



# ORION

High Performance Drills for Difficult-to-Cut Material



Excellent Hole Accuracy with a Low Cutting Force Design

Optimized Cutting Edge

Point Design for Accuracy

3xD & 5xD Drilling Capabilities

Increased Positional Accuracy

Less Heat Build Up

**NEW**

*New Diameters from 3/64" & 1.00mm*

**NEW**

*New 5xD Sizes Added*



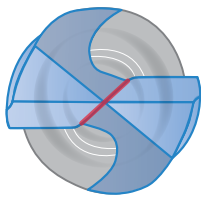
# ORION High Performance Drill

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

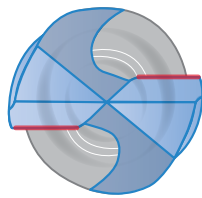
## 1 Optimized Cutting Edge for Increased Accuracy

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

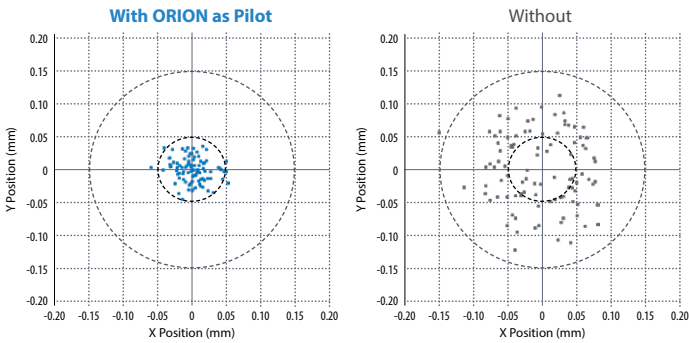


Primary Cutting Edge

Centering Edge



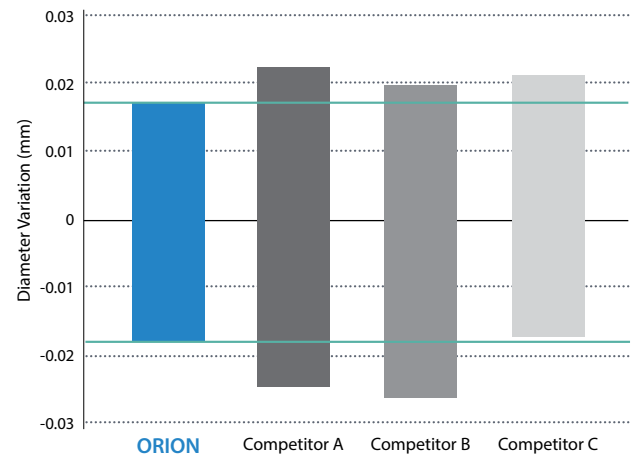
3mm Coolant Fed Drill Hole Positional Accuracy  
(After using the ORION as a pilot drill)



	With ORION	Without
Cp	3.80	1.98
CpK	3.17	1.06
Spec (+/-)	0.15	0.15

Cutting Conditions : N = 2588rpm, Vf = 196mm/min Drill Diameter Ø3mm Drilling Depth 9mm 17-4PH-900

Hole Diameter Variation (In-house Evaluation)



Drill	No. of Holes	Diameter Variation (mm)
ORION	600	0.0071
Competitor A	600	0.0113
Competitor B	600	0.0109
Competitor C	600	0.0087

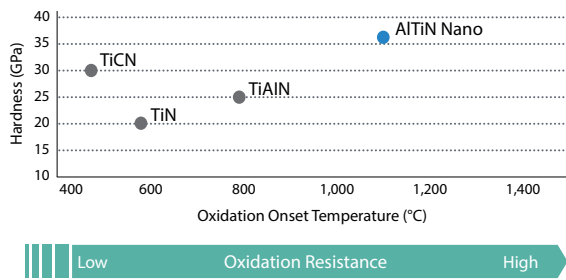
Cutting Conditions : N = 2588rpm, Vf = 196mm/min Drill Diameter Ø3mm Drilling Depth 9mm 17-4PH-900



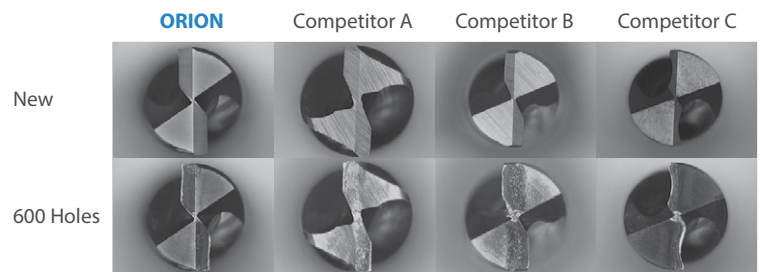
## 2 Nanocomposite Super-nitride AlTiN Coating Technology

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)

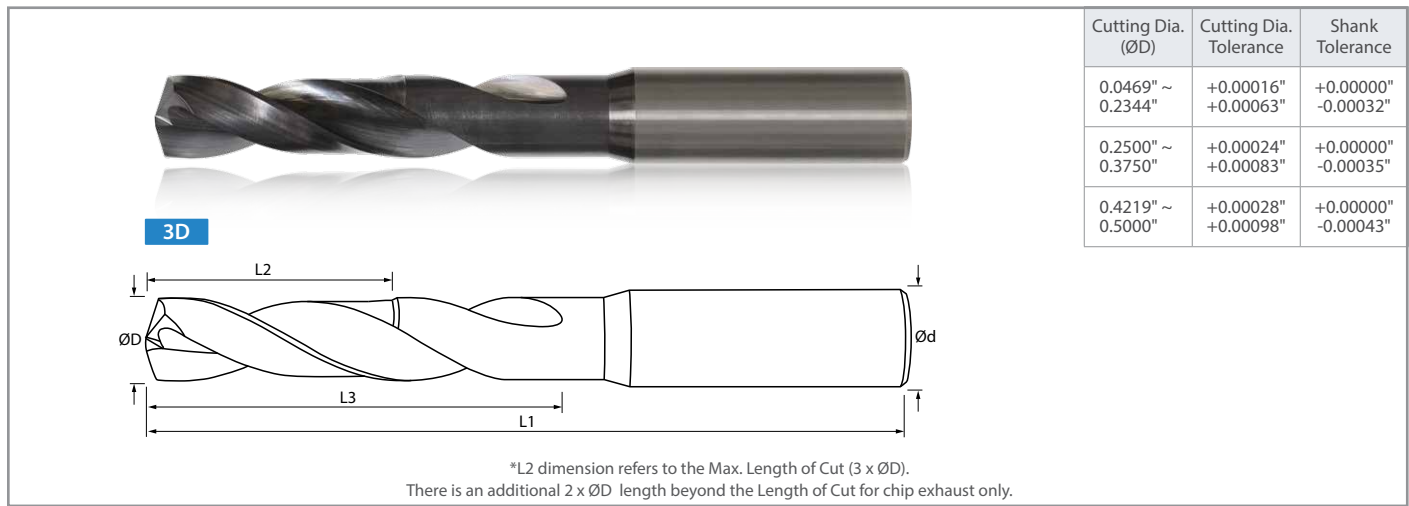


The ORION performed with good overall wear while still maintaining good tool finish

Drill	Total Holes	At 300 Holes	At 600 Holes
		Wear (mm)	Wear (mm)
<b>ORION</b>	600	0.032	0.068
Competitor A	600	0.031	0.057
Competitor B	600	0.044	0.073
Competitor C	600	0.044	0.071

Cutting Conditions : N = 2588rpm, Vf = 196mm/min Drill Diameter Ø3mm Drilling Depth 9mm 17-4PH-900

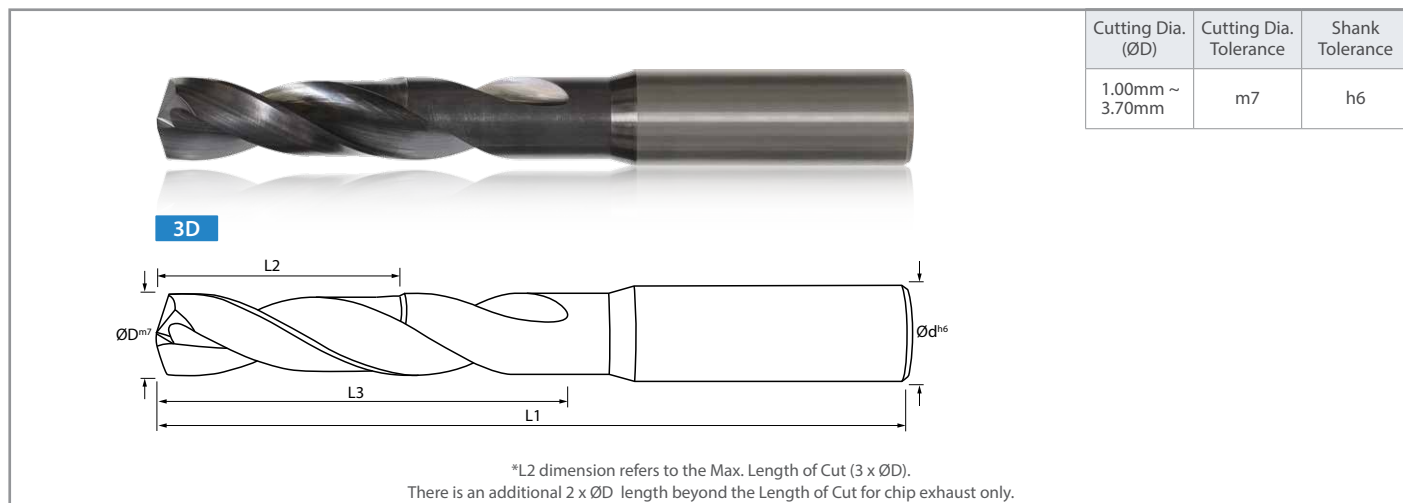
## 3xD ORION Drills - Inch Sizes (Ø0.0469" - Ø0.5000")



### Inch Drill Dimensions

	Part Number	Stock	Dimensions (in)					Point Angle	
			ØD		Ød	L1	*L2		L3
NEW	160-0469AG234	●	0.0469	3/64	1/8	2	0.141	0.234	142°
NEW	160-0625AG313	●	0.0625	1/16	1/8	2	0.188	0.313	142°
NEW	160-0781AG391	●	0.0781	5/64	1/8	2	0.234	0.391	142°
NEW	160-0938AG469	●	0.0938	3/32	1/8	2	0.281	0.469	142°
NEW	160-1094AG547	●	0.1094	7/64	1/8	2	0.328	0.547	142°
	160-1250AG625	●	0.1250	1/8	3/16	2 1/2	0.375	0.625	142°
	160-1406AG703	●	0.1406	9/64	3/16	2 1/2	0.422	0.703	142°
	160-1563AG781	●	0.1563	5/32	3/16	2 1/2	0.468	0.781	142°
	160-1719AG859	●	0.1719	11/64	3/16	2 1/2	0.515	0.859	142°
	160-1875AG938	●	0.1875	3/16	1/4	2 1/2	0.563	0.938	142°
	160-2031AG1016	●	0.2031	13/64	1/4	2 1/2	0.610	1.016	142°
	160-2188AG1094	●	0.2188	7/32	1/4	2 1/2	0.656	1.094	142°
	160-2344AG1172	●	0.2344	15/64	1/4	2 1/2	0.703	1.172	142°
	160-2500AG1250	●	0.2500	1/4	5/16	3	0.750	1.250	142°
	160-2570AG1285	●	0.2570	F	5/16	3	0.771	1.285	142°
	160-2656AG1328	●	0.2656	17/64	5/16	3	0.797	1.328	142°
	160-2813AG1406	●	0.2813	9/32	5/16	3	0.843	1.406	142°
	160-3125AG1563	●	0.3125	5/16	3/8	4	0.938	1.563	142°
	160-3320AG1660	●	0.3320	Q	3/8	4	0.996	1.660	142°
	160-3438AG1719	●	0.3438	11/32	3/8	4	1.031	1.719	142°
	160-3750AG1875	●	0.3750	3/8	7/16	4 1/2	1.125	1.875	142°
	160-4219AG2109	●	0.4219	27/64	7/16	4 1/2	1.265	2.109	142°
	160-4375AG2188	●	0.4375	7/16	1/2	5	1.313	2.188	142°
	160-4531AG2266	●	0.4531	29/64	1/2	5	1.360	2.266	142°
	160-5000AG2500	●	0.5000	1/2	5/8	5	1.500	2.500	142°

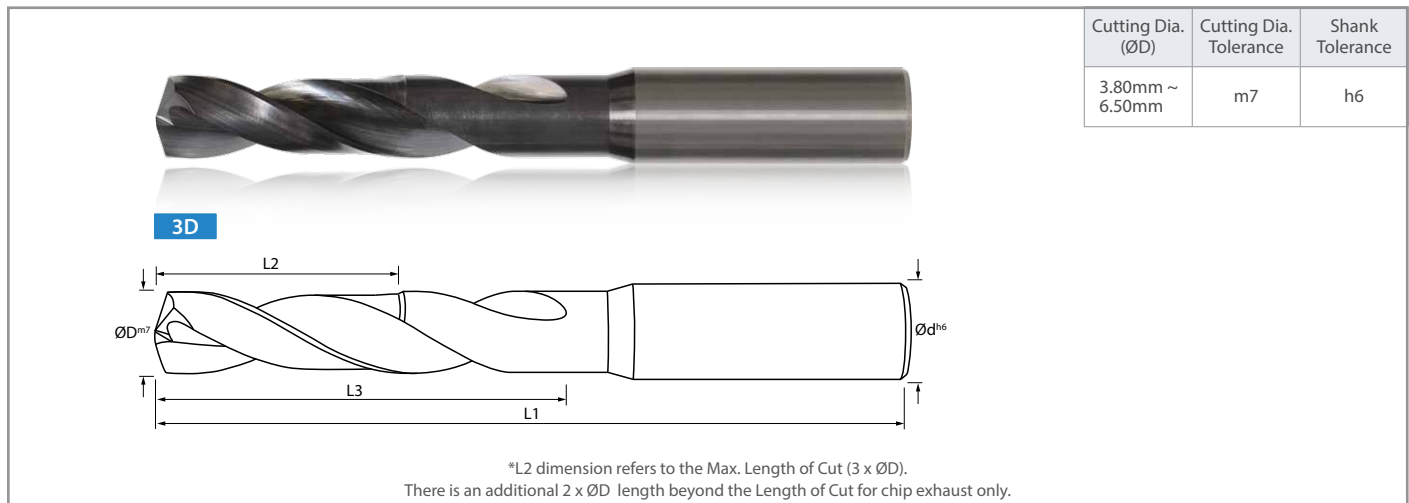
# 3xD ORION Drills - Metric Sizes (Ø1.00mm - Ø3.70mm)



## Metric Drill Dimensions

	Part Number	Stock	Dimensions (mm)				Point Angle	
			ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2		L3
NEW	165-0394AG197	●	1.00	3.00	50.00	3.00	5.00	142°
NEW	165-0433AG217	●	1.10	3.00	50.00	3.30	5.50	142°
NEW	165-0472AG236	●	1.20	3.00	50.00	3.60	6.00	142°
NEW	165-0512AG256	●	1.30	3.00	50.00	3.90	6.50	142°
NEW	165-0551AG276	●	1.40	3.00	50.00	4.20	7.00	142°
NEW	165-0591AG295	●	1.50	3.00	50.00	4.50	7.50	142°
NEW	165-0630AG315	●	1.60	3.00	50.00	4.80	8.00	142°
NEW	165-0669AG335	●	1.70	3.00	50.00	5.10	8.50	142°
NEW	165-0709AG354	●	1.80	3.00	50.00	5.40	9.00	142°
NEW	165-0748AG374	●	1.90	3.00	50.00	5.70	9.50	142°
NEW	165-0787AG394	●	2.00	3.00	50.00	6.00	10.00	142°
	165-0827AG413	●	2.10	3.00	50.00	6.30	10.50	142°
	165-0866AG433	●	2.20	3.00	50.00	6.60	11.00	142°
	165-0906AG453	●	2.30	3.00	50.00	6.90	11.50	142°
	165-0945AG472	●	2.40	3.00	50.00	7.20	12.00	142°
	165-0984AG492	●	2.50	3.00	50.00	7.50	12.50	142°
	165-1024AG512	●	2.60	3.00	50.00	7.80	13.00	142°
	165-1063AG531	●	2.70	3.00	50.00	8.10	13.50	142°
	165-1102AG551	●	2.80	3.00	50.00	8.40	14.00	142°
	165-1142AG571	●	2.90	3.00	50.00	8.70	14.50	142°
	165-1181AG591	●	3.00	4.00	60.00	9.00	15.00	142°
	165-1220AG610	●	3.10	4.00	60.00	9.30	15.50	142°
	165-1260AG630	●	3.20	4.00	60.00	9.60	16.00	142°
	165-1299AG650	●	3.30	4.00	60.00	9.90	16.50	142°
	165-1339AG669	●	3.40	4.00	60.00	10.20	17.00	142°
	165-1378AG689	●	3.50	4.00	60.00	10.50	17.50	142°
	165-1417AG709	●	3.60	4.00	60.00	10.80	18.00	142°
	165-1457AG728	●	3.70	4.00	60.00	11.10	18.50	142°

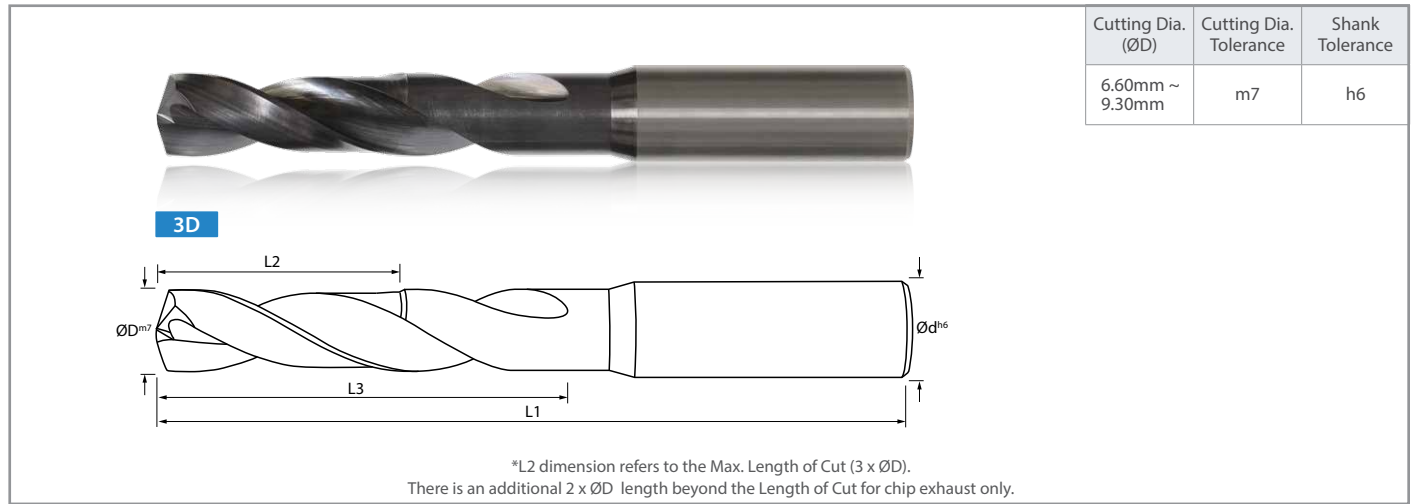
## 3xD ORION Drills - Metric Sizes (Ø3.80mm - Ø6.50mm)



### Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-1496AG748	●	3.80	4.00	60.00	11.40	19.00	142°
165-1535AG768	●	3.90	4.00	60.00	11.70	19.50	142°
165-1575AG787	●	4.00	6.00	70.00	12.00	20.00	142°
165-1614AG807	●	4.10	6.00	70.00	12.30	20.50	142°
165-1654AG827	●	4.20	6.00	70.00	12.60	21.00	142°
165-1693AG846	●	4.30	6.00	70.00	12.90	21.50	142°
165-1732AG866	●	4.40	6.00	70.00	13.20	22.00	142°
165-1772AG886	●	4.50	6.00	70.00	13.50	22.50	142°
165-1811AG906	●	4.60	6.00	70.00	13.80	23.00	142°
165-1850AG925	●	4.70	6.00	70.00	14.10	23.50	142°
165-1890AG945	●	4.80	6.00	70.00	14.40	24.00	142°
165-1929AG965	●	4.90	6.00	70.00	14.70	24.50	142°
165-1969AG984	●	5.00	6.00	70.00	15.00	25.00	142°
165-2008AG1004	●	5.10	6.00	70.00	15.30	25.50	142°
165-2047AG1024	●	5.20	6.00	70.00	15.60	26.00	142°
165-2087AG1043	●	5.30	6.00	70.00	15.90	26.50	142°
165-2126AG1063	●	5.40	6.00	70.00	16.20	27.00	142°
165-2165AG1083	●	5.50	6.00	70.00	16.50	27.50	142°
165-2205AG1102	●	5.60	6.00	70.00	16.80	28.00	142°
165-2244AG1122	●	5.70	6.00	70.00	17.10	28.50	142°
165-2283AG1142	●	5.80	6.00	70.00	17.40	29.00	142°
165-2323AG1161	●	5.90	6.00	70.00	17.70	29.50	142°
165-2362AG1181	●	6.00	8.00	80.00	18.00	30.00	142°
165-2402AG1201	●	6.10	8.00	80.00	18.30	30.50	142°
165-2441AG1220	●	6.20	8.00	80.00	18.60	31.00	142°
165-2480AG1240	●	6.30	8.00	80.00	18.90	31.50	142°
165-2520AG1260	●	6.40	8.00	80.00	19.20	32.00	142°
165-2559AG1280	●	6.50	8.00	80.00	19.50	32.50	142°

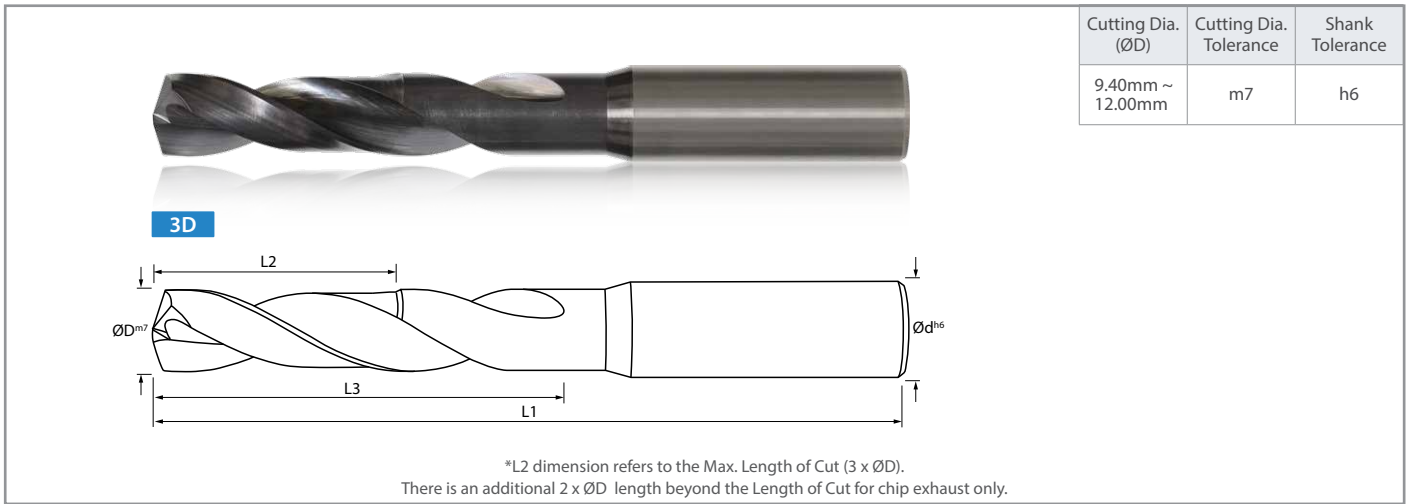
# 3xD ORION Drills - Metric Sizes (Ø6.60mm - Ø9.30mm)



## Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-2598AG1299	●	6.60	8.00	80.00	19.80	33.00	142°
165-2638AG1319	●	6.70	8.00	80.00	20.10	33.50	142°
165-2677AG1339	●	6.80	8.00	80.00	20.40	34.00	142°
165-2717AG1358	●	6.90	8.00	80.00	20.70	34.50	142°
165-2756AG1378	●	7.00	8.00	80.00	21.00	35.00	142°
165-2795AG1398	●	7.10	8.00	80.00	21.30	35.50	142°
165-2835AG1417	●	7.20	8.00	80.00	21.60	36.00	142°
165-2874AG1437	●	7.30	8.00	80.00	21.90	36.50	142°
165-2913AG1457	●	7.40	8.00	80.00	22.20	37.00	142°
165-2953AG1476	●	7.50	8.00	80.00	22.50	37.50	142°
165-2992AG1496	●	7.60	8.00	80.00	22.80	38.00	142°
165-3031AG1516	●	7.70	8.00	80.00	23.10	38.50	142°
165-3071AG1535	●	7.80	8.00	80.00	23.40	39.00	142°
165-3110AG1555	●	7.90	8.00	80.00	23.70	39.50	142°
165-3150AG1575	●	8.00	10.00	100.00	24.00	40.00	142°
165-3189AG1594	●	8.10	10.00	100.00	24.30	40.50	142°
165-3228AG1614	●	8.20	10.00	100.00	24.60	41.00	142°
165-3268AG1634	●	8.30	10.00	100.00	24.90	41.50	142°
165-3307AG1654	●	8.40	10.00	100.00	25.20	42.00	142°
165-3346AG1673	●	8.50	10.00	100.00	25.50	42.50	142°
165-3386AG1693	●	8.60	10.00	100.00	25.80	43.00	142°
165-3425AG1713	●	8.70	10.00	100.00	26.10	43.50	142°
165-3465AG1732	●	8.80	10.00	100.00	26.40	44.00	142°
165-3504AG1752	●	8.90	10.00	100.00	26.70	44.50	142°
165-3543AG1772	●	9.00	10.00	100.00	27.00	45.00	142°
165-3583AG1791	●	9.10	10.00	100.00	27.30	45.50	142°
165-3622AG1811	●	9.20	10.00	100.00	27.60	46.00	142°
165-3661AG1831	●	9.30	10.00	100.00	27.90	46.50	142°

## 3xD ORION Drills - Metric Sizes (Ø9.40mm - Ø12.00mm)



### Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-3701AG1850	●	9.40	10.00	100.00	28.20	47.00	142°
165-3740AG1870	●	9.50	10.00	100.00	28.50	47.50	142°
165-3780AG1890	●	9.60	10.00	100.00	28.80	48.00	142°
165-3819AG1909	●	9.70	10.00	100.00	29.10	48.50	142°
165-3858AG1929	●	9.80	10.00	100.00	29.40	49.00	142°
165-3898AG1949	●	9.90	10.00	100.00	29.70	49.50	142°
165-3937AG1969	●	10.00	12.00	110.00	30.00	50.00	142°
165-3976AG1988	●	10.10	12.00	110.00	30.30	50.50	142°
165-4016AG2008	●	10.20	12.00	110.00	30.60	51.00	142°
165-4055AG2028	●	10.30	12.00	110.00	30.90	51.50	142°
165-4094AG2047	●	10.40	12.00	110.00	31.20	52.00	142°
165-4134AG2067	●	10.50	12.00	110.00	31.50	52.50	142°
165-4173AG2087	●	10.60	12.00	110.00	31.80	53.00	142°
165-4213AG2106	●	10.70	12.00	110.00	32.10	53.50	142°
165-4252AG2126	●	10.80	12.00	110.00	32.40	54.00	142°
165-4291AG2146	●	10.90	12.00	110.00	32.70	54.50	142°
165-4331AG2165	●	11.00	12.00	110.00	33.00	55.00	142°
165-4370AG2185	●	11.10	12.00	110.00	33.30	55.50	142°
165-4409AG2205	●	11.20	12.00	110.00	33.60	56.00	142°
165-4449AG2224	●	11.30	12.00	110.00	33.90	56.50	142°
165-4488AG2244	●	11.40	12.00	110.00	34.20	57.00	142°
165-4528AG2264	●	11.50	12.00	110.00	34.50	57.50	142°
165-4567AG2283	●	11.60	12.00	110.00	34.80	58.00	142°
165-4606AG2303	●	11.70	12.00	110.00	35.10	58.50	142°
165-4646AG2323	●	11.80	12.00	110.00	35.40	59.00	142°
165-4685AG2343	●	11.90	12.00	110.00	35.70	59.50	142°
165-4724AG2362	●	12.00	14.00	110.00	36.00	60.00	142°



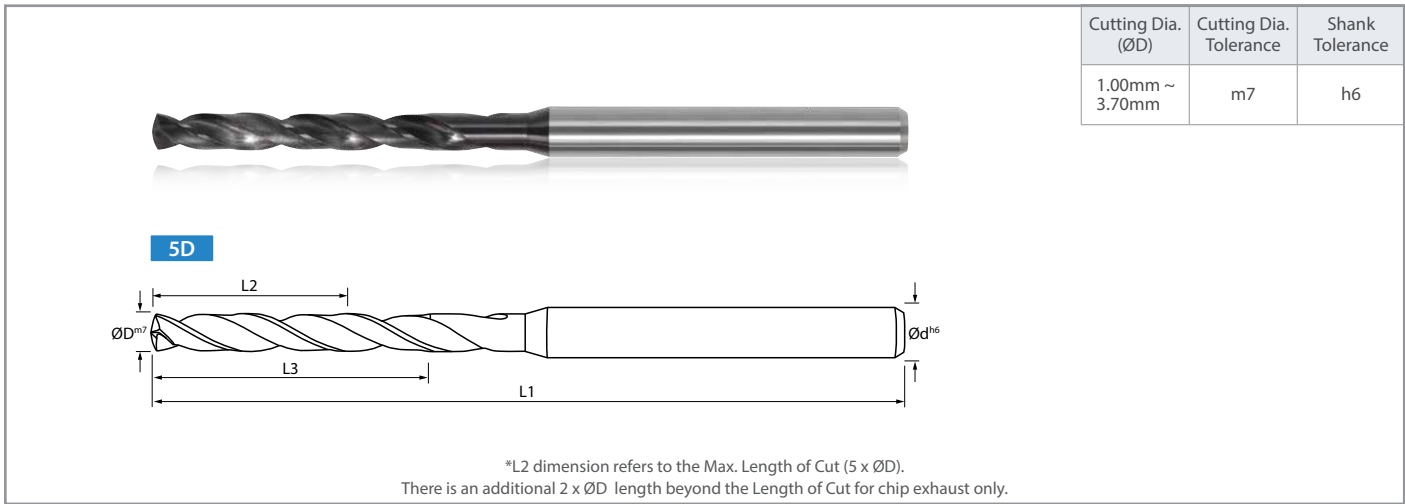


Cutting Dia. (ØD)	Cutting Dia. Tolerance	Shank Tolerance
0.0469" ~ 0.2344"	+0.00016" +0.00063"	+0.00000" -0.00032"
0.2500" ~ 0.3750"	+0.00024" +0.00083"	+0.00000" -0.00035"
0.4219" ~ 0.5000"	+0.00028" +0.00098"	+0.00000" -0.00043"

\*L2 dimension refers to the Max. Length of Cut (5 x ØD).  
There is an additional 2 x ØD length beyond the Length of Cut for chip exhaust only.

Inch Drill Dimensions

Part Number	Stock	Dimensions (in)						Point Angle
		ØD		Ød	L1	*L2	L3	
160-0469AG328	●	0.0469	3/64	1/8	2 1/2	0.235	0.328	142°
160-0625AG438	●	0.0625	1/16	1/8	2 1/2	0.313	0.438	142°
160-0781AG547	●	0.0781	5/64	1/8	2 1/2	0.391	0.547	142°
160-0938AG656	●	0.0938	3/32	1/8	2 1/2	0.469	0.656	142°
160-1094AG766	●	0.1094	7/64	1/8	2 1/2	0.547	0.766	142°
160-1250AG875	●	0.1250	1/8	3/16	3	0.625	0.875	142°
160-1406AG984	●	0.1406	9/64	3/16	3	0.703	0.984	142°
160-1563AG1094	●	0.1563	5/32	3/16	3	0.781	1.094	142°
160-1719AG1203	●	0.1719	11/64	3/16	3	0.859	1.203	142°
160-1875AG1313	●	0.1875	3/16	1/4	3 1/2	0.938	1.313	142°
160-2031AG1422	●	0.2031	13/64	1/4	3 1/2	1.016	1.422	142°
160-2188AG1531	●	0.2188	7/32	1/4	3 1/2	1.094	1.531	142°
160-2344AG1641	●	0.2344	15/64	1/4	3 1/2	1.172	1.641	142°
160-2500AG1750	●	0.2500	1/4	5/16	4	1.250	1.750	142°
160-2570AG1799	●	0.2570	F	5/16	4	1.285	1.799	142°
160-2656AG1859	●	0.2656	17/64	5/16	4	1.328	1.859	142°
160-2813AG1969	●	0.2813	9/32	5/16	4	1.406	1.969	142°
160-3125AG2188	●	0.3125	5/16	3/8	4 1/2	1.563	2.188	142°
160-3320AG2324	●	0.3320	Q	3/8	4 1/2	1.660	2.324	142°
160-3438AG2406	●	0.3438	11/32	3/8	4 1/2	1.719	2.406	142°
160-3750AG2625	●	0.3750	3/8	7/16	5	1.875	2.625	142°
160-4219AG2953	●	0.4219	27/64	7/16	5	2.109	2.953	142°
160-4375AG3063	●	0.4375	7/16	1/2	6	2.188	3.063	142°
160-4531AG3172	●	0.4531	29/64	1/2	6	2.266	3.172	142°
160-5000AG3500	●	0.5000	1/2	5/8	6	2.500	3.500	142°



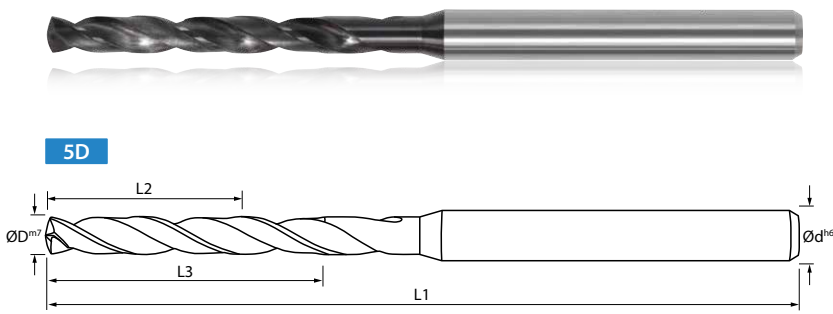
Cutting Dia. (ØD)	Cutting Dia. Tolerance	Shank Tolerance
1.00mm ~ 3.70mm	m7	h6

Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-0394AG276	●	1.00	3.00	60.00	5.00	0.276	142°
165-0433AG303	●	1.10	3.00	60.00	5.50	0.303	142°
165-0472AG331	●	1.20	3.00	60.00	6.00	0.331	142°
165-0512AG358	●	1.30	3.00	60.00	6.50	0.358	142°
165-0551AG386	●	1.40	3.00	60.00	7.00	0.386	142°
165-0591AG413	●	1.50	3.00	60.00	7.50	10.50	142°
165-0630AG441	●	1.60	3.00	60.00	8.00	11.20	142°
165-0669AG469	●	1.70	3.00	60.00	8.50	11.90	142°
165-0709AG496	●	1.80	3.00	60.00	9.00	12.60	142°
165-0748AG524	●	1.90	3.00	60.00	9.50	13.30	142°
165-0787AG551	●	2.00	3.00	60.00	10.00	14.00	142°
165-0827AG579	●	2.10	3.00	60.00	10.50	14.70	142°
165-0866AG606	●	2.20	3.00	60.00	11.00	15.40	142°
165-0906AG634	●	2.30	3.00	60.00	11.50	16.10	142°
165-0945AG661	●	2.40	3.00	60.00	12.00	16.80	142°
165-0984AG689	●	2.50	3.00	60.00	12.50	17.50	142°
165-1024AG717	●	2.60	3.00	60.00	13.00	18.20	142°
165-1063AG744	●	2.70	3.00	60.00	13.50	18.90	142°
165-1102AG772	●	2.80	3.00	60.00	14.00	19.60	142°
165-1142AG799	●	2.90	3.00	60.00	14.50	20.30	142°
165-1181AG827	●	3.00	4.00	70.00	15.00	21.00	142°
165-1220AG854	●	3.10	4.00	70.00	15.50	21.70	142°
165-1260AG882	●	3.20	4.00	70.00	16.00	22.40	142°
165-1299AG909	●	3.30	4.00	70.00	16.50	23.10	142°
165-1339AG937	●	3.40	4.00	70.00	17.00	23.80	142°
165-1378AG965	●	3.50	4.00	70.00	17.50	24.50	142°
165-1417AG992	●	3.60	4.00	70.00	18.00	25.20	142°
165-1457AG1020	●	3.70	4.00	70.00	18.50	25.90	142°



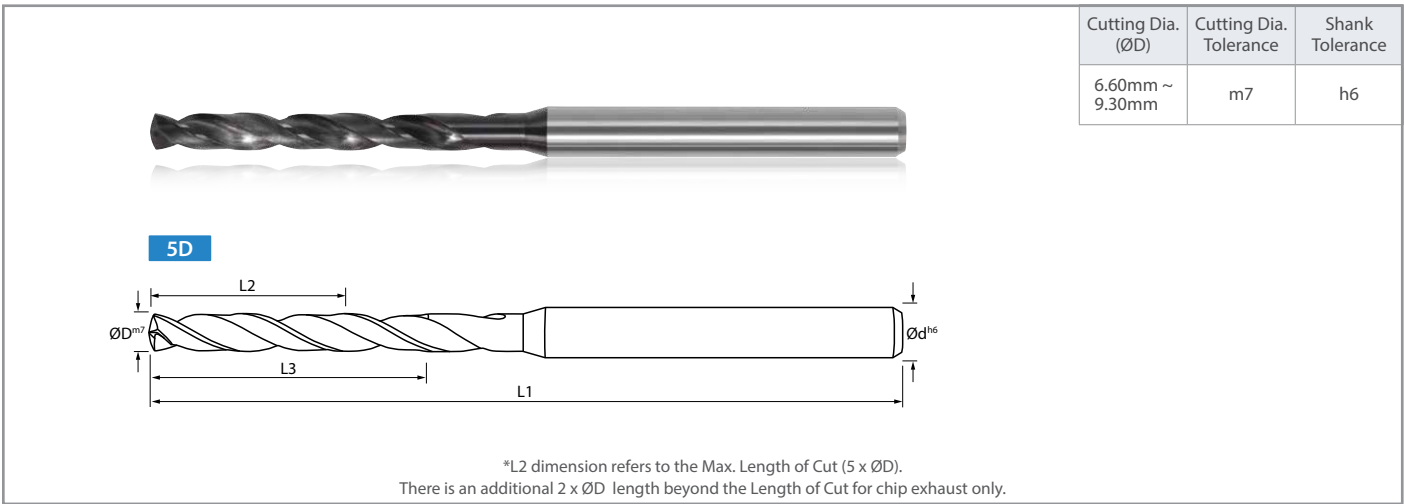
Cutting Dia. (ØD)	Cutting Dia. Tolerance	Shank Tolerance
3.80mm ~ 6.50mm	m7	h6



\*L2 dimension refers to the Max. Length of Cut (5 x ØD).  
There is an additional 2 x ØD length beyond the Length of Cut for chip exhaust only.

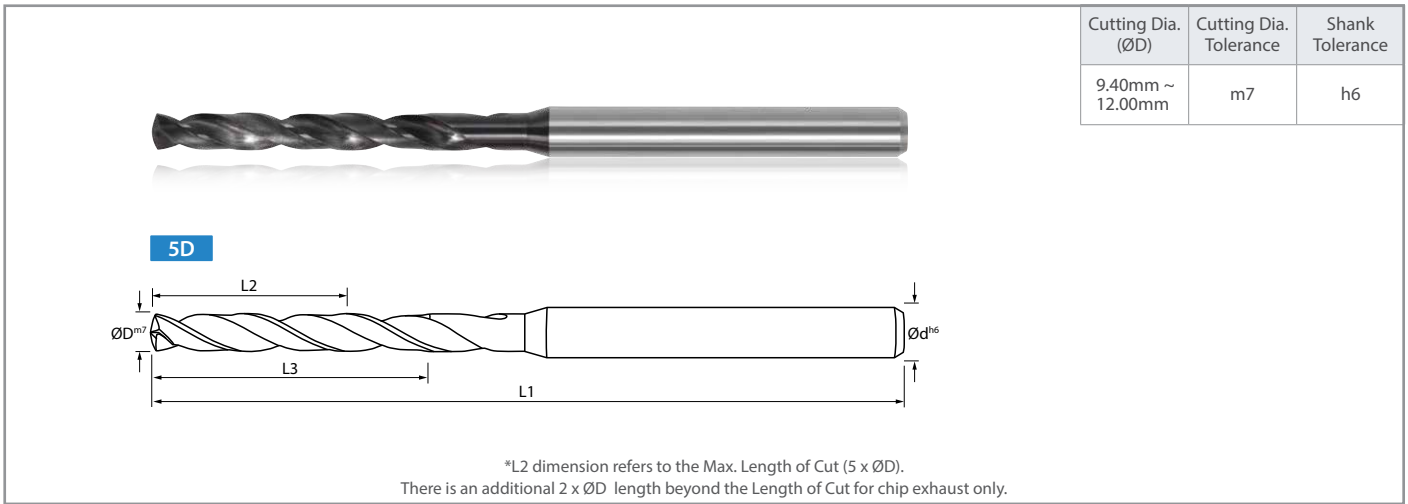
Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-1496AG1047	●	3.80	4.00	70.00	19.00	26.60	142°
165-1535AG1075	●	3.90	4.00	70.00	19.50	27.30	142°
165-1575AG1102	●	4.00	6.00	90.00	20.00	28.00	142°
165-1614AG1130	●	4.10	6.00	90.00	20.50	28.70	142°
165-1654AG1157	●	4.20	6.00	90.00	21.00	29.40	142°
165-1693AG1185	●	4.30	6.00	90.00	21.50	30.10	142°
165-1732AG1213	●	4.40	6.00	90.00	22.00	30.80	142°
165-1772AG1240	●	4.50	6.00	90.00	22.50	31.50	142°
165-1811AG1268	●	4.60	6.00	90.00	23.00	32.20	142°
165-1850AG1295	●	4.70	6.00	90.00	23.50	32.90	142°
165-1890AG1323	●	4.80	6.00	90.00	24.00	33.60	142°
165-1929AG1350	●	4.90	6.00	90.00	24.50	34.30	142°
165-1969AG1378	●	5.00	6.00	90.00	25.00	35.00	142°
165-2008AG1406	●	5.10	6.00	90.00	25.50	35.70	142°
165-2047AG1433	●	5.20	6.00	90.00	26.00	36.40	142°
165-2087AG1461	●	5.30	6.00	90.00	26.50	37.10	142°
165-2126AG1488	●	5.40	6.00	90.00	27.00	37.80	142°
165-2165AG1516	●	5.50	6.00	90.00	27.50	38.50	142°
165-2205AG1543	●	5.60	6.00	90.00	28.00	39.20	142°
165-2244AG1571	●	5.70	6.00	90.00	28.50	39.90	142°
165-2283AG1598	●	5.80	6.00	90.00	29.00	40.60	142°
165-2323AG1626	●	5.90	6.00	90.00	29.50	41.30	142°
165-2362AG1654	●	6.00	8.00	100.00	30.00	42.00	142°
165-2402AG1681	●	6.10	8.00	100.00	30.50	42.70	142°
165-2441AG1709	●	6.20	8.00	100.00	31.00	43.40	142°
165-2480AG1736	●	6.30	8.00	100.00	31.50	44.10	142°
165-2520AG1764	●	6.40	8.00	100.00	32.00	44.80	142°
165-2559AG1791	●	6.50	8.00	100.00	32.50	45.50	142°



Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-2598AG1819	●	6.60	8.00	100.00	33.00	46.20	142°
165-2638AG1846	●	6.70	8.00	100.00	33.50	46.90	142°
165-2677AG1874	●	6.80	8.00	100.00	34.00	47.60	142°
165-2717AG1902	●	6.90	8.00	100.00	34.50	48.30	142°
165-2756AG1929	●	7.00	8.00	100.00	35.00	49.00	142°
165-2795AG1957	●	7.10	8.00	100.00	35.50	49.70	142°
165-2835AG1984	●	7.20	8.00	100.00	36.00	50.40	142°
165-2874AG2012	●	7.30	8.00	100.00	36.50	51.10	142°
165-2913AG2039	●	7.40	8.00	100.00	37.00	51.80	142°
165-2953AG2067	●	7.50	8.00	100.00	37.50	52.50	142°
165-2992AG2094	●	7.60	8.00	100.00	38.00	53.20	142°
165-3031AG2122	●	7.70	8.00	100.00	38.50	53.90	142°
165-3071AG2150	●	7.80	8.00	100.00	39.00	54.60	142°
165-3110AG2177	●	7.90	8.00	100.00	39.50	55.30	142°
165-3150AG2205	●	8.00	10.00	120.00	40.00	56.00	142°
165-3189AG2232	●	8.10	10.00	120.00	40.50	56.70	142°
165-3228AG2260	●	8.20	10.00	120.00	41.00	57.40	142°
165-3268AG2287	●	8.30	10.00	120.00	41.50	58.10	142°
165-3307AG2315	●	8.40	10.00	120.00	42.00	58.80	142°
165-3346AG2343	●	8.50	10.00	120.00	42.50	59.50	142°
165-3386AG2370	●	8.60	10.00	120.00	43.00	60.20	142°
165-3425AG2398	●	8.70	10.00	120.00	43.50	60.90	142°
165-3465AG2425	●	8.80	10.00	120.00	44.00	61.60	142°
165-3504AG2453	●	8.90	10.00	120.00	44.50	62.30	142°
165-3543AG2480	●	9.00	10.00	120.00	45.00	63.00	142°
165-3583AG2508	●	9.10	10.00	120.00	45.50	63.70	142°
165-3622AG2535	●	9.20	10.00	120.00	46.00	64.40	142°
165-3661AG2563	●	9.30	10.00	120.00	46.50	65.10	142°



Metric Drill Dimensions

Part Number	Stock	Dimensions (mm)					Point Angle
		ØD <sup>m7</sup>	Ød <sup>h6</sup>	L1	*L2	L3	
165-3701AG2591	●	9.40	10.00	120.00	47.00	65.80	142°
165-3740AG2618	●	9.50	10.00	120.00	47.50	66.50	142°
165-3780AG2646	●	9.60	10.00	120.00	48.00	67.20	142°
165-3819AG2673	●	9.70	10.00	120.00	48.50	67.90	142°
165-3858AG2701	●	9.80	10.00	120.00	49.00	68.60	142°
165-3898AG2728	●	9.90	10.00	120.00	49.50	69.30	142°
165-3937AG2756	●	10.00	12.00	140.00	50.00	70.00	142°
165-3976AG2783	●	10.10	12.00	140.00	50.50	70.70	142°
165-4016AG2811	●	10.20	12.00	140.00	51.00	71.40	142°
165-4055AG2839	●	10.30	12.00	140.00	51.50	72.10	142°
165-4094AG2866	●	10.40	12.00	140.00	52.00	72.80	142°
165-4134AG2894	●	10.50	12.00	140.00	52.50	73.50	142°
165-4173AG2921	●	10.60	12.00	140.00	53.00	74.20	142°
165-4213AG2949	●	10.70	12.00	140.00	53.50	74.90	142°
165-4252AG2976	●	10.80	12.00	140.00	54.00	75.60	142°
165-4291AG3004	●	10.90	12.00	140.00	54.50	76.30	142°
165-4331AG3031	●	11.00	12.00	140.00	55.00	77.00	142°
165-4370AG3059	●	11.10	12.00	140.00	55.50	77.70	142°
165-4409AG3087	●	11.20	12.00	140.00	56.00	78.40	142°
165-4449AG3114	●	11.30	12.00	140.00	56.50	79.10	142°
165-4488AG3142	●	11.40	12.00	140.00	57.00	79.80	142°
165-4528AG3169	●	11.50	12.00	140.00	57.50	80.50	142°
165-4567AG3197	●	11.60	12.00	140.00	58.00	81.20	142°
165-4606AG3224	●	11.70	12.00	140.00	58.50	81.90	142°
165-4646AG3252	●	11.80	12.00	140.00	59.00	82.60	142°
165-4685AG3280	●	11.90	12.00	140.00	59.50	83.30	142°
165-4724AG3307	●	12.00	14.00	140.00	60.00	84.00	142°

# Recommended Cutting Conditions

Workpiece Material	Material Hardness/Types	Recommended Cutting Speed (sfm)	Cutting Dia. ØD (in)	Cutting Dia. ØD (mm)	Drill Length (Cutting Depth)
					Feed Rate (lpr) 3xD & 5xD
Low Carbon Steel	12L14 A36	270 - <b>300</b> -330	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0015 - 0.0030
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0030 - 0.0060
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0060 - 0.0090
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0090 - 0.0120
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0120 - 0.0150
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0120 - 0.0150
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0120 - 0.0150
Mild Carbon Steel	1018 1028 1050	250 - <b>275</b> - 300	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0015 - 0.0030
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0030 - 0.0060
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0060 - 0.0090
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0090 - 0.0120
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0120 - 0.0150
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0120 - 0.0150
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0120 - 0.0150
Alloy Steel	4130 4140 4150 8620	225 - <b>250</b> - 275	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0010 - 0.0020
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0020 - 0.0045
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0045 - 0.0070
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0070 - 0.0090
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0090 - 0.0115
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0090 - 0.0115
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0090 - 0.0115
Preharden Tool Steel	4140PH A2 D2 H13 P20	150 - <b>200</b> -250	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0010 - 0.0020
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0020 - 0.0040
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0040 - 0.0060
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0060 - 0.0080
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0060 - 0.0080
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0060 - 0.0080
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0060 - 0.0080
Harden Tool Steel	>48 HRc	75 - <b>100</b> - 125	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0005 - 0.0010
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0010 - 0.0020
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0020 - 0.0030
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0030 - 0.0040
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0040 - 0.0050
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0040 - 0.0050
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0040 - 0.0050
Stainless Steel	303 304 316 321	115 - <b>130</b> - 145	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0010 - 0.0020
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0020 - 0.0045
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0045 - 0.0070
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0070 - 0.0090
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0090 - 0.0115
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0110 - 0.0125
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.00120 - 0.0135
Stainless Steel	15-SPH 17-4PH 13-8 400 Series	90 - <b>100</b> - 110	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0010 - 0.0020
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0020 - 0.0040
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0040 - 0.0060
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0050 - 0.0070
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0060 - 0.0080
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0070 - 0.0090
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0090 - 0.0110
Gray Cast Iron	-	295 - <b>325</b> - 355	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0015 - 0.0030
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0030 - 0.0060
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0060 - 0.0090
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0090 - 0.0120
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0120 - 0.0150
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0150 - 0.0170
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0170 - 0.0190
Nodular Cast Iron	-	235 - <b>260</b> - 285	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0010 - 0.0025
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0025 - 0.0050
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0055 - 0.0080
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0080 - 0.0110
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0110 - 0.0130
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0130 - 0.0150
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0150 - 0.0170

\*\* Above recommendations are suggested starting parameters. Cutting speeds and feeds may vary according to machining application, setup, and tool runout.

\*PECK CYCLE: Depending on material, coolant pressure/ location, and depth of hole pecking may be needed. If needed the recommended peck depth is 1.0xDia to 3.0xDia per peck.\*

# Recommended Cutting Conditions

Workpiece Material	Material Hardness/Types	Recommended Cutting Speed (sfm)	Cutting Dia. ØD (in)	Cutting Dia. ØD (mm)	Drill Length (Cutting Depth) Feed Rate (lpr)
					3xD & 5xD
Aluminum	-	ALLOY 320 - <b>350</b> - 380	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0015 - 0.0030
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0030 - 0.0070
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0070 - 0.0095
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0095 - 0.0125
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0125 - 0.0140
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0140 - 0.0155
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0155 - 0.0170
Copper Alloys	-	280 - <b>325</b> - 360	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0015 - 0.0030
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0030 - 0.0070
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0070 - 0.0095
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0095 - 0.0125
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0125 - 0.0140
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0140 - 0.0155
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0155 - 0.0170
Heat Resistant Alloy	Hastelloy Inconel Monel Waspaloy Promet	60 - <b>75</b> - 85	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0005 - 0.0010
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0010 - 0.0020
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0020 - 0.0030
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0030 - 0.0040
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0040 - 0.0050
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0050 - 0.0060
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0060 - 0.0070
Titanium Alloy	-	90 - <b>100</b> - 110	Ø0.0394 - Ø0.0787	Ø1.00 - Ø2.00	0.0005 - 0.0010
			Ø0.0787 - Ø0.1535	Ø2.00 - Ø3.90	0.0010 - 0.0020
			Ø0.1575 - Ø0.2320	Ø4.00 - Ø5.90	0.0020 - 0.0030
			Ø0.2360 - Ø0.3110	Ø6.00 - Ø7.90	0.0030 - 0.0040
			Ø0.3150 - Ø0.3898	Ø8.00 - Ø9.90	0.0040 - 0.0050
			Ø0.3937 - Ø0.4685	Ø10.00 - Ø11.90	0.0040 - 0.0050
			Ø0.4685 - Ø0.5000	Ø11.90 - Ø12.70	0.0040 - 0.0050

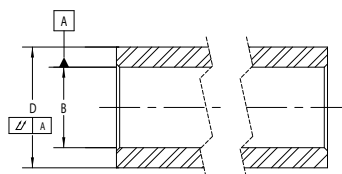
\*\* Above recommendations are suggested starting parameters. Cutting speeds and feeds may vary according to machining application, setup, and tool runout.

\*PECK CYCLE: Depending on material, coolant pressure/ location, and depth of hole pecking may be needed. If needed the recommended peck depth is 1.0xDia to 3.0xDia per peck.\*

## Case Studies

### Bushing 17-4PH Stainless Steel

Vc = 147.3 sfm (n = 1,800 rpm)  
Vf = 4.32 ipm  
D.O.C. = 0.500"  
Ø0.3125"  
160-3125AG1563



Tool Life

ORION Ø0.3125"

**659** pcs / tool

Tool Life  
**3.3x**

Competitor A  
Ø0.3125"

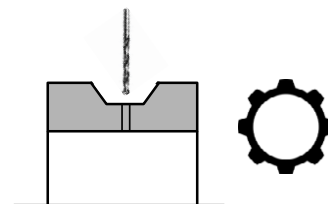
**200** pcs / tool

The ORION drill showed 3.3 times the tool life of Competitor A.

(User Evaluation)

### Gear 1045 Steel

Vc = 165 sfm (n = 7,583 rpm)  
Vf = 0.005 ipt  
D.O.C. = 0.276"  
Ø2.1mm  
165-0827AG413 (Special)  
Number of Holes: 4



Tool Life

ORION Ø2.1mm

**1,000** Parts (4,000 Holes)

Tool Life  
**1.7x**

Competitor B  
Ø2.1mm

**600** Parts (2,400 Holes)

The ORION drill showed 1.7 times the tool life of Competitor B.  
There is also a 10% better cost performance.

(User Evaluation)

# Explore Kyocera's Broad Range of Drilling Solutions



**ORION**

High Performance Drills



**HYDROS**

Coolant Through Deep Drills



**2ZDK**

Flat Bottom Drills



**HP131N**

Drills for Non-Ferrous & Aluminum



**DRA**

Replaceable Insert Tip Magic Drills



**DRV**

High Efficiency Indexable Magic Drills



**HOLESHOT™**

DR Indexable Drills

Drill Diameter Range		Drill Diameter Range										
		Solid Drills					Indexable Drills					
		1.5D	2D	3D	4D	5D	6D	7D	8D	10D	15D	
<b>ORION</b> (Inch)	0.047"~0.500"											
<b>ORION</b> (Metric)	1.00mm~12.00mm			•		•						
<b>HYDROS</b> (Inch)	0.125"~0.500"											
<b>HYDROS</b> (Metric)	1.00mm~12.00mm							•	•	•	•	
<b>2ZDK</b> (Metric)	1.00mm~20.00mm											
<b>HP131N</b> (Metric)	3.00mm~12.00mm					•						
<b>DRA</b> (Inch)	0.313"~1.004"											
<b>DRA</b> (Metric)	7.94mm~25.50mm	•		•		•				•		
<b>DRV</b> (Inch)	0.625"~1.000" <i>FUTURE EXPANSION</i>											
<b>DRV</b> (Metric)	14.00mm~32.00mm			•	•	•	•	•				
<b>HOLESHOT</b> (Inch)	0.515"~4.000"											
<b>HOLESHOT</b> (Metric)	14.00mm~63.00mm											



## Bring Back Performance

Save More with Solid Tool Reconditioning

Kyocera Precision Tools reconditioning program returns your solid carbide drills and end mills to their original off-the-shelf performance at a fraction of the cost of buying new.

**Order Form** | [www.kyoceraprecisiontools.com/micro/reconditioning](http://www.kyoceraprecisiontools.com/micro/reconditioning)

Call Now  
for More Info

**888-848-8449**



**KYOCERA Precision Tools, Inc.**

3565 Cadillac Ave.  
Costa Mesa, CA 92626  
Customer Service | 888.848.8449  
Technical Support | 800.823.7284



Official Website | [www.kyoceraprecisiontools.com](http://www.kyoceraprecisiontools.com)  
Distributor Website | [mykpti.kyocera.com](http://mykpti.kyocera.com)  
Email | [cuttingtools@kyocera.com](mailto:cuttingtools@kyocera.com)

©KYOCERA Precision Tools, Inc.  
06/18, 1K Printed in U.S.A.