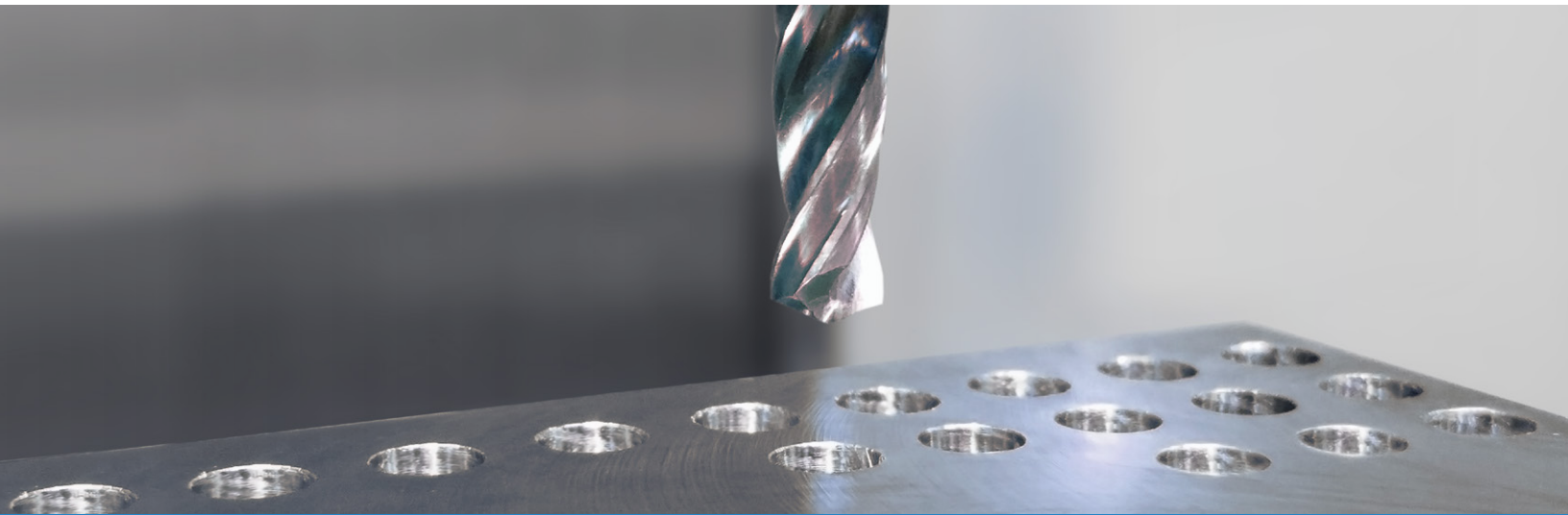




HYDROS Deep Drill

Coolant Fed Deep Drill for Difficult-to-Cut Material



Excellent Hole Accuracy with a Low Cutting Force Design

Optimized Cutting Edge

Point Design for Accuracy

Double Margin for Smooth Hole Wall Finish

10xD Drilling Capabilities

Match with ORION Pilot Drills - Series 160/165



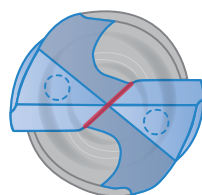
HYDROS Deep Drill

Excellent Hole Accuracy with a Low Cutting Force Design
Good for Difficult-to-Cut Materials

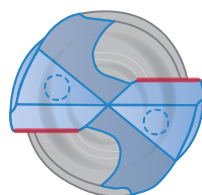
1 Optimized Cutting Edge for Increased Accuracy

The optimized cutting edge creates excellent drilling accuracy during the initial cut by consistently controlling the cutting force across the face of both cutting edges.

Cutting Edge



Centering Edge

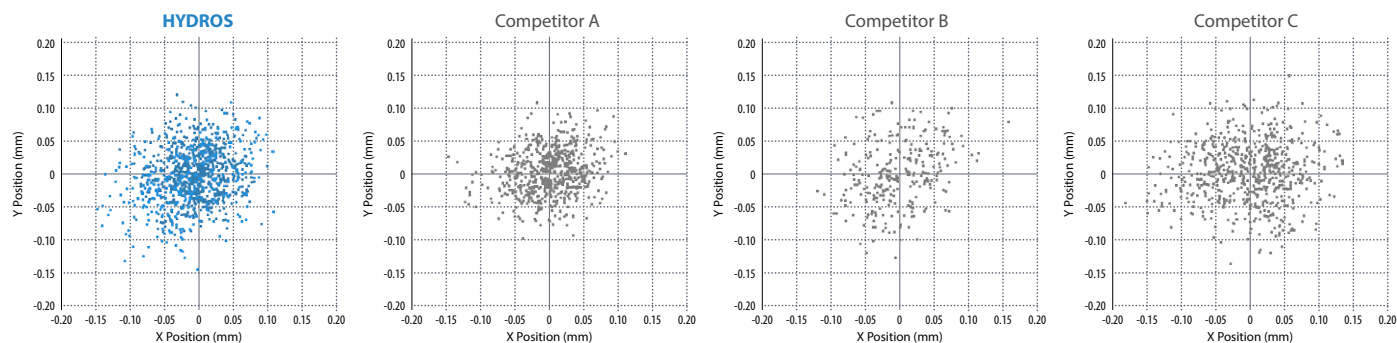


Primary Cutting Edge

Centering Edge



Drill Hole Positional Accuracy After 1400 Holes (In-house Evaluation)

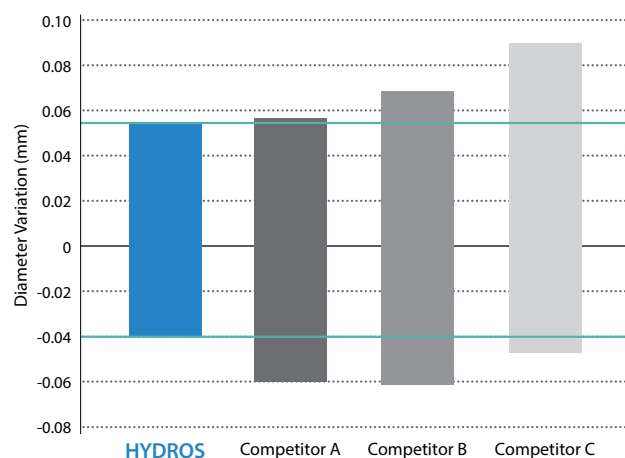


Excellent Hole Positional Accuracy

	HYDROS	Competitor A	Competitor B	Competitor C
Cp	1.92	1.97	1.70	1.50
CpK	1.34	1.35	1.03	0.86
Spec (+/-)	0.15mm	0.15mm	0.15mm	0.15mm

Cutting Conditions : N = 6468rpm, Vf = 575mm/min Drill Diameter Ø3mm Drilling Depth 25.4mm 17-4PH-900

Hole Diameter Variation (In-house Evaluation)



	No. of Holes	Diameter Variation (mm)
HYDROS	600	0.0937
Competitor A	600	0.1141
Competitor B	269 (Broken)	0.1281
Competitor C	600	0.1347

Cutting Conditions : N = 6468rpm, Vf = 575mm/min Drill Diameter Ø3mm Drilling Depth 25.4mm 17-4PH-900

2

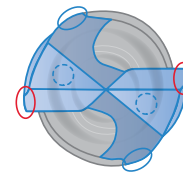
Double Margin for Smooth Hole Finish

Two margins create a cutting and wiping effect that create a smooth hole finish and smooth cutting performance along the hole wall.

Chip Comparison



Double Margins

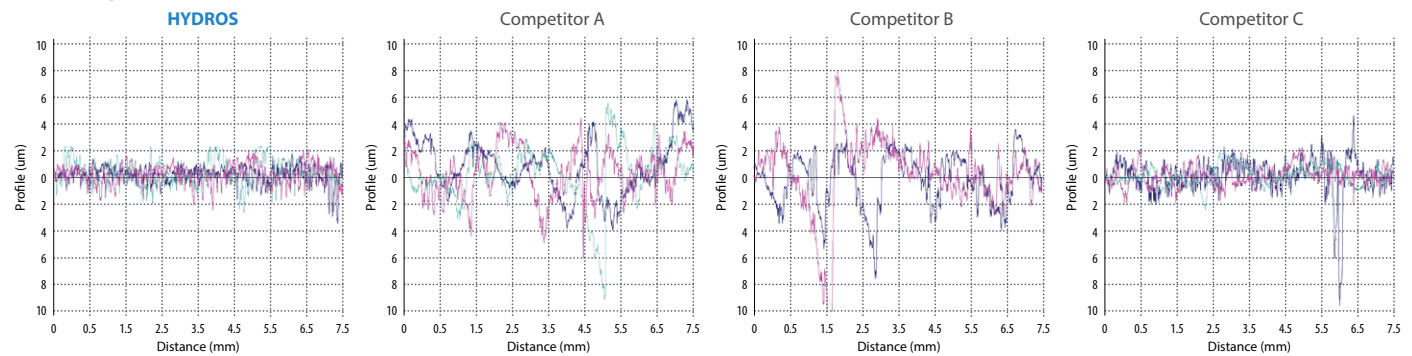


Cutting Edge

Wiping Edge

Optimized for smooth cutting performance with excellent chip evacuation

Hole Roughness (In-house Evaluation)



	HYDROS			Competitor A			Competitor B			Competitor C		
	Hole 1	Hole 300	Hole 600	Hole 1	Hole 300	Hole 600	Hole 1	Hole 300	Hole 600	Hole 1	Hole 300	Hole 600
R _a (µm)	0.421	0.539	0.676	1.705	1.540	1.572	1.638	1.977	Broken	0.893	0.559	0.562
R _q (µm)	0.554	0.677	0.869	2.123	1.832	2.113	1.979	2.581	Broken	1.249	0.712	0.687
R _z (µm)	3.282	3.478	4.406	8.076	8.480	10.077	8.847	10.973	Broken	7.178	3.845	3.206

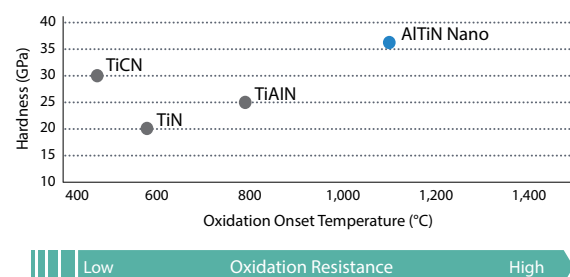
Cutting Conditions : N = 6468rpm, Vf = 575mm/min Drill Diameter Ø3mm Drilling Depth 25.4mm 17-4PH-900

3

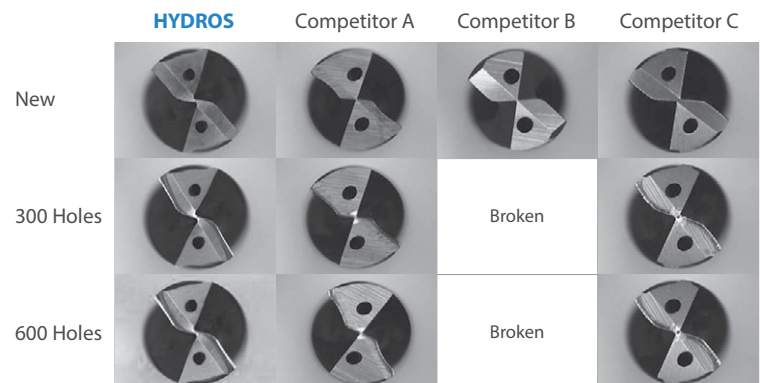
Nanocomposite Super-nitride AlTiN Coating Technology

Great for difficult-to-cut and hardened materials, the 2nd generation AlTiN supernitride with a nanocomposite coating structure has a hardness GPa of 36.3 and maximum application temperature (°C) of 1,100.

Coating Properties



Wear Resistance Comparison (In-house Evaluation)



	Total Holes	At 300 Holes			At 600 Holes		
		Facet (mm)	Wear (mm)	% Wear	Facet (mm)	Wear (mm)	% Wear
HYDROS	600	0.408	0.066	16.2%	0.408	0.111	27.1%
Competitor A	600	0.506	0.085	16.8%	0.506	0.094	18.6%
Competitor B	600	0.321	0.069	21.3%	0.321	0.078	24.1%
Competitor C	269	Broken					

Cutting Conditions : N = 6468rpm, Vf = 575mm/min Drill Diameter Ø3mm Drilling Depth 25.4mm 17-4PH-900

HYDROS Deep Drills - Inch Sizes (Ø0.1250" - Ø0.5000")



Cutting Dia. (ØDc)	Tolerance
0.1250 ~ 0.2344	+0.0000 -0.0005
0.2500 ~ 0.3750	+0.0000 -0.0006
0.4219 ~ 0.5000	+0.0000 -0.0007

Shank Dia. (ØDs)	Tolerance
0.1250 ~ 0.2500	+0.00000 -0.00032
0.3125 ~ 0.3750	+0.00000 -0.00035
0.4375 ~ 0.5000	+0.00000 -0.00043

10D

Match with **ORION Pilot Drills**
Series 160

Toolholder Dimension

Description	Stock	Dimensions (in)						Point Angle
		ØDc		ØDs	L	L1	*L2	
860-1250AG1625	◆	0.1250	1/8	0.1250	3 1/2	1.6250	1.2500	135°
860-1406AG1828	◆	0.1406	9/64	0.1875	4	1.8280	1.4060	
860-1563AG2031	◆	0.1563	5/32		4	2.0310	1.5630	
860-1719AG2234	◆	0.1719	11/64		4	2.2340	1.7190	
860-1875AG2438	◆	0.1875	3/16		4 1/2	2.4380	1.8750	
860-2031AG2641	◆	0.2031	13/64	0.2500	4 1/2	2.6410	2.0310	
860-2188AG2844	◆	0.2188	7/32		5	2.8440	2.1880	
860-2344AG3047	◆	0.2344	15/64		5	3.0470	2.3440	
860-2500AG3250	◆	0.2500	1/4		5	3.2500	2.5000	
860-2570AG3341	◆	0.2570	F	0.3125	5 1/2	3.3410	2.5700	
860-2656AG3453	◆	0.2656	17/64		5 1/2	3.4530	2.6560	
860-2813AG3656	◆	0.2813	9/32		5 1/2	3.6560	2.8130	
860-3125AG4063	◆	0.3125	5/16		6	4.0630	3.1250	
860-3320AG4316	◆	0.3320	Q	0.3750	6 1/2	4.3160	3.3200	
860-3438AG4469	◆	0.3438	11/32		6 1/2	4.4690	3.4380	
860-3750AG4875	◆	0.3750	3/8		7	4.8750	3.7500	
860-4219AG5484	◆	0.4219	27/64	0.4375	7 1/2	5.4840	4.2190	
860-4375AG5688	◆	0.4375	7/16		7 1/2	5.6880	4.3750	
860-4531AG5891	◆	0.4531	29/64	0.5000	8	5.8910	4.5310	
860-5000AG6500	◆	0.5000	1/2		8 1/2	6.5000	5.0000	

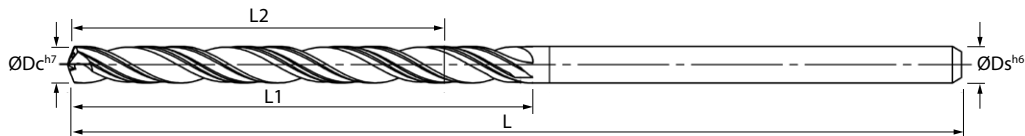
*L2 dimensions refers to the length of cut (10 x ØDc).

◆ : Available End of 2016

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10D



Cutting Dia. (ØDc)	Tolerance
3.00 ~ 5.90	h7
Shank Dia. (ØDs)	Tolerance
3 ~ 6	h6

Match with **ORION Pilot Drills**
Series 165

Toolholder Dimension

Description	Stock	Dimensions (mm)					Point Angle
		ØDc ^{h7}	ØDs ^{h6}	L	L1	*L2	
865-1181AG1535	◆	3.00	3	90	39.0	30	135°
865-1220AG1587	◆	3.10		90	40.3	31	
865-1260AG1638	◆	3.20		90	41.6	32	
865-1299AG1689	◆	3.30		90	42.9	33	
865-1339AG1740	◆	3.40		90	44.2	34	
865-1378AG1791	◆	3.50		90	45.5	35	
865-1417AG1843	◆	3.60		90	46.8	36	
865-1457AG1894	◆	3.70		100	48.1	37	
865-1496AG1945	◆	3.80		100	49.4	38	
865-1535AG1996	◆	3.90		100	50.7	39	
865-1575AG2047	◆	4.00	4	100	52.0	40	
865-1614AG2098	◆	4.10		100	53.3	41	
865-1654AG2150	◆	4.20		110	54.6	42	
865-1693AG2201	◆	4.30		110	55.9	43	
865-1732AG2252	◆	4.40		110	57.2	44	
865-1772AG2303	◆	4.50		110	58.5	45	
865-1811AG2354	◆	4.60		110	59.8	46	
865-1850AG2406	◆	4.70		110	61.1	47	
865-1890AG2457	◆	4.80		110	62.4	48	
865-1929AG2508	◆	4.90		110	63.7	49	
865-1969AG2559	◆	5.00	6	110	65.0	50	
865-2008AG2610	◆	5.10		120	66.3	51	
865-2047AG2661	◆	5.20		120	67.6	52	
865-2087AG2713	◆	5.30		120	68.9	53	
865-2126AG2764	◆	5.40		120	70.2	54	
865-2165AG2815	◆	5.50		120	71.5	55	
865-2205AG2866	◆	5.60		120	72.8	56	
865-2244AG2917	◆	5.70		120	74.1	57	
865-2283AG2969	◆	5.80		120	75.4	58	
865-2323AG3020	◆	5.90		120	76.7	59	

*L2 dimensions refers to the length of cut (10 x ØDc).

◆ : Available End of 2016

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Toolholder Dimension

Description	Stock	Dimensions (mm)					Point Angle
		ØDc ^{h7}	ØDs ^{h6}	L	L1	*L2	
865-2362AG3071	◆	6.00	6	130	78.0	60	135°
865-2402AG3122	◆	6.10		130	79.3	61	
865-2441AG3173	◆	6.20		130	80.6	62	
865-2480AG3224	◆	6.30		130	81.9	63	
865-2520AG3276	◆	6.40		130	83.2	64	
865-2559AG3327	◆	6.50		140	84.5	65	
865-2598AG3378	◆	6.60		140	85.8	66	
865-2638AG3429	◆	6.70		140	87.1	67	
865-2677AG3480	◆	6.80		140	88.4	68	
865-2717AG3531	◆	6.90		140	89.7	69	
865-2756AG3583	◆	7.00		140	91.0	70	
865-2795AG3634	◆	7.10		140	92.3	71	
865-2835AG3685	◆	7.20		140	93.6	72	
865-2874AG3736	◆	7.30		140	94.9	73	
865-2913AG3787	◆	7.40		150	96.2	74	
865-2953AG3839	◆	7.50		150	97.5	75	
865-2992AG3890	◆	7.60		150	98.8	76	
865-3031AG3941	◆	7.70		150	100.1	77	
865-3071AG3992	◆	7.80		150	101.4	78	
865-3110AG4043	◆	7.90		150	102.7	79	
865-3150AG4094	◆	8.00		150	104.0	80	
865-3189AG4146	◆	8.10	10	160	105.3	81	
865-3228AG4197	◆	8.20		160	106.6	82	
865-3268AG4248	◆	8.30		160	107.9	83	
865-3307AG4299	◆	8.40		160	109.2	84	
865-3346AG4350	◆	8.50		160	110.5	85	
865-3386AG4402	◆	8.60		160	111.8	86	
865-3425AG4453	◆	8.70		160	113.1	87	
865-3465AG4504	◆	8.80		170	114.4	88	
865-3504AG4555	◆	8.90		170	115.7	89	
865-3543AG4606	◆	9.00		170	117.0	90	

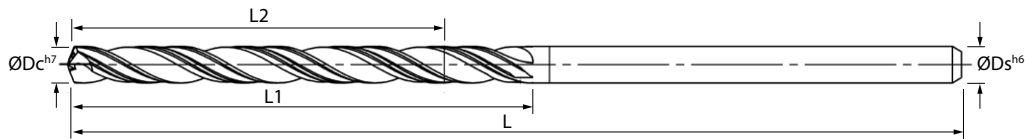
*L2 dimensions refers to the length of cut (10 x ØDc).

◆ : Available End of 2016

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10D



Cutting Dia. (ØDc)	Tolerance
9.10 ~ 12.00	h7
Shank Dia. (ØDs)	Tolerance
10 ~ 12	h6

Match with **ORION Pilot Drills**
Series 165

Toolholder Dimension

Description	Stock	Dimensions (mm)					Point Angle
		ØDc ^{h7}	ØDs ^{h6}	L	L1	*L2	
865-3583AG4657	◆	9.10	10	170	118.3	91	135°
865-3622AG4709	◆	9.20		170	119.6	92	
865-3661AG4760	◆	9.30		170	120.9	93	
865-3701AG4811	◆	9.40		170	122.2	94	
865-3740AG4862	◆	9.50		170	123.5	95	
865-3780AG4913	◆	9.60		180	124.8	96	
865-3819AG4965	◆	9.70		180	126.1	97	
865-3858AG5016	◆	9.80		180	127.4	98	
865-3898AG5067	◆	9.90		180	128.7	99	
865-3937AG5118	◆	10.00		180	130.0	100	
865-3976AG5169	◆	10.10	12	180	131.3	101	
865-4016AG5220	◆	10.20		190	132.6	102	
865-4055AG5272	◆	10.30		190	133.9	103	
865-4094AG5323	◆	10.40		190	135.2	104	
865-4134AG5374	◆	10.50		190	136.5	105	
865-4173AG5425	◆	10.60		190	137.8	106	
865-4213AG5476	◆	10.70		190	139.1	107	
865-4252AG5528	◆	10.80		190	140.4	108	
865-4291AG5579	◆	10.90		190	141.7	109	
865-4331AG5630	◆	11.00		200	143.0	110	
865-4370AG5681	◆	11.10		200	144.3	111	
865-4409AG5732	◆	11.20		200	145.6	112	
865-4449AG5783	◆	11.30		200	146.9	113	
865-4488AG5835	◆	11.40		200	148.2	114	
865-4528AG5886	◆	11.50		200	149.5	115	
865-4567AG5937	◆	11.60		200	150.8	116	
865-4606AG5988	◆	11.70		200	152.1	117	
865-4646AG6039	◆	11.80		200	153.4	118	
865-4685AG6091	◆	11.90		210	154.7	119	
865-4724AG6142	◆	12.00		210	156.0	120	

*L2 dimensions refers to the length of cut (10 x ØDc).

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Recommended Cutting Conditions

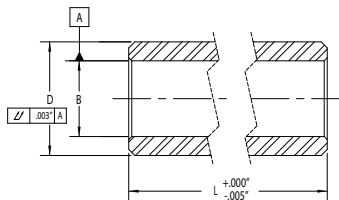
Workpiece Material	Hardness	Cutting Speed (sfm)	Drill Diameter / Feed Rate (ipr)			
			Ø3.00mm - Ø5.90mm Ø0.1250" - Ø0.2344"	Ø6.00mm - Ø9.90mm Ø0.2500" - Ø0.3438"	Ø10.00mm - Ø11.90mm Ø0.3750" - Ø0.4531"	Ø12.00mm Ø0.5000"
Low Carbon Steel	<24 HRc	330	0.0060	0.0100	0.0120	0.0140
Alloy Steel	24 - 30 HRc	260	0.0060	0.0080	0.0100	0.0120
Stainless Steel	< 30HRc	200	0.0035	0.0070	0.0100	0.0120
Gray Cast Iron	<50 kpsi	330	0.0070	0.0100	0.0120	0.0140
Nodular Cast Iron	<60 kpsi	230	0.0060	0.0080	0.0100	0.0120
Aluminum	-	390	0.0070	0.0120	0.0160	0.0180
Copper	-	260	0.0050	0.0080	0.0100	0.0120
Heat Resistant Alloy	-	80	0.0020	0.0040	0.0050	0.0060
Titanium Alloy	-	150	0.0025	0.0050	0.0070	0.0090
Hardened Steel	30 - 50 HRc	140	0.0040	0.0070	0.0100	0.0120
Tool Steel	> 50 HRc	100	0.0030	0.0050	0.0060	0.0080

• Above recommendations are suggested starting parameters. Cutting speeds and feed rates may vary according to machining application.

Case Studies

Adapter - Aerospace 17-4PH1150

Vc = 67sfm (n = 1,050rpm)
Vf = 4.2ipm
D.O.C. = 2.000"
Wet (Internal Coolant)
Ø0.244"
865-2441AG3173



Tool Life

HYDROS Ø0.244"

130 pcs / tool

Tool Life
1.6x

Competitor A
Ø0.244"

80 pcs / tool

The HYDROS drill showed 1.6 times the tool life of Competitor A.

(User Evaluation)

Implant Device - Medical 17-4

Vc = 125sfm (n = 3,970rpm)
Vf = 4.76ipm
D.O.C. = 1.000"
Wet (Internal Coolant)
Ø0.118"
865-1181AG1535



Tool Life

HYDROS Ø0.118"

180 pcs / tool

Tool Life
1.1x

Competitor B
Ø0.118"

165 pcs / tool

The HYDROS showed better wear and tool life was 1.1 times that of Competitor B.

(User Evaluation)



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