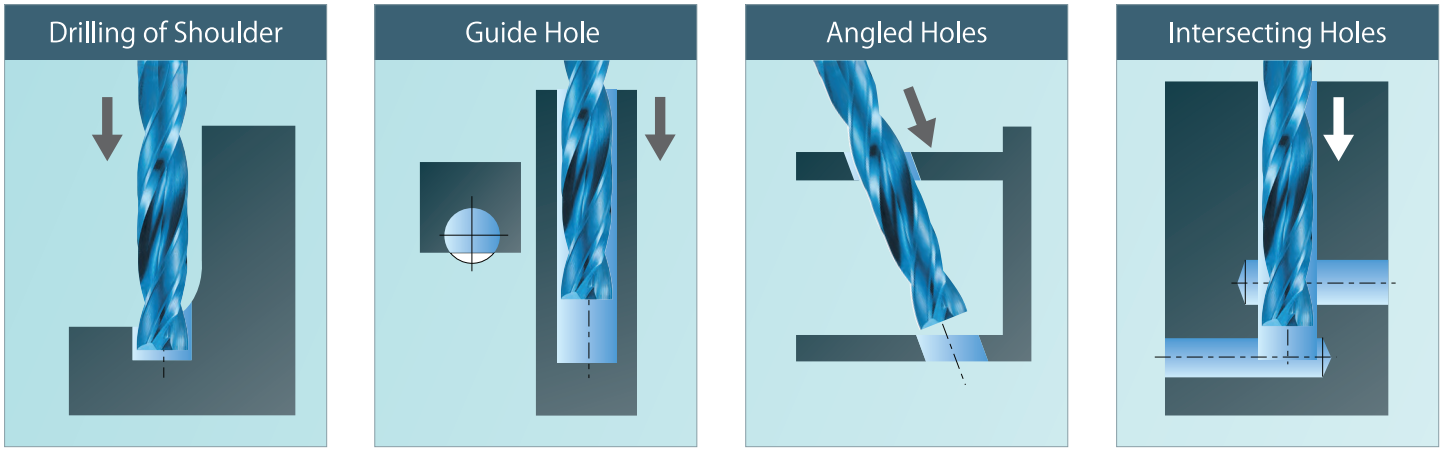
“One Step Drilling with Minimal Burrs”

Aqua EX Flat Series Line Up

List No.	Diameter Metric	Diameter Fractional
L9610 L9611	0.2 - 20.0	1/8 - 3/4
L9628	2.0 - 20.0	
L9818 L9819	3.0 - 20.0	1/8 - 3/4
L9816 L9817	3.0 - 20.0	1/8 - 3/4
L9812 L9813	1.0 - 16.0	1/8 - 3/4
L9814 L9815	1.0 - 16.0	1/8 - 5/8
L9830 L9831	3.0 - 12.0	1/8 - 3/4

Aqua Drill EX Flat

Additional Applications



◎ = Great ○ = Good

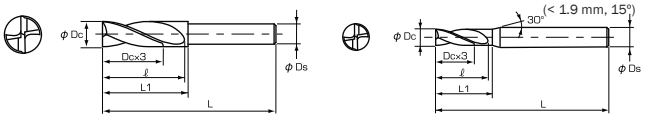
Aqua EX Flat

Work Material	Applicable work materials											
	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
L9610, L9611 L9818, L9819 L9816, L9817	◎	◎	◎	◎	○			◎		◎	○	○
L9812, L9813 L9814, L9815	◎	◎	◎	◎	○		○	◎	○	◎	◎	◎

Aqua Drill EX Flat Stub

Carbide Material | AQ EX Coating | 20° Helix | h7 Dia.Tol | 180° Point Angle | h6 Shank Dia. Tolerance

<1.9 mm, Dc x 2.3D



L9610 / L9611

Metric Size / Fractional Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9610	0751974	0.2	0.0079	0.66		0.98		•
L9610	0751968	0.3	0.0188	0.99		1.36		•
L9610	0751951	0.4	0.0157	1.32		1.65		•
L9610	0737198	0.5	0.0197	1.65		2.03		•
L9610	0737181	0.6	0.0236	1.98		2.32		•
L9610	0737175	0.7	0.0276	2.31		2.71		•
L9610	0737169	0.8	0.0315	2.64	47	2.99		•
L9610	0737152	0.9	0.0354	2.97		3.28		•
L9610	0715148	1.0	0.0394	3.3		3.6	3	•
L9610	0715154	1.1	0.0433	3.5		3.9		•
L9610	0715160	1.2	0.0472	3.9		4.2		•
L9610	0715177	1.3	0.0512	4.2		4.5		•
L9610	0715183	1.4	0.0551	4.6		4.9		•
L9610	0715190	1.5	0.0591	4.9		5.2		•
L9610	0715205	1.6	0.0630	5.2		5.5		•
L9610	0715211	1.7	0.0669	5.5		5.8		•
L9610	0715228	1.8	0.0709	5.8		6.1		•
L9610	0715234	1.9	0.0748	6.2		6.5		•
L9610	0711354	2.0	0.0787	9		9.8		•
L9610	0713180	2.1	0.0827			11.4		•
L9610	0711360	2.2	0.0866	11		11.4		•
L9610	0713197	2.3	0.0906			11.5		•
L9610	0713202	2.4	0.0945			12.6	4	•
L9610	0711377	2.5	0.0984	12		12.7		•
L9610	0713219	2.6	0.1024			12.8		•
L9610	0713225	2.7	0.1063			14.9		•
L9610	0713231	2.8	0.1102	14	50	15.0		•
L9610	0713248	2.9	0.1142			15.0		•
L9610	0709920	3.0	0.1181			14.4		•
L9610	0713254	3.1	0.1220			15.5		•
L9611	1455595	1/8	0.1250	15		18		•
L9610	0713260	3.2	0.1260			15.6		•
L9610	0710839	3.3	0.1299			15.7		•
L9610	0713277	3.4	0.1339			16.2		•
L9610	0709936	3.5	0.1378	16		16.3		•
L9610	0713283	3.6	0.1417			16.4		•
L9610	0713290	3.7	0.1457			18.0		•
L9610	0713305	3.8	0.1496	18		18.1		•
L9610	0713311	3.9	0.1535			18.2		•
L9611	1455600	5/32	0.1563			20		•
L9610	0709942	4.0	0.1575			18.3		•
L9610	0713328	4.1	0.1614			20.4		•
L9610	0710845	4.2	0.1654	19		20.4		•
L9610	0713334	4.3	0.1693			20.5		•
L9610	0713340	4.4	0.1732			22.6		•
L9610	0709959	4.5	0.1772	21		22.7	6	•
L9610	0713357	4.6	0.1811			22.8		•
L9610	0713363	4.7	0.1850			22.9		•
L9611	1455617	3/16	0.1875	22		24		•
L9610	0713370	4.8	0.1890			23.0		•
L9610	0713386	4.9	0.1929			23.0		•
L9610	0709965	5.0	0.1969	23		23.1		•
L9610	0713392	5.1	0.2008		60	26.2		•
L9610	0713408	5.2	0.2047	24		26.3		•
L9610	0711390	5.3	0.2087			26.4		•
L9610	0713414	5.4	0.2126			27.5		•
L9610	0709971	5.5	0.2165	25		27.6		•
L9611	1455623	7/32	0.2188			28		•
L9610	0713420	5.6	0.2205			27.7		•
L9610	0713437	5.7	0.2244			29.7		•
L9610	0713443	5.8	0.2283	27		29.8		•
L9610	0713450	5.9	0.2323			29.9		•
L9610	0709988	6.0	0.2362			30		•

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9610	0713466	6.1	0.2402					•
L9610	0713472	6.2	0.2441	28		31		•
L9610	0713489	6.3	0.2480					•
L9611	1455630	1/4	0.2500					•
L9610	0713495	6.4	0.2520	30				•
L9610	0709994	6.5	0.2559					•
L9610	0713500	6.6	0.2598			33		•
L9610	0713517	6.7	0.2638					•
L9610	0710851	6.8	0.2677	31				•
L9610	0713523	6.9	0.2717					•
L9610	0710008	7.0	0.2756	32				•
L9610	0713530	7.1	0.2795		70		6	•
L9611	1455646	9/32	0.2812	33				•
L9610	0713546	7.2	0.2835					•
L9610	0713552	7.3	0.2874			36		•
L9610	0713569	7.4	0.2913					•
L9610	0710014	7.5	0.2953	34				•
L9610	0713575	7.6	0.2992					•
L9610	0713581	7.7	0.3031					•
L9610	0713598	7.8	0.3071					•
L9610	0713603	7.9	0.3110	36		39		•
L9611	1455652	5/16	0.3125					•
L9610	0710020	8.0	0.3150					•
L9610	0713610	8.1	0.3189					•
L9610	0713626	8.2	0.3228	37		40		•
L9610	0713632	8.3	0.3268					•
L9611	1455669	21/64	0.3281					•
L9610	0713649	8.4	0.3307	39				•
L9610	0710037	8.5	0.3346					•
L9610	0713655	8.6	0.3386			42		•
L9610	0713661	8.7	0.3425					•
L9610	0711405	8.8	0.3465	40				•
L9610	0713678	8.9	0.3504					•
L9610	0710043	9.0	0.3543	41			8	•
L9610	0713684	9.1	0.3583	42	80			•
L9611	1455675	23/64	0.3594					•
L9610	0713690	9.2	0.3622					•
L9610	0713706	9.3	0.3661					•
L9610	0713712	9.4	0.3701	43		45		•
L9610	0710050	9.5	0.3740					•
L9611	1455681	3/8	0.3750					•
L9610	0713729	9.6	0.3780					•
L9610	0713735	9.7	0.3819					•
L9610	0713741	9.8	0.3858	45		48		•
L9610	0713758	9.9	0.3898					•
L9610	0710066	10.0	0.3937					•
L9610	0713764	10.1	0.3976					•
L9610	0713770	10.2	0.4016	46		49		•
L9610	0710868	10.3	0.4055					•
L9611	1455698	13/32	0.4063					•
L9610	0713787	10.4	0.4094	48				•
L9610	0710072	10.5	0.4134			51		•
L9610	0713793	10.6	0.4173					•
L9610	0713809	10.7	0.4213				10	•
L9610	0711411	10.8	0.4252	49	90			•
L9610	0713815	10.9	0.4291					•
L9610	0710089	11.0	0.4331	50				•
L9610	0713821	11.1	0.4370					•
L9611	1455703	7/16	0.4375	51		54		•
L9610	0713838	11.2	0.4409					•
L9610	0713844	11.3	0.4449					•
L9610	0713850	11.4	0.4488	52				•
L9610	0710095	11.5	0.4528					•

* Package Qty: 1 per Tube Size

L9610 / L9611

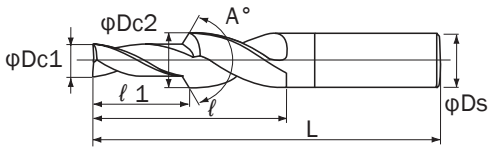
Metric Size / Fractional Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9611	1455710	29/64	0.4531	52	90	54	10	•
L9610	0713867	11.6	0.4567					•
L9610	0713873	11.7	0.4606	54		57		•
L9610	0713880	11.8	0.4646					•
L9610	0713896	11.9	0.4685					•
L9611	1455726	15/32	0.4688					•
L9610	0710100	12.0	0.4724				12	•
L9610	0724619	12.1	0.4764		100			•
L9610	0724625	12.2	0.4803					•
L9610	0724631	12.3	0.4843					•
L9610	0724648	12.4	0.4882					•
L9610	0710117	12.5	0.4921	57		60		•
L9610	0724654	12.6	0.4961					•
L9610	0724660	12.7	0.5000					•
L9611	1455732	1/2	0.5000	58				•
L9610	0724677	12.8	0.5039	57				•
L9610	0724683	12.9	0.5079					•
L9610	0710123	13.0	0.5118	59		63		•
L9610	0724690	13.1	0.5157					•
L9610	0724705	13.2	0.5197					•
L9610	0724711	13.3	0.5236					•
L9610	0724728	13.4	0.5276					•
L9610	0710130	13.5	0.5315	61				•
L9610	0724734	13.6	0.5354					•
L9610	0724740	13.7	0.5394					•
L9610	0724757	13.8	0.5433					•
L9610	0724763	13.9	0.5472					•
L9610	0710146	14.0	0.5512	63		66		•
L9610	0724770	14.1	0.5551					•
L9610	0724786	14.2	0.5591					•
L9611	1455749	9/16	0.5625	64	105	67		•
L9610	0724792	14.3	0.5630	63	100	66		•
L9610	0724808	14.4	0.5669					•
L9610	0710152	14.5	0.5709	66	105	69		•
L9610	0724814	14.6	0.5748					•
L9610	0724820	14.7	0.5787					•
L9610	0724837	14.8	0.5827					•
L9610	0724843	14.9	0.5866					•
L9610	0710169	15.0	0.5906	68				•
L9610	0724850	15.1	0.5945					•
L9610	0724866	15.2	0.5984					•
L9610	0724872	15.3	0.6024					•
L9610	0724889	15.4	0.6063					•
L9610	0710175	15.5	0.6102	70	115	72		•
L9610	0724895	15.6	0.6142					•
L9610	0724900	15.7	0.6181					•
L9610	0724917	15.8	0.6220					•
L9611	1455755	5/8	0.6250	72		75		•
L9610	0724923	15.9	0.6260	70		72		•
L9610	0710181	16.0	0.6299	72		75	16	•
L9610	0710198	16.5	0.6496	75		78		•
L9610	0710203	17.0	0.6693	77	125	79		•
L9611	1455761	11/16	0.6875	79		81		•
L9610	0710210	17.5	0.6890	79		81		•
L9610	0710226	18.0	0.7087	81		84		•
L9610	0710232	18.5	0.7283	84	135	87		•
L9610	0710249	19.0	0.7480	86		87		•
L9611	1455778	3/4	0.7500	87		90		•
L9610	0710255	19.5	0.7677	88	145	91		•
L9610	0710261	20.0	0.7874	90		93	20	•

⚠ **WARNING:** Cancer - www.P65Warnings.ca.gov

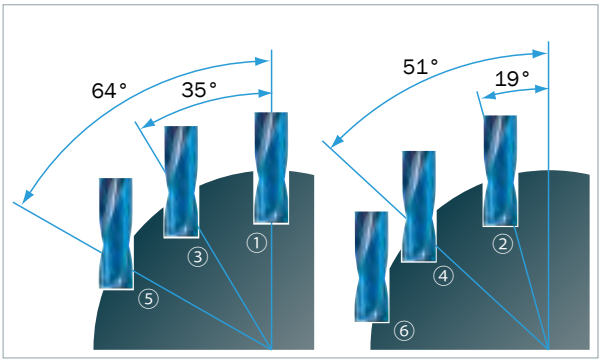
Custom Orders Available

Designed specifically for your application

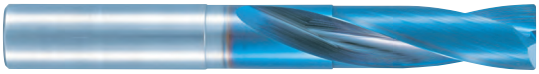


Special length, diameter, step drill, deep hole

Available for all Flat Bottom Carbide Drills

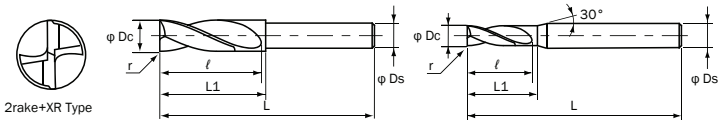


Aqua Drill EX Flat Radius



Carbide | AO EX | h7 | 180° | 20° | h6

Material | Coating | Dia. Tol. | Point Angle | Helix | Shank Dia.



L9830 / L9831

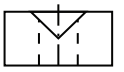
Metric Size / Fractional Size

List No.	EDP NO.	Size	Decimal Equivalent	Radius	FL	OAL	L1	Shank Dia.	Stock
		Dc		r	ℓ	L	L1	Ds	
9830	0732580	3.0	0.1181	0.3	14	50	16	6	•
9830	1490158	3.1	0.1220		15		17		•
9831	1489960	1/8	0.1250						•
9830	1490164	3.2	0.1260						•
9830	0732597	3.3	0.1299						•
9830	1490170	3.4	0.1339		16		18		•
9830	0732602	3.5	0.1378						•
9830	1490187	3.6	0.1417						•
9830	1490193	3.7	0.1457		18		20		•
9830	1490209	3.8	0.1496						•
9830	1490215	3.9	0.1535						•
9831	1489977	5/32	0.1563						•
9830	0732619	4.0	0.1575						•
9830	1490221	4.1	0.1614		19	60	21		•
9830	0732625	4.2	0.1654						•
9830	1490238	4.3	0.1693						•
9830	1490244	4.4	0.1732		21		23		•
9830	0732631	4.5	0.1772						•
9830	1490250	4.6	0.1811						•
9830	1490267	4.7	0.1850		22		24		•
9831	1489983	3/16	0.1875						•
9830	1490273	4.8	0.1890						•
9830	1490280	4.9	0.1929						•
9830	0732648	5.0	0.1969		23		25		•
9830	1490296	5.1	0.2008		24		26		•
9830	1490301	5.2	0.2047						•
9830	0732654	5.3	0.2087						•
9830	1490318	5.4	0.2126		25		27		•
9830	0732660	5.5	0.2165						•
9831	1489990	7/32	0.2188						•
9830	1490324	5.6	0.2205						•
9830	1490330	5.7	0.2244		27		29		•
9830	1490347	5.8	0.2283						•
9830	1490353	5.9	0.2323						•
9830	0732677	6.0	0.2362	0.4					•
9830	1490360	6.1	0.2402		28	70	30		•
9830	1490376	6.2	0.2441						•
9830	1490382	6.3	0.2480						•
9831	1490003	1/4	0.2500		30		31		•
9830	1490399	6.4	0.2520						•
9830	0732683	6.5	0.2559						•
9830	1490404	6.6	0.2598						•
9830	1490410	6.7	0.2638		31		33		•
9830	0732690	6.8	0.2677						•
9830	1490427	6.9	0.2717						•
9830	0732705	7.0	0.2756		32				•
9830	1490433	7.1	0.2795		33		36		•
9831	1490010	9/32	0.2812						•
9830	1490440	7.2	0.2835						•
9830	1490456	7.3	0.2874						•
9830	1490462	7.4	0.2913		34				•
9830	0732711	7.5	0.2953						•
9830	1490479	7.6	0.2992						•
9830	1490485	7.7	0.3031		36		39		•
9830	1490491	7.8	0.3071						•

List No.	EDP NO.	Size	Decimal Equivalent	Radius	FL	OAL	L1	Shank Dia.	Stock
		Dc		r	ℓ	L	L1	Ds	
9830	1490507	7.9	0.3110	0.4	36	70	39	6	•
9831	1490026	5/16	0.3125						•
9830	0732728	8.0	0.3150					8	•
9830	1490513	8.1	0.3189		37	80	40		•
9830	1490520	8.2	0.3228						•
9830	1490536	8.3	0.3268						•
9831	1490032	21/64	0.3281		39		42		•
9830	1490542	8.4	0.3307						•
9830	0732734	8.5	0.3346						•
9830	1490559	8.6	0.3386						•
9830	1490565	8.7	0.3425		40				•
9830	0732740	8.8	0.3465						•
9830	1490571	8.9	0.3504						•
9830	0732757	9.0	0.3543		41				•
9830	1490588	9.1	0.3583		42		44		•
9831	1490049	23/64	0.3594						•
9830	1490594	9.2	0.3622						•
9830	1490600	9.3	0.3661						•
9830	1490616	9.4	0.3701		43		45		•
9830	0732763	9.5	0.3740						•
9831	1490055	3/8	0.3750						•
9830	1490622	9.6	0.3780						•
9830	1490639	9.7	0.3819		45		48		•
9830	1490645	9.8	0.3858						•
9830	1490651	9.9	0.3898						•
9830	0732770	10.0	0.3937	0.5	46	90	49	10	•
9830	1490668	10.1	0.3976						•
9830	1490674	10.2	0.4016						•
9830	0732786	10.3	0.4055						•
9831	1490061	13/32	0.4063		48		51		•
9830	1490680	10.4	0.4094						•
9830	0732792	10.5	0.4134						•
9830	1490697	10.6	0.4173						•
9830	1490702	10.7	0.4213		49				•
9830	0732808	10.8	0.4252						•
9830	1490719	10.9	0.4291						•
9830	0732814	11.0	0.4331		50		54		•
9830	1490725	11.1	0.4370		51				•
9831	1490078	7/16	0.4375						•
9830	1490731	11.2	0.4409						•
9830	1490748	11.3	0.4449						•
9830	1490754	11.4	0.4488		52				•
9830	0732820	11.5	0.4528						•
9831	1490084	29/64	0.4531						•
9830	1490760	11.6	0.4567						•
9830	1490777	11.7	0.4606		54		57		•
9830	1490783	11.8	0.4646						•
9830	1490790	11.9	0.4685						•
9831	1490090	15/32	0.4688						•
9830	0732837	12.0	0.4724						•
9831	1490106	1/2	0.5000		58	100	60	12	•
9831	1490112	9/16	0.5625	0.6	64	105	67		•
9831	1490129	5/8	0.6250		72	115	75		•
9831	1490135	11/16	0.6875		79	125	81	16	•
9831	1490141	3/4	0.7500		87	135	90		•

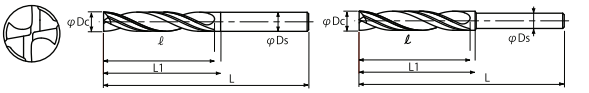
Aqua Drill EX Flat Jobber Length

- For entry on flat surfaces, Center Drill Hole is recommended



- Center Hole Diameter should be 0.5mm larger than Flat drill Diameter

Carbide Material | AQ EX Coating | 20° Helix | h7 Dia.Tol | 180° Point Angle | h6 Shank Dia.Tolerance



L9818 / L9819

Metric Size / Fractional Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9818	0720751	3.0	0.1181	19	60	20	6	•
L9818	0720768	3.1	0.1220	21		23		•
L9819	1489249	1/8	0.1250					•
L9818	0720774	3.2	0.1260					•
L9818	0720780	3.3	0.1299			24		•
L9818	0720797	3.4	0.1339	23				•
L9818	0720802	3.5	0.1378					•
L9818	0720819	3.6	0.1417			25		•
L9818	0720825	3.7	0.1457	25				•
L9818	0720831	3.8	0.1496					•
L9818	0720848	3.9	0.1535					•
L9819	1489255	5/32	0.1563					•
L9818	0720854	4.0	0.1575					•
L9818	0720860	4.1	0.1614	27	70	29		•
L9818	0720877	4.2	0.1654					•
L9818	0720883	4.3	0.1693			30		•
L9818	0720890	4.4	0.1732	29		32		•
L9818	0720905	4.5	0.1772					•
L9818	0720911	4.6	0.1811					•
L9818	0720928	4.7	0.1850	31		33		•
L9819	1489261	3/16	0.1875					•
L9818	0720934	4.8	0.1890					•
L9818	0720940	4.9	0.1929			32		•
L9818	0720957	5.0	0.1969	32				•
L9818	0720963	5.1	0.2008	34		36		•
L9818	0720970	5.2	0.2047					•
L9818	0720986	5.3	0.2087					•
L9818	0720992	5.4	0.2126	36		37		•
L9818	0721007	5.5	0.2165					•
L9819	1489278	7/32	0.2188			39		•
L9818	0721013	5.6	0.2205					•
L9818	0721020	5.7	0.2244	38				•
L9818	0721036	5.8	0.2283					•
L9818	0721042	5.9	0.2323					•
L9818	0721059	6.0	0.2362	40				•
L9818	0721065	6.1	0.2402			41		•
L9818	0721071	6.2	0.2441					•
L9818	0721088	6.3	0.2480					•
L9819	1489284	1/4	0.2500	42	85	43		•
L9818	0721094	6.4	0.2520		70			•
L9818	0721100	6.5	0.2559					•
L9818	0721116	6.6	0.2598					•
L9818	0721122	6.7	0.2638	44		45		•
L9818	0721139	6.8	0.2677					•
L9818	0721145	6.9	0.2717					•
L9818	0721151	7.0	0.2756	46	90	47		•
L9818	0721168	7.1	0.2795					•
L9819	1489290	9/32	0.2812					•
L9818	0721174	7.2	0.2835					•
L9818	0721180	7.3	0.2874	48		49		•
L9818	0721197	7.4	0.2913					•
L9818	0721202	7.5	0.2953					•
L9818	0721219	7.6	0.2992	51		52		•
L9818	0721225	7.7	0.3031					•
L9818	0721231	7.8	0.3071					•
L9818	0721248	7.9	0.3110					•
L9819	1489306	5/16	0.3125					•
L9818	0721254	8.0	0.3150		100	53	8	•
L9818	0721260	8.1	0.3189	52				•
L9818	0721277	8.2	0.3228					•
L9818	0721283	8.3	0.3268					•
L9819	1489312	21/64	0.3281	54		55		•
L9818	0721290	8.4	0.3307					•

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9818	0721305	8.5	0.3346	54	100	55	8	•
L9818	0721311	8.6	0.3386					•
L9818	0721328	8.7	0.3425	56		57		•
L9818	0721334	8.8	0.3465					•
L9818	0721340	8.9	0.3504					•
L9818	0721357	9.0	0.3543	58		59		•
L9818	0721363	9.1	0.3583	59		60		•
L9819	1489329	23/64	0.3594					•
L9818	0721370	9.2	0.3622					•
L9818	0721386	9.3	0.3661					•
L9818	0721392	9.4	0.3701	61		62		•
L9818	0721408	9.5	0.3740					•
L9819	1489335	3/8	0.3750					•
L9818	0721414	9.6	0.3780					•
L9818	0721420	9.7	0.3819	63		64		•
L9818	0721437	9.8	0.3858					•
L9818	0721443	9.9	0.3898					•
L9818	0721450	10.0	0.3937		110	65	10	•
L9818	0721466	10.1	0.3976	65		66		•
L9818	0721472	10.2	0.4016					•
L9818	0721489	10.3	0.4055			68		•
L9819	1489341	13/32	0.4063	67				•
L9818	0721495	10.4	0.4094					•
L9818	0721500	10.5	0.4134					•
L9818	0721517	10.6	0.4173			70		•
L9818	0721523	10.7	0.4213	69				•
L9818	0721530	10.8	0.4252					•
L9818	0721546	10.9	0.4291					•
L9818	0721552	11.0	0.4331	70	115	71		•
L9818	0721569	11.1	0.4370	71		72		•
L9819	1489358	7/16	0.4375					•
L9818	0721575	11.2	0.4409					•
L9818	0721581	11.3	0.4449					•
L9818	0721598	11.4	0.4488	73		74		•
L9818	0721603	11.5	0.4528					•
L9819	1489364	29/64	0.4531					•
L9818	0721610	11.6	0.4567					•
L9818	0721626	11.7	0.4606	76		77		•
L9818	0721632	11.8	0.4646					•
L9818	0721649	11.9	0.4685					•
L9819	1489370	15/32	0.4688					•
L9818	0721655	12.0	0.4724		125	78	12	•
L9818	0721661	12.5	0.4921	80		81		•
L9819	1489387	1/2	0.5000	81		83		•
L9818	0721678	13.0	0.5118	82	130	83		•
L9818	0721684	13.5	0.5315	86		87		•
L9818	0721690	14.0	0.5512	88	135	89		•
L9819	1489393	9/16	0.5625	90		91		•
L9818	0721706	14.5	0.5709	92		93		•
L9818	0721712	15.0	0.5906	95	145	96		•
L9818	0721729	15.5	0.6102	98		99		•
L9819	1489409	5/8	0.6250	101		102		•
L9818	0721735	16.0	0.6299	101	160	104	16	•
L9818	0721741	16.5	0.6496	105		106		•
L9818	0721758	17.0	0.6693	108	165	109		•
L9819	1489415	11/16	0.6875	111		112		•
L9818	0721764	17.5	0.6890	111		112		•
L9818	0721770	18.0	0.7087	113	175	114		•
L9818	0721787	18.5	0.7283	118		119		•
L9818	0721793	19.0	0.7480	120		121		•
L9819	1489421	3/4	0.7500	122	185	123		•
L9818	0721809	19.5	0.7677	124		125		•
L9818	0721815	20.0	0.7874	126	195	129	20	•

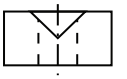
* Package Qty: 1 per Tube Size

⚠ **WARNING:** Cancer - www.P65Warnings.ca.gov

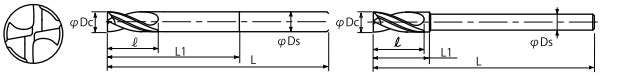
Aqua Drill EX Flat Long Shank

Carbide Material | AQ EX Coating | 20° Helix | h7 Dia.Tol | 180° Point Angle | h6 Shank Dia.Tolerance

- For entry on flat surfaces, Center Drill Hole is recommended



- Center Hole Diameter should be 0.5mm larger than Flat drill Diameter



L9816 / L9817

Metric Size / Fractional Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9816	0717701	3.0	0.1181	14	100	30	6	•
L9816	0717718	3.1	0.1220	15		31		•
L9817	1489438	1/8	0.1250			32		•
L9816	0717724	3.2	0.1260			32		•
L9816	0717730	3.3	0.1299			33		•
L9816	0717747	3.4	0.1339	16		34		•
L9816	0717753	3.5	0.1378			35		•
L9816	0717760	3.6	0.1417			36		•
L9816	0717776	3.7	0.1457	18		37		•
L9816	0717782	3.8	0.1496			38		•
L9816	0717799	3.9	0.1535			39		•
L9817	1489444	5/32	0.1563			40		•
L9816	0717804	4.0	0.1575			40		•
L9816	0717810	4.1	0.1614	19		41		•
L9816	0717827	4.2	0.1654			42		•
L9816	0717833	4.3	0.1693			43		•
L9816	0717840	4.4	0.1732	21		44		•
L9816	0717856	4.5	0.1772			45		•
L9816	0717862	4.6	0.1811			46		•
L9816	0717879	4.7	0.1850	22		47		•
L9817	1489450	3/16	0.1875			48		•
L9816	0717885	4.8	0.1890			48		•
L9816	0717891	4.9	0.1929			49		•
L9816	0717907	5.0	0.1969	23	110	50		•
L9816	0717913	5.1	0.2008	24		51		•
L9816	0717920	5.2	0.2047			52		•
L9816	0717936	5.3	0.2087			53		•
L9816	0717942	5.4	0.2126	25		54		•
L9816	0717959	5.5	0.2165			55		•
L9817	1489467	7/32	0.2188			56		•
L9816	0717965	5.6	0.2205			56		•
L9816	0717971	5.7	0.2244	27		57		•
L9816	0717988	5.8	0.2283			58		•
L9816	0717994	5.9	0.2323			59		•
L9816	0718009	6.0	0.2362			60		•
L9816	0718015	6.1	0.2402	28		30		•
L9816	0718021	6.2	0.2441					•
L9816	0718038	6.3	0.2480					•
L9817	1489473	1/4	0.2500	30		32		•
L9816	0718044	6.4	0.2520					•
L9816	0718050	6.5	0.2559					•
L9816	0718067	6.6	0.2598					•
L9816	0718073	6.7	0.2638	31		33		•
L9816	0718080	6.8	0.2677					•
L9816	0718096	6.9	0.2717					•
L9816	0718101	7.0	0.2756	32	120	34		•
L9816	0718118	7.1	0.2795	33		35		•
L9817	1489480	9/32	0.2812					•
L9816	0718124	7.2	0.2835					•
L9816	0718130	7.3	0.2874					•
L9816	0718147	7.4	0.2913	34		36		•
L9816	0718153	7.5	0.2953					•
L9816	0718160	7.6	0.2992					•
L9816	0718176	7.7	0.3031	36		38		•
L9816	0718182	7.8	0.3071					•
L9816	0718199	7.9	0.3110					•
L9817	1489496	5/16	0.3125					•
L9816	0718204	8.0	0.3150		130	80	8	•
L9816	0718210	8.1	0.3189	37		39		•
L9816	0718227	8.2	0.3228					•
L9816	0718233	8.3	0.3268					•
L9817	1489501	21/64	0.3281	39		41		•
L9816	0718240	8.4	0.3307					•
L9816	0718256	8.5	0.3346	39	130	41	8	•
L9816	0718262	8.6	0.3386					•
L9816	0718279	8.7	0.3425	40		42		•
L9816	0718285	8.8	0.3465					•
L9816	0718291	8.9	0.3504					•
L9816	0718307	9.0	0.3543	41		43		•
L9816	0718313	9.1	0.3583	42		44		•
L9817	1489518	23/64	0.3594					•
L9816	0718320	9.2	0.3622					•
L9816	0718336	9.3	0.3661					•
L9816	0718342	9.4	0.3701	43		45		•
L9816	0718359	9.5	0.3740					•
L9817	1489524	3/8	0.3750					•
L9816	0718365	9.6	0.3780					•
L9816	0718371	9.7	0.3819	45		47		•
L9816	0718388	9.8	0.3858					•
L9816	0718394	9.9	0.3898					•
L9816	0718400	10.0	0.3937		150	100	10	•
L9816	0718416	10.1	0.3976	46		48		•
L9816	0718422	10.2	0.4016					•
L9816	0718439	10.3	0.4055					•
L9817	1489530	13/32	0.4063	48		50		•
L9816	0718445	10.4	0.4094					•
L9816	0718451	10.5	0.4134					•
L9816	0718468	10.6	0.4173					•
L9816	0718474	10.7	0.4213	49		51		•
L9816	0718480	10.8	0.4252					•
L9816	0718497	10.9	0.4291					•
L9816	0718502	11.0	0.4331	50		52		•
L9816	0718519	11.1	0.4370	51		53		•
L9817	1489547	7/16	0.4375					•
L9816	0718525	11.2	0.4409					•
L9816	0718531	11.3	0.4449					•
L9816	0718548	11.4	0.4488	52		54		•
L9816	0718554	11.5	0.4528					•
L9817	1489553	29/64	0.4531					•
L9816	0718560	11.6	0.4567					•
L9816	0718577	11.7	0.4606	54		56		•
L9816	0718583	11.8	0.4646					•
L9816	0718590	11.9	0.4685					•
L9817	1489560	15/32	0.4688					•
L9816	0718605	12.0	0.4724		170	120	12	•
L9816	0718611	12.5	0.4921	57		59		•
L9817	1489576	1/2	0.5000	58		60		•
L9816	0718628	13.0	0.5118	59	180	61		•
L9816	0718634	13.5	0.5315	61		63		•
L9816	0718640	14.0	0.5512	63		65		•
L9817	1489582	9/16	0.5625	64	190	66		•
L9816	0718657	14.5	0.5709	66		68		•
L9816	0718663	15.0	0.5906	67		69		•
L9816	0718670	15.5	0.6102	70	200	72		•
L9817	1489599	5/8	0.6250	72		74		•
L9816	0718686	16.0	0.6299	72		160		•
L9816	0718692	16.5	0.6496	75		77		•
L9816	0718708	17.0	0.6693	77	220	79		•
L9817	1489604	11/16	0.6875	79		81		•
L9816	0718714	17.5	0.6890	79		81		•
L9816	0718720	18.0	0.7087	81	240	83	16	•
L9816	0718737	18.5	0.7283	84		86		•
L9816	0718743	19.0	0.7480	86		88		•
L9817	1489610	3/4	0.7500	87	250	89		•
L9816	0718750	19.5	0.7677	88		90		•
L9816	0718766	20.0	0.7874	90		200	20	•

* Package Qty: 1 per Tube Size

Aqua Drill EX Flat - Standard Drilling Conditions

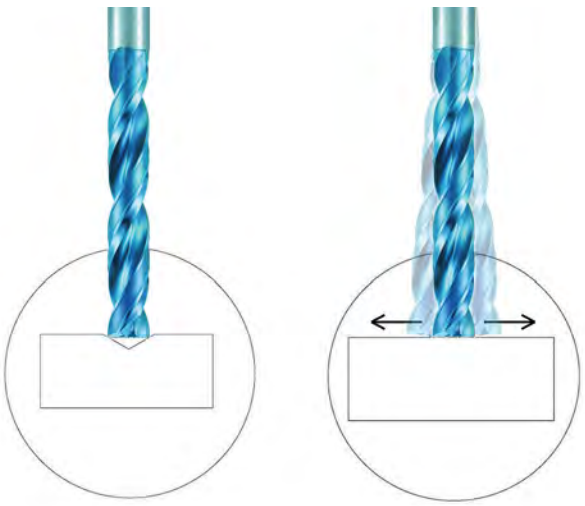
LIST 9610, 9611, 9830, 9831

Work Material / Speed (SFM) / Drill Diameter		Cast Irons / Carbon Steels		Alloy Steels (20-30 HRC)		Mold Steels/ (30-35 HRC)		Ductile Cast Irons		Stainless Steel (300 Series)		Aluminum Alloys		Aluminum Casting	
		65-230 SFM		60-200 SFM		35-120 SFM		60-200 SFM		125-500 SFM		125-500 SFM		120-350 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
0.2	0.007	32000	0.0001	29000	0.0001	14000	0.0001	29000	0.0001	16000	0.0001	32000	0.0002	32000	0.0001
0.5	0.019	25500	0.0001	21000	0.0001	10000	0.0001	21000	0.0001	12500	0.0002	29000	0.0004	25500	0.0033
1	0.039	19000	0.0006	15900	0.0006	6400	0.0003	15900	0.0005	9550	0.0004	24000	0.0012	19000	0.0008
1.5	0.059	25500	0.0001	21000	0.0001	10000	0.0001	21000	0.0001	7300	0.0007	29000	0.0004	25500	0.0033
2	0.078	12000	0.0009	11500	0.0009	3200	0.0007	11500	0.0009	5030	0.0014	21000	0.0016	14500	0.0013
Speed (SFM)		325-328 SFM		290-295 SFM		220-225 SFM		290-295 SFM		515-525 SFM		515-525 SFM		260-400 SFM	
3	0.118	7950	0.0020	6900	0.0020	3700	0.0020	6900	0.0015	2600	0.0020	17000	0.0025	12500	0.0020
4	0.157	5950	0.0025	5150	0.0025	2800	0.0025	5150	0.0025	1950	0.0023	12500	0.0030	9550	0.0025
5	0.197	4800	0.0035	4150	0.0035	2200	0.0030	4100	0.0030	1550	0.0026	10000	0.0040	7650	0.0035
6	0.236	4000	0.0040	3450	0.0040	1800	0.0035	3450	0.0035	1300	0.0031	8500	0.0045	6400	0.0040
8	0.315	3000	0.0055	2600	0.0055	1400	0.0050	2600	0.0045	970	0.0038	6350	0.0065	4750	0.0055
10	0.394	2400	0.0070	2050	0.0070	1100	0.0060	2050	0.0060	780	0.0047	5100	0.0080	3800	0.0070
12	0.472	2000	0.0085	1700	0.0085	950	0.0070	1700	0.0070	650	0.0057	4250	0.0095	3200	0.0080
16	0.630	1500	0.0110	1300	0.0110	700	0.0095	1300	0.0095	550	0.0063	3200	0.0125	2400	0.0110
20	0.787	1200	0.0140	1050	0.0135	550	0.0120	1050	0.0115	480	0.0066	2550	0.0155	1900	0.0135

Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Use the table values for drilling depths upto 2xD. Adjust cutting conditions per table based on "degree angle to be drilled."
3) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
4) Not recommended for drilling in Stainless Steel. We recommend using List9814 AQUA EX Flat OH3Dor OH5D for Stainless Steel & Hi-temp alloys.
5) Center Drill or Guide hole required. (1: Use AG Starting drill or Aqua Ex Flat drill)

Formulas : RPM $= \frac{\text{SFM} \times 3.82}{\text{Drill dia.}}$ Feed Rate (in/min) : RPM×IPR

Drilling Conditions for Angled Surfaces					
Reduction % to above table values					
Degree Angle		Reduction %		Reduction % (Multiplier)	
		RPM	Feed	RPM	Feed
0°	5°	100%	100%	Table Value	Table Value
6°	20°	50%	50%	(Table Value)x0.5	(Table Value)x0.5
21°	35°	70%	40%	(Table Value)x0.3	(Table Value)x0.6
36°	60°	70%	40%	(Table Value)x0.3	(Table Value)x0.6
61°		70%	30%	(Table Value)x0.3	(Table Value)x0.7



The longer a drill is, the higher the chance that it will walk. Flat bottom drills have a true 180* point. When entering on a flat surface, this amount of surface contact can cause the drill to walk. If this occurs, using a spot drill prior to the flat bottom drill will help to alleviate some of the surface contact to allow the drill to start properly.

Aqua Drill EX Flat - Standard Drilling Conditions

LIST 9818, 9819

Work Material / Speed (SFM) / Drill Diameter		Cast Irons / Carbon Steels		Alloy Steels (20-30 HRC)		Mold Steels/ Hardened Steels (30-35 HRC)		Ductile Cast Irons		Aluminum Alloys		Aluminum Casting	
		325-328 SFM		290-295 SFM		220-225 SFM		290-295 SFM		515-525 SFM		260-400 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3	0.118	10600	0.002	9500	0.002	7400	0.002	9500	0.002	17000	0.002	12700	0.002
4	0.157	7900	0.003	7100	0.002	5550	0.002	7100	0.002	12500	0.002	9500	0.003
5	0.197	6300	0.004	5700	0.003	4450	0.003	5700	0.003	10000	0.003	7600	0.004
6	0.236	5300	0.005	4750	0.004	3700	0.004	4750	0.004	8500	0.003	6400	0.005
8	0.315	3950	0.006	3550	0.005	2790	0.005	3550	0.005	6350	0.005	4780	0.006
10	0.394	3150	0.008	2860	0.006	2230	0.006	2860	0.006	5100	0.006	3800	0.008
12	0.472	2650	0.009	2390	0.007	1860	0.007	2390	0.007	4250	0.007	3180	0.009
16	0.630	1990	0.012	1790	0.009	1390	0.009	1790	0.009	3200	0.009	2390	0.013
20	0.787	1590	0.016	1430	0.012	1110	0.012	1430	0.012	2550	0.012	1910	0.016

LIST 9816, 9817

Work Material / Speed (SFM) / Drill Diameter		Cast Irons / Carbon Steels		Alloy Steels (20-30 HRC)		Mold Steels/ Hardened Steels (30-35 HRC)		Ductile Cast Irons		Aluminum Alloys		Aluminum Casting	
		325-328 SFM		290-295 SFM		220-225 SFM		290-295 SFM		515-525 SFM		260-400 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
3	0.118	10600	0.003	9500	0.002	7400	0.002	9500	0.002	17000	0.002	12700	0.002
4	0.157	7900	0.004	7100	0.003	5550	0.002	7100	0.003	12500	0.002	9500	0.003
5	0.197	6300	0.005	5700	0.004	4450	0.003	5700	0.004	10000	0.003	7600	0.004
6	0.236	5300	0.006	4750	0.005	3700	0.004	4750	0.005	8500	0.003	6400	0.005
8	0.315	3950	0.008	3550	0.006	2790	0.005	3550	0.006	6350	0.005	4780	0.006
10	0.394	3150	0.010	2860	0.008	2230	0.006	2860	0.008	5100	0.006	3800	0.008
12	0.472	2650	0.012	2390	0.009	1860	0.007	2390	0.009	4250	0.007	3180	0.009
16	0.630	1990	0.016	1790	0.013	1390	0.009	1790	0.013	3200	0.009	2390	0.013
20	0.787	1590	0.020	1430	0.016	1110	0.012	1430	0.016	2550	0.012	1910	0.016

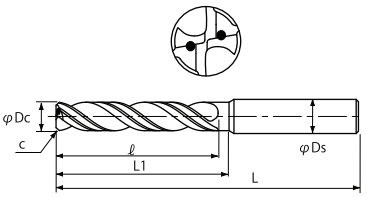
Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Use the table values for drilling depths upto 2xD. Adjust cutting conditions per table based on "degree angle to be drilled."
3) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
4) Not recommended for drilling in Stainless Steel. We recommend using List9814 AQUA EX Flat OH3Dor OH5D for Stainless Steel & Hi-temp alloys.
5) Center Drill or Guide hole required. (1: Use AG Starting drill or Aqua Ex Flat drill)

Formulas : $\text{RPM} = \frac{\text{SFM} \times 3.82}{\text{Drill dia.}}$ Feed Rate (in/min) : RPM×IPR

Aqua Drill EX Flat Oil Hole 3D

Carbide Material | AQ EX Coating | 24°~30° Helix | h7 Dia.Tol | 180° Point Angle | h6 Shank Dia.Tolerance

Drill Dia (in mm)		Corner Chamfer
Above	Up to	C (mm)
	6.0	0.04
6.0	10.0	0.1
10.0		0.2



L9812 / L9813

Metric Size / Fractional Size Including NEW MICRO Sizes!

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9812	0760322	1.0	0.0394	4.3	55	4.6		•
L9812	0760339	1.1	0.0433	4.7		5		•
L9812	0760345	1.2	0.0472	5.2		5.5		•
L9812	0760351	1.3	0.0512	5.6		5.9		•
L9812	0760368	1.4	0.0551	6		6.3		•
L9812	0760374	1.5	0.0591	6.5	58	6.8		•
L9812	0760380	1.6	0.0630	6.9		7.2		•
L9812	0760397	1.7	0.0669	7.3		7.6		•
L9812	0760402	1.8	0.0709	7.7		8		•
L9812	0760419	1.9	0.0748	8.2		8.5		•
L9812	0760425	2.0	0.0787	8.6		8.9	3	•
L9812	0760431	2.1	0.0827	9		9.3		•
L9812	0760448	2.2	0.0866	9.5		9.8		•
L9812	0760454	2.3	0.0906	9.9	62	10.2		•
L9812	0760460	2.4	0.0945	10.3		10.6		•
L9812	0760477	2.5	0.0984	10.8		11.1		•
L9812	0760483	2.6	0.1024	11.2		11.5		•
L9812	0760490	2.7	0.1063	11.6	68	11.9		•
L9812	0760505	2.8	0.1102	12		12.3		•
L9812	0760511	2.9	0.1142	12.5		12.9		•
L9812	0718772	3.0	0.1181	14	68	15		•
L9812	0718789	3.1	0.1220	15		17		•
L9813	1489627	1/8	0.1250					•
L9812	0718795	3.2	0.1260					•
L9812	0718800	3.3	0.1299					•
L9812	0718817	3.4	0.1339	16				•
L9812	0718823	3.5	0.1378		72	18	4	•
L9812	0718830	3.6	0.1417					•
L9812	0718846	3.7	0.1457	18		19		•
L9812	0718852	3.8	0.1496					•
L9812	0718869	3.9	0.1535					•
L9813	1489633	5/32	0.1563					•
L9812	0718875	4.0	0.1575					•
L9812	0718881	4.1	0.1614	19		22		•
L9812	0718898	4.2	0.1654					•
L9812	0718903	4.3	0.1693					•
L9812	0718910	4.4	0.1732	21		23		•
L9812	0718926	4.5	0.1772		80		5	•
L9812	0718932	4.6	0.1811			24		•
L9812	0718949	4.7	0.1850	22				•
L9813	1489640	3/16	0.1875					•
L9812	0718955	4.8	0.1890					•
L9812	0718961	4.9	0.1929					•
L9812	0718978	5.0	0.1969	23				•
L9812	0718984	5.1	0.2008	24		26		•
L9812	0718990	5.2	0.2047					•
L9812	0719005	5.3	0.2087					•
L9812	0719011	5.4	0.2126	25		27		•
L9812	0719028	5.5	0.2165		82		6	•
L9813	1489656	7/32	0.2188					•
L9812	0719034	5.6	0.2205			28		•
L9812	0719040	5.7	0.2244	27				•
L9812	0719057	5.8	0.2283					•
L9812	0719063	5.9	0.2323					•

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9812	0719070	6.0	0.2362	27	82	28	6	•
L9812	0719086	6.1	0.2402					•
L9812	0719092	6.2	0.2441	28				•
L9812	0719108	6.3	0.2480			31		•
L9813	1489662	1/4	0.2500					•
L9812	0719114	6.4	0.2520	30				•
L9812	0719120	6.5	0.2559		88	32	7	•
L9812	0719137	6.6	0.2598					•
L9812	0719143	6.7	0.2638					•
L9812	0719150	6.8	0.2677	31		33		•
L9812	0719166	6.9	0.2717					•
L9812	0719172	7.0	0.2756	32				•
L9812	0719189	7.1	0.2795					•
L9813	1489679	9/32	0.2812	33		35		•
L9812	0719195	7.2	0.2835					•
L9812	0719200	7.3	0.2874					•
L9812	0719217	7.4	0.2913					•
L9812	0719223	7.5	0.2953	34		36		•
L9812	0719230	7.6	0.2992		94		8	•
L9812	0719246	7.7	0.3031			37		•
L9812	0719252	7.8	0.3071					•
L9812	0719269	7.9	0.3110	36				•
L9813	1489685	5/16	0.3125					•
L9812	0719275	8.0	0.3150					•
L9812	0719281	8.1	0.3189					•
L9812	0719298	8.2	0.3228	37				•
L9812	0719303	8.3	0.3268			40		•
L9813	1489691	21/64	0.3281					•
L9812	0719310	8.4	0.3307	39				•
L9812	0719326	8.5	0.3346		100	41	9	•
L9812	0719332	8.6	0.3386					•
L9812	0719349	8.7	0.3425					•
L9812	0719355	8.8	0.3465	40		42		•
L9812	0719361	8.9	0.3504					•
L9812	0719378	9.0	0.3543	41				•
L9812	0719384	9.1	0.3583					•
L9813	1489707	23/64	0.3594	42				•
L9812	0719390	9.2	0.3622			44		•
L9812	0719406	9.3	0.3661					•
L9812	0719412	9.4	0.3701					•
L9812	0719429	9.5	0.3740	43		45		•
L9813	1489713	3/8	0.3750		106		10	•
L9812	0719435	9.6	0.3780					•
L9812	0719441	9.7	0.3819			46		•
L9812	0719458	9.8	0.3858	45				•
L9812	0719464	9.9	0.3898					•
L9812	0719470	10.0	0.3937					•
L9812	0719487	10.1	0.3976	46				•
L9812	0719493	10.2	0.4016			49		•
L9812	0719509	10.3	0.4055		116		11	•
L9813	1489720	13/32	0.4063	48				•
L9812	0719515	10.4	0.4094					•
L9812	0719521	10.5	0.4134			50		•
L9812	0719538	10.6	0.4173			51		•

* Package Qty: 1 per Tube Size

L9812 **Metric Size**
L9813 **Fractional Size**

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9812	0719544	10.7	0.4213	49	116	51	11	•
L9812	0719550	10.8	0.4252					•
L9812	0719567	10.9	0.4291					•
L9812	0719573	11.0	0.4331	50				•
L9812	0719580	11.1	0.4370	51	122	53	12	•
L9813	**1489736**	**7/16**	**0.4375**					•
L9812	0719596	11.2	0.4409					•
L9812	0719601	11.3	0.4449	52				•
L9812	0719618	11.4	0.4488					•
L9812	0719624	11.5	0.4528			54		•
L9813	**1489742**	**29/64**	**0.4531**			55		•
L9812	0719630	11.6	0.4567					•
L9812	0719647	11.7	0.4606	54				•
L9812	0719653	11.8	0.4646					•
L9812	0719660	11.9	0.4685					•

* Package Qty: 1 per Tube Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9813	**1489759**	**15/32**	**0.4688**	54	122	55	12	•
L9812	0719676	12.0	0.4724					•
L9812	0719682	12.5	0.4921	57	128	59	13	•
L9813	**1489765**	**1/2**	**0.5000**	**58**	**128**	**60**		•
L9812	0719699	13.0	0.5118	59	128	60		•
L9812	0719704	13.5	0.5315	61	134	63	14	•
L9812	0719710	14.0	0.5512	63	134	64		•
L9813	**1489771**	**9/16**	**0.5625**	**64**	**140**	**68**	15	•
L9812	0719727	14.5	0.5709	66	140	68		•
L9812	0719733	15.0	0.5906	68	140	69		•
L9812	0719740	15.5	0.6102	70	146	72	16	•
L9813	**1489788**	**5/8**	**0.6250**	**72**	**146**	**73**		•
L9812	0719756	16.0	0.6299	72	146	73		•
L9813	**1496964**	**11/16**	**0.6875**	**74**	**146**	**75**	**18**	•
L9813	**1496970**	**3/4**	**0.7500**	**76**	**152**	**77**	**20**	•

⚠ **WARNING:** Cancer - www.P65Warnings.ca.gov

Standard Drilling Conditions

LIST 9812, 9813

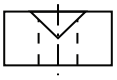
Work Material / Speed (SFM)		Cast Irons / Carbon Steels		Alloy Steels (20-30 HRC)		Mold Steels (30-40 HRC)		Hardened Steels (40-50 HRC)		Ductile Cast Irons		Stainless Steel (300-Series Stainless)		Nickel Alloys, Titanium Alloys, PH Stainless		Aluminum Alloys		Aluminum Casting	
Drill Diameter		160 - 200 SFM		130 - 170 SFM		95 - 140 SFM		80 - 100 SFM		130 - 165 SFM		95 - 135 SFM		70 - 80 SFM		180 - 200 SFM		160 - 185 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
1	0.039	15900	0.0003	12700	0.0002	9550	0.0002	7960	0.0002	12700	0.0002	9550	0.0001	6850	0.0006	18400	0.0008	15610	0.0004
1.5	0.059	10600	0.0005	8490	0.0004	6370	0.0003	5320	0.0003	8490	0.0003	6370	0.0001	4600	0.0009	12300	0.0012	10430	0.0006
2	0.079	9550	0.0007	7960	0.0005	5570	0.0004	4790	0.0004	7960	0.0004	6370	0.0002	3900	0.0012	9200	0.0014	8890	0.0007
Speed (SFM)		390 - 395 SFM		245 - 330 SFM		225 - 245 SFM		145 - 165 SFM		245 - 330 SFM		175 - 195 SFM		80 - 100 SFM		450 - 550 SFM		360 - 455 SFM	
2.5	0.098	11500	0.002	9600	0.001	9500	0.001	5750	0.001	10600	0.001	7500	0.001	3300	0.002	19400	0.004	14000	0.002
3	0.118	12700	0.003	10600	0.002	7400	0.002	5300	0.002	10600	0.002	6000	0.003	3200	0.002	16200	0.005	14800	0.004
4	0.157	9500	0.004	7900	0.003	5550	0.002	4000	0.003	7900	0.002	4500	0.004	2400	0.003	12100	0.006	11100	0.005
5	0.197	7600	0.005	6300	0.004	4450	0.003	3200	0.004	6300	0.003	3600	0.005	1900	0.004	9700	0.008	8900	0.006
6	0.236	6300	0.006	5300	0.005	3700	0.004	2700	0.004	5300	0.004	3000	0.006	1600	0.005	8100	0.010	7400	0.007
8	0.315	4800	0.008	3950	0.006	2790	0.005	2000	0.006	3950	0.005	2250	0.008	1200	0.006	6050	0.011	5570	0.009
10	0.394	3800	0.010	3150	0.008	2230	0.006	1600	0.007	3150	0.006	1800	0.010	950	0.007	4850	0.013	4460	0.012
12	0.472	3200	0.012	2650	0.009	1860	0.007	1300	0.009	2650	0.007	1500	0.012	800	0.007	4050	0.016	3710	0.014
16	0.630	2400	0.016	1990	0.013	1390	0.009	1000	0.011	1990	0.009	1100	0.016	600	0.009	3050	0.018	2790	0.019

Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Use the table values for drilling depths upto 5xD. Adjust cutting conditions per table based on "degree angle to be drilled."
3) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
4) Center Drill or Guide hole required. (1: Use AG Starting drill or Aqua Ex Flat drill 2: For drilling guide holes in Stainless use AQUA EX Flat OH3D)

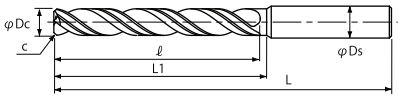
Formulas : $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$ Feed Rate (in/min) : RPM×IPR

Aqua Drill EX Flat Oil Hole 5D

- For entry on flat surfaces, Center Drill Hole is recommended



- Center Hole Diameter should be 0.5mm larger than Flat drill Diameter



Drill Dia (in mm)		Corner Chamfer
Above	Up to	C (mm)
	6.0	0.04
6.0	10.0	0.1
10.0		0.2

L9814 / L9815

Metric Size / Fractional Size Including NEW MICRO Sizes!

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9814	0760528	1.0	0.0394	6.3	57	6.6		•
L9814	0760534	1.1	0.0433	6.9		7.2		•
L9814	0760540	1.2	0.0472	7.6		7.9		•
L9814	0760557	1.3	0.0512	8.2		8.5		•
L9814	0760563	1.4	0.0551	8.8		9.1		•
L9814	0760570	1.5	0.0591	9.5	60	9.8		•
L9814	0760586	1.6	0.0630	10.1		10.4		•
L9814	0760592	1.7	0.0669	10.7		11		•
L9814	0760608	1.8	0.0709	11.3		11.6		•
L9814	0760614	1.9	0.0748	12		12.3	3	•
L9814	0760620	2.0	0.0787	12.6		12.9		•
L9814	0760637	2.1	0.0827	13.2		13.5		•
L9814	0760643	2.2	0.0866	13.9		14.2		•
L9814	0760650	2.3	0.0906	14.5	64	14.8		•
L9814	0760666	2.4	0.0945	15.1		15.4		•
L9814	0760672	2.5	0.0984	15.8		16.1		•
L9814	0760689	2.6	0.1024	16.4		16.7		•
L9814	0760695	2.7	0.1063	17	74	17.3		•
L9814	0760700	2.8	0.1102	17.6		17.9		•
L9814	0760717	2.9	0.1142	18.3		18.6		•
L9814	0719762	3.0	0.1181	20	74	21		•
L9814	0719779	3.1	0.1220					•
L9815	1489794	1/8	0.1250	22		25		•
L9814	0719785	3.2	0.1260					•
L9814	0719791	3.3	0.1299					•
L9814	0719807	3.4	0.1339	24				•
L9814	0719813	3.5	0.1378		80		4	•
L9814	0719820	3.6	0.1417			27		•
L9814	0719836	3.7	0.1457					•
L9814	0719842	3.8	0.1496	26				•
L9814	0719859	3.9	0.1535					•
L9815	1489800	5/32	0.1563					•
L9814	0719865	4.0	0.1575					•
L9814	0719871	4.1	0.1614					•
L9814	0719888	4.2	0.1654	28		30		•
L9814	0719894	4.3	0.1693					•
L9814	0719900	4.4	0.1732					•
L9814	0719916	4.5	0.1772	29		31		•
L9814	0719922	4.6	0.1811		90		5	•
L9814	0719939	4.7	0.1850					•
L9815	1489816	3/16	0.1875	32		34		•
L9814	0719945	4.8	0.1890					•
L9814	0719951	4.9	0.1929					•
L9814	0719968	5.0	0.1969	33				•
L9814	0719974	5.1	0.2008					•
L9814	0719980	5.2	0.2047	35		38		•
L9814	0719997	5.3	0.2087					•
L9814	0720000	5.4	0.2126					•
L9814	0720017	5.5	0.2165	37		39		•
L9815	1489822	7/32	0.2188		94		6	•
L9814	0720023	5.6	0.2205					•
L9814	0720030	5.7	0.2244			40		•
L9814	0720046	5.8	0.2283	39				•
L9814	0720052	5.9	0.2323					•

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9814	0720069	6.0	0.2362					•
L9814	0720075	6.1	0.2402	41				•
L9814	0720081	6.2	0.2441					•
L9814	0720098	6.3	0.2480			44		•
L9815	1489839	1/4	0.2500					•
L9814	0720103	6.4	0.2520	43				•
L9814	0720110	6.5	0.2559		101	45	7	•
L9814	0720126	6.6	0.2598					•
L9814	0720132	6.7	0.2638					•
L9814	0720149	6.8	0.2677	45		46		•
L9814	0720155	6.9	0.2717					•
L9814	0720161	7.0	0.2756	46				•
L9814	0720178	7.1	0.2795					•
L9815	1489845	9/32	0.2812	48				•
L9814	0720184	7.2	0.2835			51		•
L9814	0720190	7.3	0.2874					•
L9814	0720206	7.4	0.2913					•
L9814	0720212	7.5	0.2953	50	110	52	8	•
L9814	0720229	7.6	0.2992					•
L9814	0720235	7.7	0.3031					•
L9814	0720241	7.8	0.3071	52		53		•
L9814	0720258	7.9	0.3110					•
L9815	1489851	5/16	0.3125					•
L9814	0720264	8.0	0.3150					•
L9814	0720270	8.1	0.3189					•
L9814	0720287	8.2	0.3228	54				•
L9814	0720293	8.3	0.3268			57		•
L9815	1489868	21/64	0.3281					•
L9814	0720309	8.4	0.3307	56				•
L9814	0720315	8.5	0.3346		117	58	9	•
L9814	0720321	8.6	0.3386					•
L9814	0720338	8.7	0.3425					•
L9814	0720344	8.8	0.3465	58		59		•
L9814	0720350	8.9	0.3504					•
L9814	0720367	9.0	0.3543	59				•
L9814	0720373	9.1	0.3583			64		•
L9815	1489874	23/64	0.3594	61		65		•
L9814	0720380	9.2	0.3622					•
L9814	0720396	9.3	0.3661			64		•
L9814	0720401	9.4	0.3701					•
L9814	0720418	9.5	0.3740	63	126	65	10	•
L9815	1489880	3/8	0.3750					•
L9814	0720424	9.6	0.3780					•
L9814	0720430	9.7	0.3819			66		•
L9814	0720447	9.8	0.3858	65				•
L9814	0720453	9.9	0.3898					•
L9814	0720460	10.0	0.3937					•
L9814	0720476	10.1	0.3976					•
L9814	0720482	10.2	0.4016	67		70		•
L9814	0720499	10.3	0.4055					•
L9815	1489897	13/32	0.4063					•
L9814	0720504	10.4	0.4094	69				•
L9814	0720510	10.5	0.4134		138	71	11	•
L9814	0720527	10.6	0.4173					•

* Package Qty: 1 per Tube Size

L9814 **Metric Size**
L9815 **Fractional Size**

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9814	0720533	10.7	0.4213	72	138	73	11	•
L9814	0720540	10.8	0.4252					•
L9814	0720556	10.9	0.4291					•
L9814	0720562	11.0	0.4331	73				•
L9814	0720579	11.1	0.4370	74	146	77	12	•
L9815	**1489902**	**7/16**	**0.4375**					•
L9814	0720585	11.2	0.4409					•
L9814	0720591	11.3	0.4449					•
L9814	0720607	11.4	0.4488	76		78		•
L9814	0720613	11.5	0.4528					•
L9815	**1489919**	**29/64**	**0.4531**			79		•
L9814	0720620	11.6	0.4567					•
L9814	0720636	11.7	0.4606	78				•
L9814	0720642	11.8	0.4646					•

* Package Qty: 1 per Tube Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9814	0720659	11.9	0.4685	78	146	79	12	•
L9815	**1489925**	**15/32**	**0.4688**					•
L9814	0720665	12.0	0.4724					•
L9814	0720671	12.5	0.4921	82	**153**	84	13	•
L9815	**1489931**	**1/2**	**0.5000**	**85**		**86**		•
L9814	0720688	13.0	0.5118	86		86		•
L9814	0720694	13.5	0.5315	89	162	91	14	•
L9814	0720700	14.0	0.5512	91		92		•
L9815	**1489948**	**9/16**	**0.5625**	**93**	169	**97**	15	•
L9814	0720716	14.5	0.5709	95		97		•
L9814	0720722	15.0	0.5906	98		98		•
L9814	0720739	15.5	0.6102	102	178	104	16	•
L9815	**1489954**	**5/8**	**0.6250**	**104**		**105**		•
L9814	0720745	16.0	0.6299	104		105		•

⚠ **WARNING:** Cancer - www.P65Warnings.ca.gov

Standard Drilling Conditions

LIST 9814, 9815

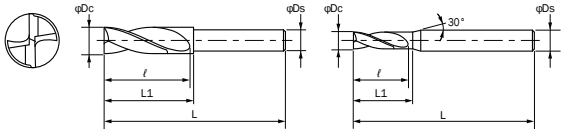
Work Material		Cast Irons / Carbon Steels		Alloy Steels (20-30 HRC)		Mold Steels (30-35 HRC)		Hardened Steels (40-50 HRC)		Ductile Cast Irons		Stainless Steel (300-Series Stainless)		Nickel Alloys, Titanium Alloys, PH Stainless		Aluminum Alloys		Aluminum Casting	
Speed (SFM)																			
Drill Diameter		115 - 140 SFM		90 - 115 SFM		65 - 80 SFM		55 - 70 SFM		90 - 115 SFM		65 - 95 SFM		70 - 80 SFM		180 - 200 SFM		160 - 185 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
1	0.039	11130	0.0003	8890	0.0002	6685	0.0002	5572	0.0002	8890	0.0002	6685	0.0001	6850	0.0006	18400	0.0008	15610	0.0004
1.5	0.059	7420	0.0005	5943	0.0004	4459	0.0003	3724	0.0003	5943	0.0003	4459	0.0001	4600	0.0009	12300	0.0012	10430	0.0006
2	0.079	6685	0.0007	5572	0.0005	3899	0.0004	3353	0.0004	5572	0.0004	4459	0.0002	3900	0.0012	9200	0.0014	8890	0.0007
Speed (SFM)		295 - 395 SFM		245 - 330 SFM		225 - 245 SFM		145 - 165 SFM		245 - 330 SFM		185 - 195 SFM		80 - 95 SFM		450 - 550 SFM		360 - 455 SFM	
2.5	0.098	11500	0.002	9600	0.001	9500	0.001	5750	0.001	9560	0.001	7500	0.001	3300	0.002	19400	0.004	14000	0.002
3	0.118	12700	0.003	10600	0.002	7400	0.002	5350	0.002	10600	0.002	6000	0.003	3000	0.002	16200	0.005	14800	0.004
4	0.157	9000	0.004	7500	0.003	5200	0.002	3800	0.002	7900	0.002	4200	0.003	2200	0.002	12100	0.006	11100	0.005
5	0.197	7200	0.005	5900	0.004	4200	0.003	3000	0.003	6300	0.003	3400	0.004	1800	0.003	9700	0.008	8900	0.006
6	0.236	5900	0.006	5000	0.005	3500	0.003	2500	0.003	5300	0.004	2800	0.005	1500	0.004	8100	0.010	7400	0.007
8	0.315	4500	0.008	3700	0.006	2600	0.005	1900	0.005	3950	0.005	2100	0.007	1100	0.005	6050	0.011	5570	0.009
10	0.394	3600	0.010	2900	0.008	2100	0.006	1500	0.006	3150	0.006	1700	0.009	900	0.006	4850	0.013	4460	0.012
12	0.472	3000	0.012	2500	0.009	1700	0.007	1200	0.007	2650	0.007	1400	0.010	700	0.007	4050	0.016	3710	0.014
16	0.630	2200	0.016	1800	0.013	1300	0.009	900	0.010	1990	0.009	1000	0.014	500	0.009	3050	0.018	2790	0.019

Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Use the table values for drilling depths upto 5xD. Adjust cutting conditions per table based on "degree angle to be drilled."
3) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
4) Center Drill or Guide hole required. (1: Use AG Starting drill or Aqua Ex Flat drill 2: For drilling guide holes in Stainless use AQUA EX Flat OH3D)

Formulas : $RPM = \frac{SFM \times 3.82}{\text{Drill dia.}}$ Feed Rate (in/min) : RPM×IPR

Aqua Drill EX Flat Super Stub

Carbide (Material) | AQ EX (Coating) | h7 (Dia. Tol.) | 180° (Point Angle) | 20° (Helix) | h6 (Shank Dia.)



L9628

Metric Sizes

NEW

*** Japan Stock Item**

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9628	0765754	2.0	0.0787	7	50	7.8	4	•
L9628	0765760	2.1	0.0827	8		8.4		•
L9628	0765777	2.2	0.0866			8.4		•
L9628	0765783	2.3	0.0906			8.5		•
L9628	0765790	2.4	0.0945	9		9.6		•
L9628	0765805	2.5	0.0984			9.7		•
L9628	0765811	2.6	0.1024			9.8		•
L9628	0765828	2.7	0.1063	10		10.9		•
L9628	0765834	2.8	0.1102			11		•
L9628	0765840	2.9	0.1142	11		13		•
L9628	0765055	3.0	0.1181			11.4	6	•
L9628	0765061	3.1	0.1220	12		12.5		•
L9628	0765078	3.2	0.1260			12.6		•
L9628	0765084	3.3	0.1299			12.7		•
L9628	0765090	3.4	0.1339	13		13.2		•
L9628	0765106	3.5	0.1378			13.3		•
L9628	0765112	3.6	0.1417			13.4		•
L9628	0765129	3.7	0.1457	14		14		•
L9628	0765135	3.8	0.1496			14.1		•
L9628	0765141	3.9	0.1535			14.2		•
L9628	0765158	4.0	0.1575			14.3		•
L9628	0765164	4.1	0.1614	15	60	16.4		•
L9628	0765170	4.2	0.1654			16.4		•
L9628	0765187	4.3	0.1693			16.5		•
L9628	0765193	4.4	0.1732	16		17.6		•
L9628	0765209	4.5	0.1772			17.7		•
L9628	0765215	4.6	0.1811			17.8		•
L9628	0765221	4.7	0.1850	18		18.9		•
L9628	0765238	4.8	0.1890			19		•
L9628	0765244	4.9	0.1929			19		•
L9628	0765250	5.0	0.1969			19.1		•
L9628	0765267	5.1	0.2008	19		21.2		•
L9628	0765273	5.2	0.2047			21.3		•
L9628	0765280	5.3	0.2087			21.4		•
L9628	0765296	5.4	0.2126	20		22.5		•
L9628	0765301	5.5	0.2165			22.6		•
L9628	0765318	5.6	0.2205			22.7		•
L9628	0765324	5.7	0.2244	21		23.7		•
L9628	0765330	5.8	0.2283			23.8		•
L9628	0765347	5.9	0.2323			23.9		•
L9628	0765353	6.0	0.2362			24		•
L9628	0765360	6.1	0.2402	22	70	25		•
L9628	0765376	6.2	0.2441					•
L9628	0765382	6.3	0.2480					•
L9628	0765399	6.4	0.2520	23		26		•
L9628	0765404	6.5	0.2559					•
L9628	0765410	6.6	0.2598					•
L9628	0765427	6.7	0.2638	24				•
L9628	0765433	6.8	0.2677					•
L9628	0765440	6.9	0.2717					•
L9628	0765456	7.0	0.2756					•
L9628	0765462	7.1	0.2795	26		29		•
L9628	0765479	7.2	0.2835					•
L9628	0765485	7.3	0.2874					•
L9628	0765491	7.4	0.2913	27				•
L9628	0765507	7.5	0.2953					•
L9628	0765513	7.6	0.2992					•
L9628	0765520	7.7	0.3031	28		31		•
L9628	0765536	7.8	0.3071					•
L9628	0765542	7.9	0.3110					•
L9628	0765559	8.0	0.3150				8	•

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9628	0765565	8.1	0.3189	29	80	32	8	•
L9628	0765571	8.2	0.3228					•
L9628	0765588	8.3	0.3268					•
L9628	0765594	8.4	0.3307	30		33		•
L9628	0765600	8.5	0.3346					•
L9628	0765616	8.6	0.3386					•
L9628	0765622	8.7	0.3425	32		34		•
L9628	0765639	8.8	0.3465					•
L9628	0765645	8.9	0.3504					•
L9628	0765651	9.0	0.3543					•
L9628	0765668	9.1	0.3583	33		36		•
L9628	0765674	9.2	0.3622					•
L9628	0765680	9.3	0.3661					•
L9628	0764690	9.4	0.3701	34				•
L9628	0764706	9.5	0.3740					•
L9628	0764712	9.6	0.3780					•
L9628	0764729	9.7	0.3819	35		38		•
L9628	0764735	9.8	0.3858					•
L9628	0764741	9.9	0.3898					•
L9628	0764758	10.0	0.3937				10	•
L9628	0764764	10.1	0.3976	36	90	39		•
L9628	0764770	10.2	0.4016					•
L9628	0764787	10.3	0.4055					•
L9628	0764793	10.4	0.4094	37		40		•
L9628	0764809	10.5	0.4134					•
L9628	0764815	10.6	0.4173					•
L9628	0764821	10.7	0.4213	38				•
L9628	0764838	10.8	0.4252					•
L9628	0764844	10.9	0.4291					•
L9628	0764850	11.0	0.4331					•
L9628	0764867	11.1	0.4370	40		43		•
L9628	0764873	11.2	0.4409					•
L9628	0764880	11.3	0.4449					•
L9628	0764896	11.4	0.4488	41				•
L9628	0764901	11.5	0.4528					•
L9628	0764918	11.6	0.4567					•
L9628	0764924	11.7	0.4606	42		45		•
L9628	0764930	11.8	0.4646					•
L9628	0764947	11.9	0.4685					•
L9628	0764953	12.0	0.4724	43		46	12	•
L9628	0764960	12.1	0.4764		100			•
L9628	0764976	12.2	0.4803					•
L9628	0764982	12.3	0.4843					•
L9628	0764999	12.4	0.4882	44		47		•
L9628	0765003	12.5	0.4921					•
L9628	0765010	12.6	0.4961					•
L9628	0765026	12.7	0.5000	45				•
L9628	0765032	12.8	0.5039					•
L9628	0765049	12.9	0.5079					•
L9628	0764305	13.0	0.5118					•
L9628	0764311	13.1	0.5157	47		50		•
L9628	0764328	13.2	0.5197					•
L9628	0764334	13.3	0.5236					•
L9628	0764340	13.4	0.5276	48				•
L9628	0764357	13.5	0.5315					•
L9628	0764363	13.6	0.5354					•
L9628	0764370	13.7	0.5394	49		52		•
L9628	0764386	13.8	0.5433					•
L9628	0764392	13.9	0.5472					•
L9628	0764408	14.0	0.5512					•
L9628	0764414	14.1	0.5551	50	105	53		•

* Package Qty: 1 per Tube Size

L9628 Metric Size

*Japan Stock Item

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9628	0764420	14.2	0.5591	50	105	53	12	•
L9628	0764437	14.3	0.5630					•
L9628	0764443	14.4	0.5669	51		54		•
L9628	0764450	14.5	0.5709					•
L9628	0764466	14.6	0.5748					•
L9628	0764472	14.7	0.5787	52				•
L9628	0764489	14.8	0.5827					•
L9628	0764495	14.9	0.5866					•
L9628	0764500	15.0	0.5906					•
L9628	0764517	15.1	0.5945	54	115	57		•
L9628	0764523	15.2	0.5984					•
L9628	0764530	15.3	0.6024					•
L9628	0764546	15.4	0.6063	55				•
L9628	0764552	15.5	0.6102					•

* Package Qty: 1 per Tube Size

List #	EDP #	Size	Decimal Equivalent	Flute Length	Overall Length	L1	Shank Dia.	Stock
		Dc		ℓ	L	L1	Ds	
L9628	0764569	15.6	0.6142	55	115	57	12	•
L9628	0764575	15.7	0.6181	56		59		•
L9628	0764581	15.8	0.6220					•
L9628	0764598	15.9	0.6260					•
L9628	0764603	16.0	0.6299				16	•
L9628	0764610	16.5	0.6496	58		61		•
L9628	0764626	17.0	0.6693	59	125	62		•
L9628	0764632	17.5	0.6890	61		63		•
L9628	0764649	18.0	0.7087	63		66		•
L9628	0764655	18.5	0.7283	65	135	68		•
L9628	0764661	19.0	0.7480	66		68		•
L9628	0764678	19.5	0.7677	68	145	71		•
L9628	0764684	20.0	0.7874	70		73	20	•

⚠ **WARNING:** Cancer - www.P65Warnings.ca.gov

Standard Drilling Conditions

LIST 9628

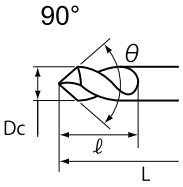
Work Material / Speed (SFM)		Cast Irons / Carbon Steels		Alloy Steels (20-30 HRC)		Mold Steels/ Hardened Steels (30-35 HRC)		Ductile Cast Irons		Aluminum Alloys		Aluminum Casting	
Drill Diameter		325-328 SFM		290-295 SFM		220-225 SFM		290-295 SFM		515-525 SFM		260-400 SFM	
Metric mm	Decimal	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)	RPM	Feed (IPR)
0.2	0.007	32000	0.0001	29000	0.0001	14000	0.0001	29000	0.0001	32000	0.0002	32000	0.0001
0.5	0.019	25500	0.0001	21000	0.0001	10000	0.0001	21000	0.0001	29000	0.0004	25500	0.0033
1	0.039	19000	0.0006	15900	0.0006	6400	0.0003	15900	0.0005	24000	0.0012	19000	0.0008
2	0.078	12000	0.0009	11500	0.0009	3200	0.0007	11500	0.0009	21000	0.0016	14500	0.0013
3	0.118	7950	0.0020	6900	0.0020	3700	0.0020	6900	0.0015	17000	0.0025	12500	0.0020
4	0.157	5950	0.0025	5150	0.0025	2800	0.0025	5150	0.0025	12500	0.0030	9550	0.0025
5	0.197	4800	0.0035	4150	0.0035	2200	0.0030	4100	0.0030	10000	0.0040	7650	0.0035
6	0.236	4000	0.0040	3450	0.0040	1800	0.0035	3450	0.0035	8500	0.0045	6400	0.0040
8	0.315	3000	0.0055	2600	0.0055	1400	0.0050	2600	0.0045	6350	0.0065	4750	0.0055
10	0.394	2400	0.0070	2050	0.0070	1100	0.0060	2050	0.0060	5100	0.0080	3800	0.0070
12	0.472	2000	0.0085	1700	0.0085	950	0.0070	1700	0.0070	4250	0.0095	3200	0.0080
16	0.630	1500	0.0110	1300	0.0110	700	0.0095	1300	0.0095	3200	0.0125	2400	0.0110
20	0.787	1200	0.0140	1050	0.0135	550	0.0120	1050	0.0115	2550	0.0155	1900	0.0135

Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Use the table values for drilling depths upto 2xD. Adjust cutting conditions per table based on "degree angle to be drilled."
3) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
4) Not recommended for drilling in Stainless Steel. We recommend using List9814 AQUA EX Flat OH3Dor OH5D for Stainless Steel & Hi-temp alloys.
5) Center Drill or Guide hole required. (1: Use AG Starting drill or Aqua Ex Flat drill)

Formulas : RPM $= \frac{\text{SFM} \times 3.82}{\text{Drill dia.}}$ Feed Rate (in/min) : RPM×IPR

Aqua Drill EX Starting Drill

For use with Aqua Flat Drills (List 9819, 9817, 9815)



Carbide Material | AQ EX Coating | 25° Helix | h7 Shank Dia. Tol

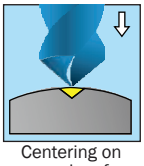
List 9624

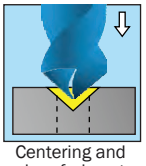
NEW

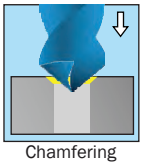
Item Code	Size	Decimal Equivalent	Drill Point Angle	Flute Length	Overall Length	Shank Dia
EDP	Dc			ℓ	L	Ds
0727355	3.0	0.1181	90°	9	48	3.0
0727360	4.0	0.1575		12	52	4.0
0727378	5.0	0.1969		14	60	5.0
0727384	6.0	0.2362		15	66	6.0
0727390	8.0	0.3150		20	79	8.0
0727406	10.0	0.3937		25	89	10.0
0727412	12.0	0.4724		30	102	12.0
0727429	16.0	0.6299		35	115	16.0
0727435	20.0	0.7874		40	131	20.0

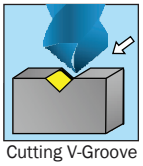
Package Qty: 1 per Tube Size

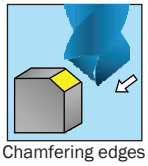
⚠ **WARNING:** Cancer - www.P65Warnings.ca.gov

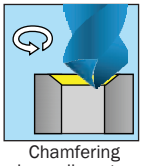

Centering on a curved surface


Centering and chamfering at the same time


Chamfering


Cutting V-Groove


Chamfering edges


Chamfering large diameter holes

Standard Drilling Conditions

Centering

Work Material / Drill Diameter		Carbon Steels / Cast Irons <20 HRC		Alloy Steels 20 ~ 30 HRC		Mold Steels 30 ~ 40 HRC		Hardened Steel 40 ~ 50 HRC		Stainless Steel 300 /Series		Aluminum Alloy Copper Alloy	
Metric mm	Decimal	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3	0.118	7400	17.7	4800	11.4	2100	3.7	1900	2.8	2650	5.1	10600	43.3
4	0.157	5600	16.9	3600	10.2	1600	3.3	1450	2.6	2000	4.3	7950	41.3
5	0.197	4450	15.0	2850	9.4	1250	3.0	1150	2.4	1600	3.9	6350	37.4
6	0.236	3700	15.0	2400	9.4	1050	3.0	950	2.4	1300	3.9	5300	37.4
8	0.315	2800	15.0	1800	9.4	800	3.0	700	2.4	1000	3.9	4000	37.4
10	0.394	2200	13.0	1450	8.7	650	2.8	550	2.2	800	3.7	3200	31.5
12	0.472	1850	13.0	1200	8.7	530	2.8	480	2.2	650	3.7	2650	31.5
16	0.630	1400	11.4	900	7.5	400	2.6	350	2.0	500	3.5	2000	27.6
20	0.787	1100	10.2	720	6.7	320	2.6	280	2.0	400	3.1	1600	25.6

Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
3) Apply sufficient cutting fluid to work area.
4) Use these cutting conditions for centering work.
5) Reduce RPM and feed rates by 20% for centering work on rolled steel or forged surfaces, curved or angled surfaces.
4) Use collet chucks or milling chucks.

Chamfering

Work Material / Drill Diameter		Carbon Steels / Cast Irons <20 HRC		Alloy Steels 20 ~ 30 HRC		Mold Steels/ Hardened Steels 30 ~ 40 HRC		Hardened Steel 40 ~ 50 HRC		Stainless Steel 300 /Series		Aluminum Alloy Copper Alloy	
Metric mm	Decimal	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)	RPM	Feed (IPM)
3	0.118	7400	14.2	4800	9.1	2100	2.6	1900	2.0	2650	3.9	10600	35.0
4	0.157	5600	13.4	3600	8.3	1600	2.4	1450	1.8	2000	3.3	7950	33.1
5	0.197	4450	11.8	2850	7.5	1250	2.2	1150	1.6	1600	3.1	6350	29.9
6	0.236	3700	11.8	2400	7.5	1050	2.2	950	1.6	1300	3.1	5300	29.9
8	0.315	2800	11.8	1800	7.5	800	2.2	700	1.6	1000	3.1	4000	29.9
10	0.394	2200	10.2	1450	6.9	650	2.0	550	1.4	800	3.0	3200	25.2
12	0.472	1850	10.2	1200	6.9	530	2.0	480	1.4	650	3.0	2650	25.2
16	0.630	1400	9.1	900	5.9	400	1.8	350	1.2	500	2.8	2000	22.0
20	0.787	1100	8.3	720	5.3	320	1.8	280	1.2	400	2.4	1600	20.1

Note : 1) Adjust drilling conditions according to the rigidity of machine or work clamp state.
2) Above table values are for drilling water soluble cutting fluid. For non-water soluble cutting fluid reduce the RPM and feed rates by 20%
3) Apply sufficient cutting fluid to work area.
4) Use these cutting conditions for chamfering.
5) Reduce RPM and feed rates at the same ratio if chattering occurs, because the workpiece is not rigidly mounted to the machine.
4) Use collet chucks or milling chucks.

AG Starting Drill

For use with Aqua Flat Drills (List 9819, 9817, 9815)

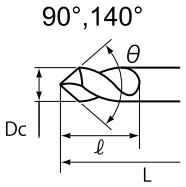
List 6502

90° Range 3.0 to 20.0
140° Range 3.0 to 20.0

Item Code	Size	Decimal Equivalent	Drill Point Angle	Flute Length	Overall Length	Shank Dia
EDP	Dc			ℓ	L	Ds
0710358	3.0	0.1181	90°	9	48	3.0
0710364	4.0	0.1575		12	52	4.0
0712613	5.0	0.1969		14	60	5.0
0710370	6.0	0.2362		15	66	6.0
0710387	8.0	0.3150		20	79	8.0
0710393	10.0	0.3937		25	89	10.0
0710409	12.0	0.4724		30	102	12.0
0710415	16.0	0.6299		35	115	16.0
0710421	20.0	0.7874		40	131	20.0
0710518	3.0	0.1181	140°	9	48	3.0
0710524	4.0	0.1575		12	52	4.0
0712636	5.0	0.1969		14	60	5.0
0710530	6.0	0.2362		15	66	6.0
0710547	8.0	0.3150		20	79	8.0
0710553	10.0	0.3937		25	89	10.0
0710560	12.0	0.4724		30	102	12.0
0710576	16.0	0.6299		35	115	16.0
0710582	20.0	0.7874		40	131	20.0

Package Qty: 1 per Tube Size

AG Starting Drill Extended Length



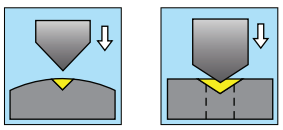
For use with Aqua Flat Drills (List 9819, 9817, 9815)

List 6504

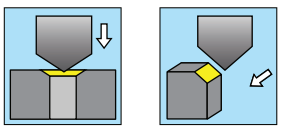
90° Range 3.0 to 12.0
140° Range 3.0 to 12.0

Item Code	Size	Decimal Equivalent	Drill Point Angle	Flute Length	Overall Length	Shank Dia
EDP	Dc			ℓ	L	Ds
0710656	3.0	0.1181	90°	9	75	3.0
0710662	4.0	0.1575		12	100	4.0
0712659	5.0	0.1969		14	100	5.0
0710679	6.0	0.2362		15	150	6.0
0710685	8.0	0.3150		20	150	8.0
0710691	10.0	0.3937		25	200	10.0
0710707	12.0	0.4724		30	200	12.0
0710771	3.0	0.1181	140°	9	75	3.0
0710788	4.0	0.1575		12	100	4.0
0712671	5.0	0.1969		14	100	5.0
0710794	6.0	0.2362		15	150	6.0
0710800	8.0	0.3150		20	150	8.0
0710816	10.0	0.3937		25	200	10.0
0710822	12.0	0.4724		30	200	12.0

AREAS OF APPLICATION FOR AG STARTING



For Pre-Drilling of Drills that have inconsistent bite and drilling holes on curved or inclined surfaces



For Chamfering of Holes and Chamfering Edges

Usage Guide

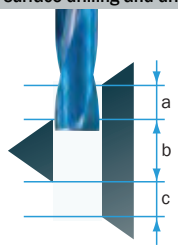
AQDEXZ/AQDEXZOH3D

AQDEXZ/AQDEXZOH3D hole distension and vibration countermeasures

- For flat surfaces, drill a guide hole in very small steps (G73).
- For sloped surfaces, reduce the feed.

- If chamfering larger than the diameter of the hole is needed, such as for tap holes, do the chamfering first.

Angled surface drilling and drilling conditions

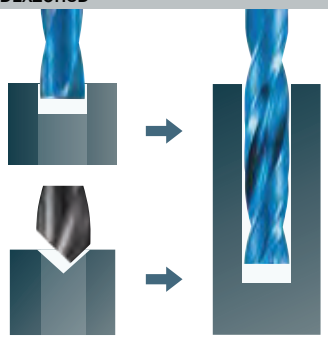


a: Reduce drilling and feed speeds.
b: Standard drilling conditions.
c: Same as 'a', or reduce feed speed.

AQDEXZR/AQDEXZLS/AQDEXZOH5D

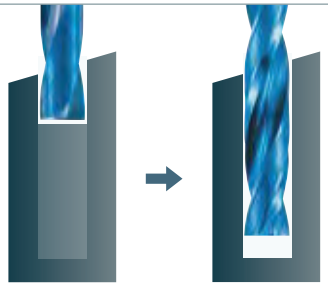
Using AQDEXZR/AQDEXZLS/AQDEXZOH5D

- Guide hole drilling with AQDEXZ.
- In case of stainless steels, use the AQDEXZOH3D.



- Chamfering with AGSTD.

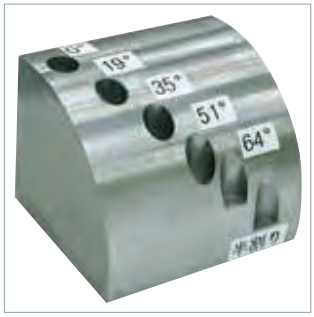
- Guide hole drilling with AQDEXZ.
- In case of stainless steels, use the AQDEXZOH3D.

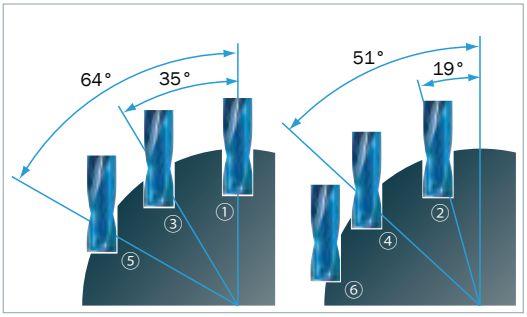


AQDEXZ - Drilling Conditions

Comparison of angled surface drilling conditions with the AQDEXZ

Position		Cutting Speed			Feed & Speed		
No.	Angle	m/min	min $^{-1}$	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	Halved				60	0.04	20%



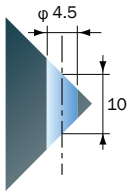


AQDEXZ1000 (φ10) /Work Material S45C / Depth 15mm /Water Soluble Cutting Fluid

AQDEXZ - Processing Examples

Slant hole in the entrance and exit

1050
Automotive
Compact Pump
Component



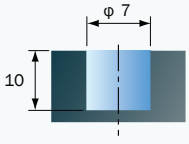
Before Improvement	After Improvement
Counterbore: Carbide Endmill Drilling: Carbide Drill	Aqua EX Flat One Step Drilling
High Tool Cost $8800/month	$4300/month
Large difference between entrance & exit holes: Max. 60 mm	Max 45 mm
Burred exit hole	Controls Burr

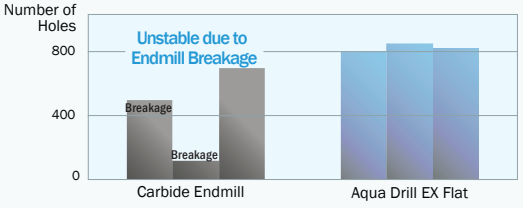
Cutting Conditions

4.5mm (0.177")	Tool Dia.
60m/min (200 SFM)	Speed/SFM
480mm/min	Feed Rate
0.11mm/rev (0.004 IPR)	
10mm (0.3937")	Depth
Water Soluble	Coolant

Before tapping

1050
Electrical
Components





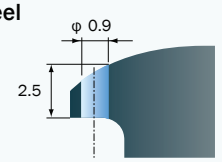
Cutting Conditions

7mm (0.2756")	Tool Dia.
60m/min (195 SFM)	Speed/SFM
150mm/min	Feed Rate
0.06mm/rev (0.002 IPR)	
10mm (0.3937")	Depth
Water Soluble	Coolant

AQDEXZ - Drilling Examples

Slant Hole Single Process

316L Stainless Steel
Precision Parts

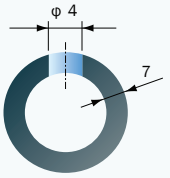


Before Improvement	After Improvement
Center Hole Drilling ↓ Drilling ↓ Form Drilling	Form Drilling ↓ **Aqua EX Flat** Reduces drilling by using special parts of different diameters

Cutting Conditions	
0.9mm (0.0354")	Tool Dia.
11m/min (40 SFM)	Speed/SFM
25mm/min	Feed Rate
0.01mm/rev (0.0002 IPR)	
2.5mm (0.0984")	Depth
Water Soluble	Coolant

Single Process / Less Burr

1045
Hydraulic Valve Parts

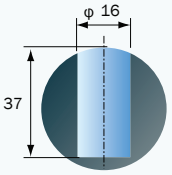


Before Improvement	After Improvement
Pre-Drilling: Carbide Endmill ↓ Drilling: Carbide Drill ↓ Burr Removal Burr	**Aqua EX Flat** **One Step Drilling** Reduces drilling, controls inner burr & reduces burr removal process with same efficiency & tool life

Cutting Conditions	
4.0mm (0.1574")	Tool Dia.
23m/min (75 SFM)	Speed/SFM
70mm/min	Feed Rate
0.04mm/rev (0.002 IPR)	
7mm (0.275")	Depth
Water Soluble	Coolant

Counter Boring

Copper Cast
Electronic parts

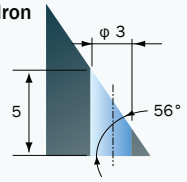


Before Improvement	After Improvement
Counter Boring: HSS Endmill ↓ Drilling: Carbide Drill ↓ Bottom Drilling: HSS Endmill	**Aqua EX Flat** **One Step Drilling** Allows drilling of copper alloys; reduces drilling

Cutting Conditions	
16.0mm (0.6299")	Tool Dia.
60m/min (200 SFM)	Speed/SFM
200mm/min	Feed Rate
0.17mm/rev (0.007 IPR)	
37mm (1.45")	Depth
Water Soluble	Coolant

Slant Hole Single Process

450 Nodular Cast Iron
Steering Parts

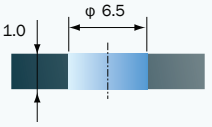


Before Improvement	After Improvement
Pre-Drilling: Carbide Endmill ↓ Drilling: Carbide Drill	**Aqua EX Flat** **One Step Drilling** Reduces drilling; Cuts tool cost

Cutting Conditions	
3.0mm (0.1181")	Tool Dia.
47m/min (155 SFM)	Speed/SFM
88mm/min	Feed Rate
0.18mm/rev (0.001 IPR)	
5mm (0.196")	Depth
Water Soluble	Coolant

Single Process of Thin Plate

Hastelloy
Heat-Reistant
Alloy Parts

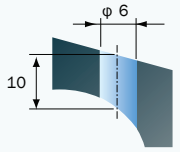


Before Improvement	After Improvement
Drilling ↓ End Mill Drilling	**Aqua EX Flat** **One Step Drilling**

Cutting Conditions	
6.5mm (0.256")	Tool Dia.
20m/min (67 SFM)	Speed/SFM
59mm/min	Feed Rate
0.06mm/rev (0.002 IPR)	
1.0mm (0.039")	Depth
Water Soluble	Coolant

Intersected Hole

1045
Hydraulic
Pump Parts



Before Improvement	After Improvement
Counter Boring: Carbide Endmill ↓ Drilling: Carbide Drill Difficult to remove burr under intersected hole	**Aqua EX Flat** **One Step Drilling** Controls back burr; Reduces drilling

Cutting Conditions	
6.0mm (0.2362")	Tool Dia.
68m/min (223 SFM)	Speed/SFM
250mm/min	Feed Rate
0.07mm/rev (0.003 IPR)	
10mm (0.3937")	Depth
Water Soluble	Coolant

NACHI

WARNING: This product can expose you to chemicals including cobalt, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov

NACHI AMERICA INC.