



Vol 2

Industry Solutions for Nickel Alloy Materials & Hardened Steels

# Nickel Alloy Solutions



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## Industry Solutions for Nickel Alloy Materials and Hardened Steel (40-55 HRC)

Nickel-based heat resistant alloys are materials with extremely poor machinability. These alloys are approximately 10 times more difficult to machine than free-cutting steel (AISI B1112). Due to their superior heat resistance, toughness and ductile characteristics, they are commonly used in turbine blades of jet engines and other aircraft related components where a high level of heat resistance is required.

Nickel-based alloy applications have become increasingly widespread. Automotive components and household combustion equipment have begun to incorporate these durable materials. To meet these new industry demands, OSG has developed a comprehensive cutting tool offering for nickel-based heat resistant alloys.

### EXOPRO® WHO-Ni Coolant-Through



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## Features

With more demand to machine nickel-based alloys, OSG has developed the EXOPRO® WHO-Ni 3D & 5D carbide drill series. A total solution for drilling nickel-based heat-resistant alloys.



1

**Sharp Cutting Edge**



The EXOPRO® WHO-Ni 3D & 5D Carbide Drills are engineered with sharper cutting edges for drilling nickel-based alloys. The sharp cutting edges are designed to suppress the generation of heat during machining and promotes the stable creation of cutting chips.

2

**High Rigidity**



A low helix angle has been used for the flutes to attain high tool rigidity and to make the machining of high precision holes possible.

3

**Great Chip Evacuation**

The WHO-Ni 3D & 5D Carbide Drills are able to produce small cutting chips to enable trouble-free chip evacuation and stable drilling.

4

**Excellent Wear Resistance**

The incredible high hardness and heat resistance of OSG's WXS® coating, coupled with internally-fed coolant, ensures long, stable tool life.

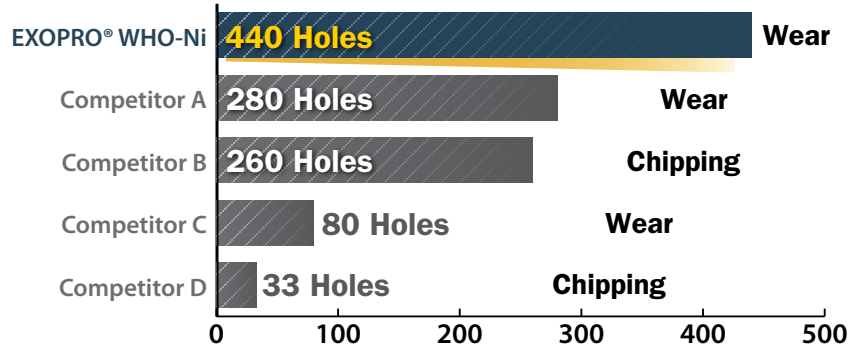


## 1.5 Times Longer Tool Life vs. Competitors

Performance in Inconel 718

The highly rigid body and sharp cutting edge are coated with OSG's WXS® coating and achieve 40% more life versus the closest competitor.

<b>Tool</b>	WHO-Ni 3D $\phi$ 6mm
<b>Work Material</b>	Inconel® 718 (43 HRC)
<b>Drilling Speed</b>	98 SFM (1,592 RPM)
<b>Feed</b>	5.63 IPM (0.0035 in/rev)
<b>Depth of Hole</b>	18mm (Blind) No-Step
<b>Coolant</b>	Water Soluble (Internal)
<b>Machine</b>	Vertical Machining Center



Wear after drilling 440 holes.

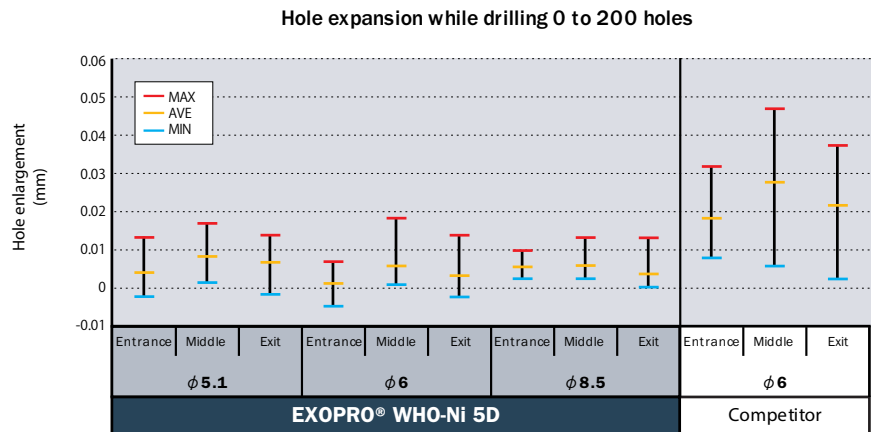


## Suppression of Hole Enlargement

Performance in Inconel 718

With a highly rigid flute form, the WHO-Ni is able to suppress the enlargement of holes of every size in a stable manner. This allows these tools to be used for machining precision holes.

<b>Tool</b>	WHO-Ni 5D (Each Size)
<b>Work Material</b>	Inconel® 718 (43 HRC)
<b>Drilling Speed</b>	98 SFM
<b>Feed</b>	1.5% D = IPR
<b>Depth of Hole</b>	3D (Blind)
<b>Coolant</b>	Water Soluble (Internal)
<b>Machine</b>	Vertical Machining Center



# EXOPRO® WHO-Ni

Drills Designed for Nickel Alloys

## List 5950Ni

3D, Coolant-Through

SPEED  
FEED  
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CARBIDE

WXS®

12-20°

SHRINK  
h6

h8 Tolerance	
3<D≤6	0 -0.018
6<D≤10	0 -0.022
10<D≤18	0 -0.027
18<D≤24	0 -0.033



EDP Number	Size					Flute Length FL	Overall Length L	Shank Diameter d
	Fractional Size	Wire Gage	Letter Size	mm	Inch			
595011311	-	-	-	2.88	0.1134	20	62	6.0
595011811	-	-	-	3.00	0.1181	20	62	6.0
595012511	1/8	-	-	3.18	0.1250	20	62	6.0
595013011	-	-	-	3.30	0.1299	21	62	6.0
595013411	-	-	-	3.40	0.1339	21	62	6.0
595013711	-	-	-	3.49	0.1374	21	62	6.0
595013811	-	-	-	3.50	0.1378	21	62	6.0
595013911	-	-	-	3.51	0.1382	23	62	6.0
595014211	-	-	-	3.60	0.1417	23	62	6.0
595014611	-	-	-	3.70	0.1457	23	62	6.0
595015011	-	25	-	3.80	0.1496	24	62	6.0
595015411	-	-	-	3.90	0.1535	24	62	6.0
595015611	5/32	-	-	3.97	0.1563	24	62	6.0
595015711	-	-	-	4.00	0.1575	24	62	6.0
595016111	-	-	-	4.10	0.1614	26	68	6.0
595016311	-	-	-	4.15	0.1634	26	68	6.0
595016511	-	-	-	4.20	0.1654	26	68	6.0
595016911	-	-	-	4.30	0.1693	27	68	6.0
595017111	11/64	-	-	4.37	0.1719	27	68	6.0
595017311	-	-	-	4.40	0.1732	27	68	6.0
595017711	-	16	-	4.50	0.1772	27	68	6.0
595018111	-	-	-	4.60	0.1811	29	68	6.0
595018511	-	13	-	4.70	0.1850	29	68	6.0
595018711	3/16	-	-	4.76	0.1875	29	68	6.0
595018911	-	12	-	4.80	0.1890	30	68	6.0
595019311	-	-	-	4.90	0.1929	30	68	6.0
595019711	-	-	-	5.00	0.1969	30	68	6.0
595020111	-	-	-	5.10	0.2008	26	74	6.0
595020311	13/64	-	-	5.16	0.2031	26	74	6.0
595020511	-	-	-	5.20	0.2047	26	74	6.0
595020611	-	-	-	5.22	0.2055	28	74	6.0
595020911	-	-	-	5.30	0.2087	28	74	6.0
595021311	-	-	-	5.40	0.2126	28	74	6.0
595021711	-	-	-	5.50	0.2165	28	74	6.0
595021611	-	-	-	5.53	0.2177	29	74	6.0
595021911	-	-	-	5.56	0.2189	29	74	6.0
595021811	7/32	-	-	5.56	0.2188	29	74	6.0
595022011	-	-	-	5.60	0.2205	29	74	6.0
595022411	-	-	-	5.70	0.2244	29	74	6.0
595022811	-	-	-	5.80	0.2283	30	74	6.0
595023211	-	-	-	5.90	0.2323	30	74	6.0
595023411	15/64	-	-	5.95	0.2344	30	74	6.0
595023611	-	-	-	6.00	0.2362	30	74	6.0
595025011	1/4	-	-	6.35	0.2500	33	83	8.0
595025611	-	-	-	6.50	0.2559	33	83	8.0
595026211	-	-	-	6.65	0.2618	34	83	8.0
595026511	17/64	-	-	6.75	0.2656	35	83	8.0
595026811	-	-	-	6.80	0.2677	35	83	8.0
595027411	-	-	-	6.96	0.2740	35	83	8.0
595027611	-	-	-	7.00	0.2756	35	83	8.0
595028111	9/32	-	-	7.15	0.2813	36	94	8.0
595029511	-	-	-	7.50	0.2953	38	94	8.0
595029611	19/64	-	-	7.54	0.2969	39	94	8.0
595030711	-	-	-	7.80	0.3071	40	94	8.0
595031211	5/16	-	-	7.94	0.3125	40	94	8.0
595031511	-	-	-	8.00	0.3150	40	94	8.0
595031711	-	-	-	8.04	0.3165	41	101	10.0
595032811	21/64	-	-	8.33	0.3281	43	101	10.0
595033411	-	-	-	8.50	0.3346	43	101	10.0
595033511	-	-	-	8.52	0.3354	44	101	10.0

Packed: 1 pc. Available WXS® coating only.



# List 5950Ni (continued)

3D, Coolant-Through



EDP Number	Size					Flute Length FL	Overall Length L	Shank Diameter d
	Fractional Size	Wire Gage	Letter Size	mm	Inch			
595033811	-	-	-	8.58	0.3378	44	101	10.0
595034211	-	-	-	8.70	0.3425	44	101	10.0
595034311	11/32	-	-	8.73	0.3438	45	101	10.0
595034611	-	-	-	8.80	0.3465	45	101	10.0
595035411	-	-	-	9.00	0.3543	45	101	10.0
595035911	23/64	-	-	9.13	0.3594	46	106	10.0
595037011	-	-	-	9.39	0.3697	48	106	10.0
595037411	-	-	-	9.50	0.3740	48	106	10.0
595037511	3/8	-	-	9.53	0.3750	49	106	10.0
595038611	-	-	W	9.80	0.3858	50	106	10.0
595038911	-	-	-	9.90	0.3898	50	106	10.0
595039011	25/64	-	-	9.92	0.3906	50	106	10.0
595039311	-	-	-	9.97	0.3925	50	106	10.0
595039411	-	-	-	10.00	0.3937	50	106	10.0
595040511	-	-	-	10.30	0.4055	53	113	12.0
595040611	13/32	-	-	10.32	0.4063	53	113	12.0
595041311	-	-	-	10.50	0.4134	53	113	12.0
595042211	27/64	-	-	10.72	0.4219	55	113	12.0
595042511	-	-	-	10.80	0.4252	55	113	12.0
595042611	-	-	-	10.83	0.4264	55	113	12.0
595043311	-	-	-	11.00	0.4331	55	113	12.0
595043711	7/16	-	-	11.11	0.4375	56	120	12.0
595045211	-	-	-	11.47	0.4516	58	120	12.0
595045411	-	-	-	11.50	0.4528	58	120	12.0
595045311	29/64	-	-	11.51	0.4531	59	120	12.0
595045511	-	-	-	11.56	0.4551	59	120	12.0
595046511	-	-	-	11.80	0.4646	60	120	12.0
595046811	15/32	-	-	11.91	0.4688	60	120	12.0
595047211	-	-	-	12.00	0.4724	60	120	12.0
595048411	31/64	-	-	12.30	0.4844	63	128	14.0
595050011	1/2	-	-	12.70	0.5000	65	128	14.0

Packed: 1 pc. Available WXS<sup>®</sup> coating only.



Work Material															
List No.	Aluminum		Cast Iron	Carbon Steel	Alloy/Die Steel	Stainless Steels			Hardened Steels			High Heat Material		MMC	Copper Alloy
	6061 7075	Casting				300	400	17-4PH	~45 HRC	45-50 HRC	50-70 HRC	Ti-Alloy	Inconel & Waspaloy		
<b>5950Ni</b>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>		

good  best

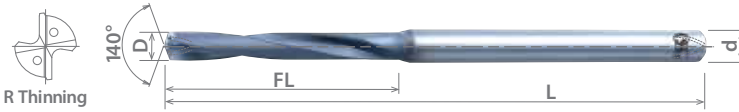


## List 5955Ni

5D, Coolant-Through



h8 Tolerance	
3<D≤6	0 -0.018
6<D≤10	0 -0.022
10<D≤18	0 -0.027
18<D≤24	0 -0.033



EDP Number	Size					Flute Length FL	Overall Length L	Shank Diameter d
	Fractional Size	Wire Gage	Letter Size	mm	Inch			
3316288	-	-	-	2.88	0.1134	29	78	6.0
3316300	-	-	-	3.00	0.1181	29	78	6.0
595512511	1/8	-	-	3.18	0.1250	29	78	6.0
3316330	-	-	-	3.30	0.1299	32	78	6.0
3316340	-	-	-	3.40	0.1339	32	78	6.0
3316349	-	-	-	3.49	0.1374	32	78	6.0
3316350	-	-	-	3.50	0.1378	32	78	6.0
595513911	-	-	-	3.51	0.1382	34	78	6.0
3316360	-	-	-	3.60	0.1417	34	78	6.0
3316370	-	-	-	3.70	0.1457	34	78	6.0
3316380	-	25	-	3.80	0.1496	36	78	6.0
3316390	-	-	-	3.90	0.1535	36	78	6.0
595515611	5/32	-	-	3.97	0.1563	36	78	6.0
3316400	-	-	-	4.00	0.1575	36	78	6.0
3316410	-	-	-	4.10	0.1614	38	88	6.0
3316415	-	-	-	4.15	0.1634	38	88	6.0
3316420	-	-	-	4.20	0.1654	38	88	6.0
3316430	-	-	-	4.30	0.1693	41	88	6.0
595517111	11/64	-	-	4.37	0.1719	41	88	6.0
3316440	-	-	-	4.40	0.1732	41	88	6.0
3316450	-	16	-	4.50	0.1772	41	88	6.0
3316460	-	-	-	4.60	0.1811	43	88	6.0
3316470	-	13	-	4.70	0.1850	43	88	6.0
595518711	3/16	-	-	4.76	0.1875	45	88	6.0
3316480	-	12	-	4.80	0.1890	45	88	6.0
3316490	-	-	-	4.90	0.1929	45	88	6.0
3316500	-	-	-	5.00	0.1969	45	88	6.0
3316510	-	-	-	5.10	0.2008	42	92	6.0
595520311	13/64	-	-	5.16	0.2031	42	92	6.0
3316520	-	-	-	5.20	0.2047	42	92	6.0
595520611	-	-	-	5.22	0.2055	44	92	6.0
3316530	-	-	-	5.30	0.2087	44	92	6.0
3316540	-	-	-	5.40	0.2126	44	92	6.0
3316550	-	-	-	5.50	0.2165	44	92	6.0
595521611	-	-	-	5.53	0.2177	46	92	6.0
3316556	-	-	-	5.56	0.2189	46	92	6.0
595521811	7/32	-	-	5.56	0.2188	46	92	6.0
3316560	-	-	-	5.60	0.2205	46	92	6.0
3316570	-	-	-	5.70	0.2244	46	92	6.0
3316580	-	-	-	5.80	0.2283	48	92	6.0
3316590	-	-	-	5.90	0.2323	48	92	6.0
595523411	15/64	-	-	5.95	0.2344	48	92	6.0
3316600	-	-	-	6.00	0.2362	48	92	6.0
595525011	1/4	-	-	6.35	0.2500	52	102	8.0
3316650	-	-	-	6.50	0.2559	52	102	8.0
595526211	-	-	-	6.65	0.2618	54	102	8.0
595526511	17/64	-	-	6.75	0.2656	55	102	8.0
3316680	-	-	-	6.80	0.2677	56	102	8.0
595527411	-	-	-	6.96	0.2740	56	102	8.0
3316700	-	-	-	7.00	0.2756	56	102	8.0
595528111	9/32	-	-	7.14	0.2813	58	118	8.0
3316750	-	-	-	7.50	0.2953	60	118	8.0
595529611	19/64	-	-	7.54	0.2969	62	118	8.0
3316780	-	-	-	7.80	0.3071	64	118	8.0
595531211	5/16	-	-	7.94	0.3125	64	118	8.0
3316800	-	-	-	8.00	0.3150	64	118	8.0
595531711	-	-	-	8.04	0.3165	66	128	10.0
595532811	21/64	-	-	8.33	0.3281	68	128	10.0
3316850	-	-	-	8.50	0.3346	68	128	10.0
595533511	-	-	-	8.52	0.3354	70	128	10.0

Packed: 1 pc. Available WXS<sup>®</sup> coating only.





# List 5955Ni

5D, Coolant-Through



EDP Number	Size					Flute Length FL	Overall Length L	Shank Diameter d
	Fractional Size	Wire Gage	Letter Size	mm	Inch			
3316858	-	-	-	8.58	0.3378	70	128	10.0
3316870	-	-	-	8.70	0.3425	70	128	10.0
595534311	11/32	-	-	8.73	0.3438	70	128	10.0
3316880	-	-	-	8.80	0.3465	72	128	10.0
3316900	-	-	-	9.00	0.3543	72	128	10.0
595535911	23/64	-	-	9.13	0.3594	74	136	10.0
595537011	-	-	-	9.39	0.3697	76	136	10.0
3316950	-	-	-	9.50	0.3740	76	136	10.0
595537511	3/8	-	-	9.53	0.3750	78	136	10.0
3316980	-	-	W	9.80	0.3858	80	136	10.0
595538911	-	-	-	9.90	0.3898	80	136	10.0
595539011	25/64	-	-	9.92	0.3906	80	136	10.0
3316997	-	-	-	9.97	0.3925	80	136	10.0
3317000	-	-	-	10.00	0.3937	80	136	10.0
3317030	-	-	-	10.30	0.4055	84	146	12.0
595540611	13/32	-	-	10.32	0.4063	84	146	12.0
3317050	-	-	-	10.50	0.4134	84	146	12.0
595542211	27/64	-	-	10.72	0.4219	88	146	12.0
3317080	-	-	-	10.80	0.4252	88	146	12.0
595542611	-	-	-	10.83	0.4264	88	146	12.0
3317100	-	-	-	11.00	0.4331	88	146	12.0
595543711	7/16	-	-	11.11	0.4375	90	156	12.0
595545211	-	-	-	11.47	0.4516	92	156	12.0
3317150	-	-	-	11.50	0.4528	92	156	12.0
595545311	29/64	-	-	11.51	0.4531	94	156	12.0
3317156	-	-	-	11.56	0.4551	94	156	12.0
3317180	-	-	-	11.80	0.4646	96	156	12.0
595546811	15/32	-	-	11.91	0.4688	96	156	12.0
3317200	-	-	-	12.00	0.4724	96	156	12.0
595548411	31/64	-	-	12.30	0.4844	100	167	14.0
595550011	1/2	-	-	12.70	0.5000	104	167	14.0

Packed: 1 pc. Available WXS<sup>®</sup> coating only.



Work Material															
List No.	Aluminum		Cast Iron	Carbon Steel	Alloy/Die Steel	Stainless Steels			Hardened Steels			High Heat Material		MMC	Copper Alloy
	6061 7075	Casting				300	400	17-4PH	~45 HRC	45-50 HRC	50-70 HRC	Ti-Alloy	Inconel & Waspaloy		
5955Ni			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>		

good  best



## Tapping Nickel-Based Alloys

### Common issues when tapping Nickel-Based Alloys



Edge chipping and wear at the chamfer.

- Short tool life
- Tap breaking off inside workpiece
- Sudden tool wear
- Chipping of cutting edge
- **High Probability of Breakage!**

OSG Solution

### OSG's Newly Designed Point Flute



The newly designed point flute improves cutting edge rigidity to prevent edge chipping and makes it effective even in blind holes.

OSG Solution

### OSG's HR Coating for Nickel-Based Alloys

This chart illustrates the wear resistance comparison among OSG's HR coating, OSG's V coating and a competitor TiCN coating. In this example, the average tapping speed was 7 SFM. By adopting OSG's HR coating, the tapping speed can be accelerated 1.4 times versus OSG's V coating and the competitor's!

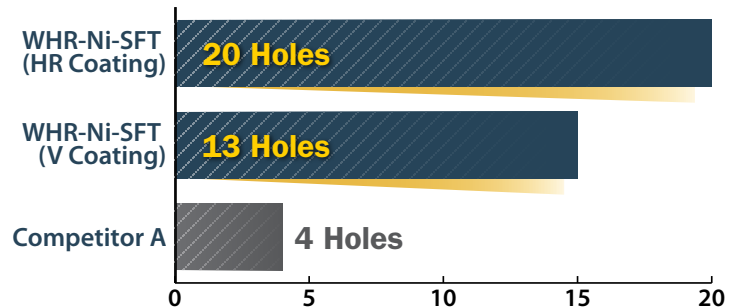
Margin Wear After 12 Holes



V Coating

HR Coating

Thread Size	3/8-16 UNJC
Thread Length	0.750"
Material	Inconel® 718 (43 HRC)
Drill Depth	φ0.319" x 1.38" (Blind)
Cutting Speed	7 SFM
Coolant	Non-Water Soluble
Machine	Vertical Machining Center

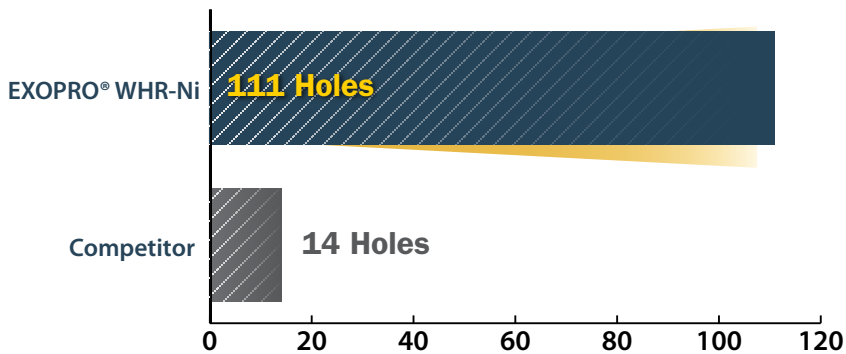


## 8 Times the Tool Life!

Performance in Inconel 718

Under identical conditions, the WHR-Ni tap achieved *8 times the tool life* versus the competitor's tap in 718 Inconel (43 HRC).

<b>Tool</b>	¼-28 UNJF
<b>Work Material</b>	Inconel <sup>®</sup> 718 (43 HRC)
<b>Hole Size</b>	φ0.217" x 0.866" (Blind)
<b>Thread Length</b>	0.500" (2D)
<b>Tapping Speed</b>	6.56 SFM (100 RPM)
<b>Coolant</b>	Non-Water Soluble
<b>Machine</b>	Vertical Machining Center

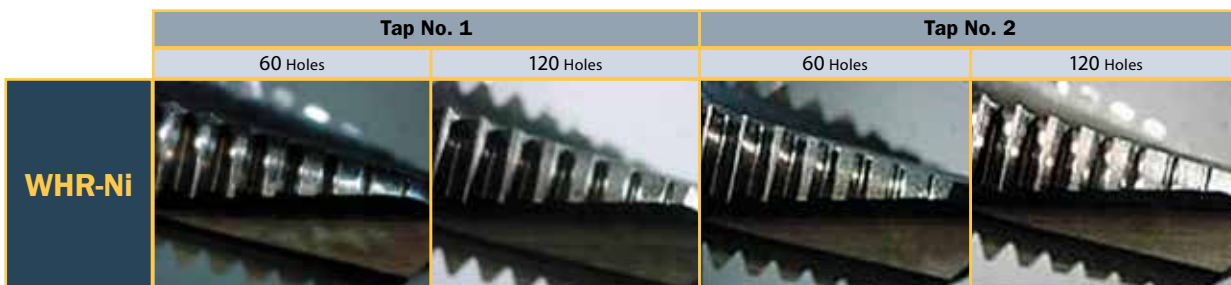
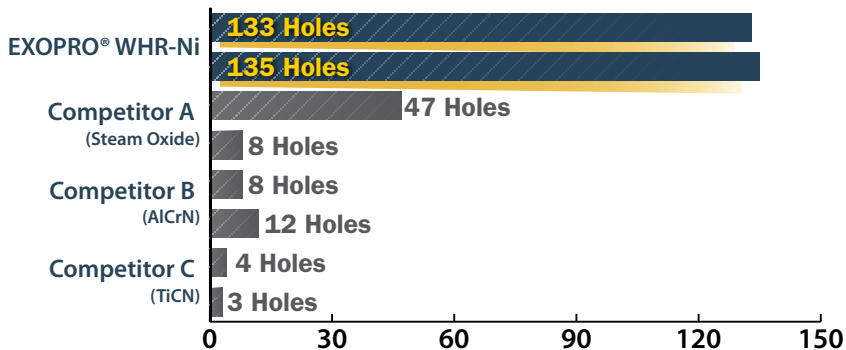


## Stable Long Tool Life

Performance in Inconel 718

Not only did the WHR-Ni tap achieve substantially longer tool life than the competition in 718 Inconel (43 HRC), but it also achieved more consistent tool life.

<b>Tool</b>	M4x0.7
<b>Work Material</b>	Inconel <sup>®</sup> 718 (43 HRC)
<b>Hole Size</b>	φ 3.3x9.5mm (Through)
<b>Tapping Length</b>	9.5mm (2.4D)
<b>Tapping Speed</b>	9.84 SFM (2,356 RPM)
<b>Coolant</b>	Non-Water Soluble
<b>Machine</b>	Vertical Machining Center



## List 335Ni

Modified Bottom (2.5P-3P), Spiral Flute



Tap Size	Threads Per Inch		Thread Limit	Number of Flutes	OAL	EDP Number
	UNC	UNF			L	
2	56	—	H2	3	45	3350002562
4	40	—	H2	3	56	3350004402
4	40	—	H3	3	56	3350004403
6	32	—	H2	3	56	3350006322
6	32	—	H3	3	56	3350006323
8	32	—	H2	3	63	3350008322
8	32	—	H3	3	63	3350008323
10	24	—	H3	3	70	3350010243
10	24	—	H5	3	70	3350010245
10	—	32	H2	3	70	3350010322
10	—	32	H3	3	70	3350010323
1/4	20	—	H3	3	80	3350014203
1/4	20	—	H5	3	80	3350014205
1/4	—	28	H3	3	80	3350014283
1/4	—	28	H4	3	80	3350014284
5/16	18	—	H3	3	90	3350516183
5/16	18	—	H5	3	90	3350516185
5/16	—	24	H3	3	90	3350516243
5/16	—	24	H5	3	90	3350516245
3/8	16	—	H3	3	100	3350038163
3/8	16	—	H5	3	100	3350038165
3/8	—	24	H3	3	90	3350038243
3/8	—	24	H4	3	90	3350038244
7/16	14	—	H3	3	100	3350716143
7/16	14	—	H5	3	100	3350716145
7/16	—	20	H3	3	100	3350716203
7/16	—	20	H5	3	100	3350716205
1/2	13	—	H3	3	110	3350012133
1/2	13	—	H5	3	110	3350012135
1/2	—	20	H3	3	100	3350012203
1/2	—	20	H5	3	100	3350012205
9/16	—	18	H3	3	100	3350096183
9/16	—	18	H5	3	100	3350096185
5/8	11	—	H3	4	110	3350058113
5/8	11	—	H5	4	110	3350058115
5/8	—	18	H3	4	100	3350058183
5/8	—	18	H5	4	100	3350058185
3/4	10	—	H3	4	125	3350034103
3/4	10	—	H5	4	125	3350034105
3/4	—	16	H3	4	110	3350034163
3/4	—	16	H5	4	110	3350034165
7/8	9	—	H3	4	140	3350078093
7/8	9	—	H5	4	140	3350078095
7/8	—	14	H3	4	125	3350078143
7/8	—	14	H5	4	125	3350078145
1	8	—	H3	4	160	3350001083
1	8	—	H5	4	160	3350001085
1	—	12	H3	4	140	3350001123
1	—	12	H5	4	140	3350001125

Packed: 1 pc. Available HR coating only.



Work Material															
Material	Aluminum		Cast Iron	Low Carbon Steel	Med. Carbon Steel	High Carbon Steel	Alloy/Die Steel	Titanium	High Nickel Alloy	Stainless Steels			Hardened Steels		
	6061 7075	Casting		1010, 1018	1035, 1045	1065	4140, 4340	Ti6Al4V	Inconel	300	400	17-4PH	~45 HRC	45-50 HRC	50-70 HRC
<b>Recommended</b>									<input checked="" type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
<b>SFM</b>									8-15			8-20		8-15	3-10

good  best



# List 336Ni

Modified Bottom (2.5P-3P), Spiral Flute



Tap Size	Pitch	Thread Limit	Number of Flutes	OAL		EDP Number
				L		
M2.5	0.45	D3	3	50		3360250453
M3	0.50	D3	3	56		3360003053
M4	0.70	D4	3	63		3360004074
M5	0.80	D4	3	70		3360005084
M6	0.75	D5	3	80		3360006755
M6	1.00	D5	3	80		3360006105
M8	1.00	D5	3	90		3360008105
M8	1.25	D5	3	90		3360008255
M10	1.25	D5	3	100		3360010255
M10	1.50	D6	3	100		3360010156
M12	1.50	D6	3	100		3360012156
M12	1.75	D6	3	110		3360012756
M14	1.50	D6	3	100		3360014156
M14	2.00	D7	3	110		3360014207
M16	1.50	D6	3	100		3360016156
M16	2.00	D7	3	110		3360016207
M18	1.50	D6	3	110		3360018156
M18	2.50	D7	3	125		3360018257
M20	1.50	D6	3	125		3360020156
M20	2.50	D8	3	140		3360020258
M22	1.50	D6	3	125		3360022156
M22	2.50	D8	3	140		3360022258
M24	1.50	D6	4	140		3360024156
M24	3.00	D8	4	160		3360024308

Packed: 1 pc. Available HR coating only.



Work Material															
Material	Aluminum		Cast Iron	Low Carbon Steel	Med. Carbon Steel	High Carbon Steel	Alloy/Die Steel	Titanium	High Nickel Alloy	Stainless Steels			Hardened Steels		
	6061 7075	Casting		1010, 1018	1035, 1045	1065	4140, 4340	Ti6Al4V	Inconel	300	400	17-4PH	~45 HRC	45-50 HRC	50-70 HRC
<b>Recommended</b>									<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>SFM</b>									8-15			8-20		8-15 3-10	

good  best



## List 337Ni

Plug (5P), Spiral Point

VC10

HR



Tap Size	Threads Per Inch		Thread Limit	Number of Flutes	OAL	EDP Number
	UNC	UNF			L	
2	56	-	H2	2	45	3370002562
4	40	-	H2	3	56	3370004402
4	40	-	H3	3	56	3370004403
4	-	48	H2	2	56	3370004482
6	32	-	H2	3	56	3370006322
6	32	-	H3	3	56	3370006323
8	32	-	H2	3	63	3370008322
8	32	-	H3	3	63	3370008323
10	24	-	H2	3	70	3370010242
10	24	-	H3	3	70	3370010243
10	-	32	H2	3	70	3370010322
10	-	32	H3	3	70	3370010323
1/4	20	-	H3	3	80	3370014203
1/4	20	-	H5	3	80	3370014205
1/4	-	28	H3	3	80	3370014283
1/4	-	28	H4	3	80	3370014284
5/16	18	-	H3	3	90	3370516183
5/16	18	-	H5	3	90	3370516185
5/16	-	24	H3	3	90	3370516243
5/16	-	24	H5	3	90	3370516245
3/8	16	-	H3	3	100	3370038163
3/8	16	-	H5	3	100	3370038165
3/8	-	24	H3	3	90	3370038243
3/8	-	24	H5	3	90	3370038245
7/16	14	-	H3	3	100	3370716143
7/16	14	-	H5	3	100	3370716145
7/16	-	20	H3	3	100	3370716203
7/16	-	20	H5	3	100	3370716205
1/2	13	-	H3	3	110	3370012133
1/2	13	-	H5	3	110	3370012135
1/2	-	20	H3	3	100	3370012203
1/2	-	20	H5	3	100	3370012205
9/16	-	18	H3	3	100	3370916183
9/16	-	18	H5	3	100	3370916185
5/8	11	-	H3	3	110	3370058113
5/8	11	-	H5	3	110	3370058115
5/8	-	18	H3	3	100	3370058183
5/8	-	18	H5	3	100	3370058185
3/4	10	-	H3	4	125	3370034103
3/4	10	-	H5	4	125	3370034105
3/4	-	16	H3	4	110	3370034163
3/4	-	16	H5	4	110	3370034165
7/8	9	-	H3	4	140	3370078093
7/8	9	-	H5	4	140	3370078095
7/8	-	14	H3	4	125	3370078143
7/8	-	14	H5	4	125	3370078145
1	8	-	H3	4	160	3370001083
1	8	-	H5	4	160	3370001085
1	-	12	H3	4	140	3370001123
1	-	12	H5	4	140	3370001125

Packed: 1 pc. Available HR coating only.

EP

### Work Material

Material	Aluminum		Cast Iron	Low Carbon Steel	Med. Carbon Steel	High Carbon Steel	Alloy/Die Steel	Titanium	High Nickel Alloy	Stainless Steels			Hardened Steels		
	6061 7075	Casting		1010, 1018	1035, 1045	1065	4140, 4340	Ti6Al4V	Inconel	300	400	17-4PH	~45 HRC	45-50 HRC	50-70 HRC
<b>Recommended</b>									<input checked="" type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
<b>SFM</b>									8-15			8-20		8-15	3-10

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## List 338Ni

Plug (5P), Spiral Point



Tap Size	Pitch	Thread Limit	Number of Flutes	OAL		EDP Number
				L		
M2.5	0.45	D3	2	50		3380250453
M3	0.50	D3	3	56		3380003053
M4	0.70	D4	3	63		3380004074
M5	0.80	D4	3	70		3380005084
M6	0.75	D5	3	80		3380006755
M6	1.00	D5	3	80		3380006105
M8	1.00	D5	3	90		3380008105
M8	1.25	D5	3	90		3380008255
M10	1.25	D5	3	100		3380010255
M10	1.50	D6	3	100		3380010156
M12	1.50	D6	3	100		3380012156
M12	1.75	D6	3	110		3380012756
M14	1.50	D6	3	100		3380014156
M14	2.00	D7	3	110		3380014207
M16	1.50	D6	3	100		3380016156
M16	2.00	D7	3	110		3380016207
M18	1.50	D6	3	110		3380018156
M18	2.50	D7	3	125		3380018257
M20	1.50	D6	3	125		3380020156
M20	2.50	D8	3	140		3380020258
M22	1.50	D6	3	125		3380022156
M22	2.50	D8	3	140		3380022258
M24	1.50	D6	4	140		3380024156
M24	3.00	D8	4	160		3380024308

Packed: 1 pc. Available HR coating only.



Work Material															
Material	Aluminum		Cast Iron	Low Carbon Steel	Med. Carbon Steel	High Carbon Steel	Alloy/Die Steel	Titanium	High Nickel Alloy	Stainless Steels			Hardened Steels		
	6061 7075	Casting		1010, 1018	1035, 1045	1065	4140, 4340	Ti6Al4V	Inconel	300	400	17-4PH	~45 HRC	45-50 HRC	50-70 HRC
<b>Recommended</b>									<input checked="" type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
<b>SFM</b>									8-15			8-20		8-15	3-10

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# EXOCARB® Thread Mill

Features & Benefits

## Threading Nickel-Based Alloys

### PROBLEMS

#### • Diversification of Work Materials

Due to the use of high-hardness materials exceeding 50HRC, heat-resistant steels and even brittle materials, small diameter internal threads are becoming increasingly difficult to machine.

#### • Machining Equipment Constraints

Along with the need for ultra-high speed and high precision operations, small machining centers without reverse function (tap cycles) have emerged.

#### • Coolant Constraints

Standard taps have difficulty machining nickel-based alloys with water-soluble coolant.

### OSG SOLUTIONS

1

#### Advanced Coatings

EXO®, WXS®, or SS coating for extreme temperature and wear resistance.

2

#### Premium Carbide Substrate

Superior wear resistance and long tool life at high cutting speeds.

3

#### Optimized Flute Geometry

Helical flute reduces cutting forces.

4

#### Coolant Through

Improved chip evacuation for stable machining with water-soluble coolant.

5

#### Optimized Thread Form

Minimizes cutting load on machine and tool.





## Machining Small Diameter Internal Threads

Performance in Inconel 718

Compared to taps, thread mills have fewer cutting condition limitations. There is no concern with chip management or coolant lubricity, and stable threading is possible. In this example, we were able to improve the yield rate of small diameter internal threads in a high value workpiece. More durability improvements and cost reductions can be expected by adjusting the feed rate and number of passes and changing the cutting fluid.

Tool	3.2x2.4 U32	
Work Material	Inconel® 718 (43 HRC)	
Cutting Speed	130 SFM 3,980 RPM	195 SFM 5,970 RPM
Feed	4.72 IPM 0.001 ipt	7.07 IPM 0.001 ipt
Internal Thread	No. 10-32 UNF	
Drill Hole Size	φ 0.161" x 0.551" (Blind)	
Tapping Length	0.354" (1.9D)	
Machining Method	Down Cut, 2/4 Passes	
Coolant	Water Soluble	
Machine	Vertical Machining Center	

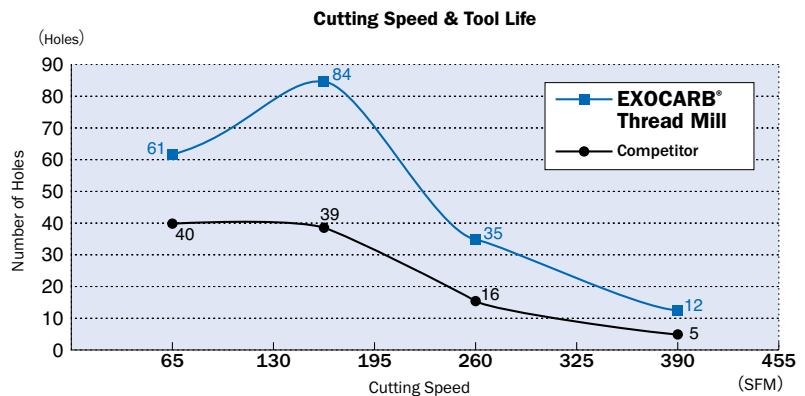
Cutting Speed	Passes	Tool life holes
130 SFM	4	50 Holes
195 SFM	4	60 Holes
	2	40 Holes

## Double the Tool Life at Any Cutting Speed

Performance in Inconel 718

At various cutting speeds under 165 SFM, better durability is achieved. The EXOCARB® Thread Mill achieves **2 times the tool life** versus the competitor, regardless of the cutting speed.

Tool	4.55x10.8 U20
Work Material	Inconel® 718 (43 HRC)
Internal Thread Size	¼-20 UNC
Tapping Length	0.354"
Feed Per Tooth	0.001 ipt
Coolant	Water Soluble (10%)
Machine	Horizontal Machining Center



# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 41000

UNC/UNF/UNEF/UNS, Regular & Long Length, Helical Flute



Size	Threads Per Inch				Cutter Diameter D	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Diameter d	No. of Flutes	Type	EDP Number
	UNC	UNF	UNEF	UNS								
10	24	-	-	-	0.130	2.5	0.374	0.437	3/16	3	1	4100000411
10	-	32	-	-	0.130	2.5	0.374	0.437	3/16	3	1	4100000511
12	24	-	-	-	0.160	3	0.331	0.374	1/4	3	1	4100000611
12	-	28	-	-	0.160	3	0.323	0.358	1/4	3	1	4100000711
1/4	20	-	-	-	0.180	3	0.402	0.449	1/4	3	1	4100000811
1/4	20	-	-	-	0.180	3	0.551	0.598	1/4	3	1	4100003211
1/4	-	28	-	-	0.180	3	0.394	0.429	1/4	3	1	4100000911
1/4	-	28	-	-	0.180	3	0.535	0.571	1/4	3	1	4100003311
1/4	-	-	32	-	0.190	3	0.374	0.406	1/4	3	1	4100002811
5/16	18	-	-	-	0.245	3	0.500	-	1/4	3	2	4100001011
5/16	18	-	-	-	0.245	3	0.720	-	1/4	3	2	4100003411
5/16	-	24	-	-	0.245	3	0.500	-	1/4	3	2	4100001111
5/16	-	24	-	-	0.245	3	0.752	-	1/4	3	2	4100003511
5/16	-	-	32	-	0.250	3	0.469	-	1/4	3	2	4100002911
3/8	16	-	-	-	0.300	3	0.594	-	5/16	3	2	4100001211
3/8	16	-	-	-	0.300	3	0.874	-	5/16	3	2	4100003611
3/8	-	24	-	-	0.300	3	0.583	-	5/16	3	2	4100001311
3/8	-	24	-	-	0.300	3	0.874	-	5/16	3	2	4100003711
3/8	-	-	32	-	0.310	3	0.563	-	5/16	3	2	4100003011
7/16	14	-	-	-	0.350	3	0.713	0.783	3/8	3	1	4100001411
7/16	14	-	-	-	0.350	3	1.071	1.142	3/8	3	1	4100003811
7/16	-	20	-	-	0.350	3	0.701	0.752	3/8	3	1	4100001511
7/16	-	20	-	-	0.350	3	1.051	1.098	3/8	3	1	4100003911
1/2	13	-	-	-	0.370	3	0.768	-	3/8	4	2	4100001611
1/2	13	-	-	-	0.370	3	1.079	-	3/8	4	2	4100004011
1/2	-	20	-	-	0.370	3	0.750	-	3/8	4	2	4100001711
1/2	-	20	-	-	0.370	3	1.098	-	3/8	4	2	4100004111
1/2	-	-	-	32	0.375	3	0.752	-	3/8	4	2	4100003111
9/16	12	-	-	-	0.430	4	0.917	1.000	1/2	4	1	4100001811
9/16	12	-	-	-	0.430	4	1.335	1.417	1/2	4	1	4100004211
9/16	-	18	-	-	0.450	4	0.890	0.945	1/2	4	1	4100001911
9/16	-	18	-	-	0.450	4	1.390	1.445	1/2	4	1	4100004311
5/8	11	-	-	-	0.430	4	1.000	1.091	1/2	4	1	4100002011
5/8	11	-	-	-	0.430	4	1.453	1.547	1/2	4	1	4100004411
5/8	-	18	-	-	0.495	4	0.945	-	1/2	4	2	4100002111
5/8	-	18	-	-	0.495	4	1.500	-	1/2	4	2	4100004511
3/4	10	-	-	-	0.620	4	1.201	-	5/8	4	2	4100002211
3/4	10	-	-	-	0.620	4	1.701	-	5/8	4	2	4100004611
3/4	-	16	-	-	0.620	4	1.126	-	5/8	4	2	4100002311
3/4	-	16	-	-	0.620	4.5	1.689	-	5/8	4	2	4100004711
7/8	9	-	-	-	0.745	4	1.335	-	3/4	4	2	4100002411

Packed: 1 pc. Available EXO® coating only.  
For internal threads only.



# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 41000 (Continued)

UNC/UNF/UNEF/UNS, Regular & Long Length, Helical Flute



Size	Threads Per Inch				Cutter Diameter D	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Diameter d	No. of Flutes	Type	EDP Number
	UNC	UNF	UNEF	UNS								
7/8	9	-	-	-	0.745	5	2.000	-	3/4	4	2	4100004811
7/8	-	14	-	-	0.745	4	1.358	-	3/4	4	2	4100002511
7/8	-	14	-	-	0.745	5	2.000	-	3/4	4	2	4100004911
1	8	-	-	-	0.745	4	1.626	-	3/4	4	2	4100002611
1	8	-	-	-	0.745	5	2.000	-	3/4	4	2	4100005011
1	-	12	-	-	0.745	4	1.583	-	3/4	4	2	4100002711
1	-	12	-	-	0.745	5	2.000	-	3/4	4	2	4100005111

Packed: 1 pc. Available EXO®coating only.  
For internal threads only.



For more information on thread mill applications, including ThreadPro software, visit: [www.osgtool.com/ThreadPro](http://www.osgtool.com/ThreadPro).



Work Material																	
List No.	Aluminum		Cast Iron	CoCr	Carbon Steel	Alloy & Die Steels	Ductile Cast Iron	MMC	Copper Alloys	Fiberglass	High Heat Material		Stainless Steels			Hardened Steels	
	6061 7075	Casting									Ti-Alloy	Inconel & Waspaloy	300	400	17-4PH	~55 HRC	55-60 HRC
41000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

good  best

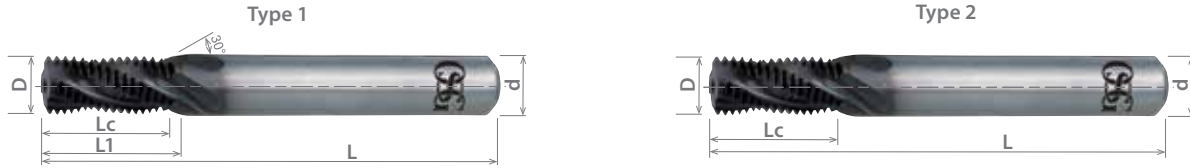


# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 41100

Regular & Long Length, Helical Flute



Size	Pitch	Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
		D	L	Lc	L1	d			
M6	1.0	4.5	60	10.0	15	6	3	1	4110000111
M6	1.0	4.5	60	13.0	15	6	3	1	3900001
M8	1.0	6.0	65	13.0	—	6	3	2	4110000211
M8	1.0	6.0	65	17.0	—	6	3	2	3900011
M8	1.25	6.0	65	13.8	—	6	3	2	4110000311
M8	1.25	6.0	65	17.5	—	6	3	2	3900012
M10	1.0	7.5	70	16.0	26	8	3	1	4110000411
M10	1.0	7.5	70	21.0	26	8	3	1	3900021
M10	1.25	7.5	70	16.3	26	8	3	1	4110000511
M10	1.5	7.5	70	16.5	26	8	3	1	4110000611
M10	1.5	7.5	70	22.5	26	8	3	1	3900023
M12	1.25	9.5	85	20.0	28	10	4	1	4110000711
M12	1.25	9.5	85	26.3	28	10	4	1	3900032
M12	1.75	9.5	85	21.0	28	10	4	1	4110000811
M12	1.75	9.5	85	26.3	28	10	4	1	3900034
M14	1.5	10.0	85	22.5	—	10	4	2	4110000911
M14	1.5	10.0	85	30.0	—	10	4	2	3900043
M14	2.0	10.0	85	24.0	—	10	4	2	4110001011
M14	2.0	10.0	85	30.0	—	10	4	2	3900044
M16	1.5	12.0	95	25.5	—	12	4	2	4110001111
M16	1.5	12.0	95	34.5	—	12	4	2	3900053
M16	2.0	12.0	95	34.0	—	12	4	2	3900054
M20	1.5	16.0	105	31.5	—	16	4	2	4110001211
M20	1.5	16.0	105	42.0	—	16	4	2	3900073
M20	2.5	16.0	105	42.5	—	16	4	2	3900075
M24	2.0	20.0	120	50.0	—	20	5	2	3900084
M24	3.0	20.0	120	51.0	—	20	5	2	3900086

Packed: 1 pc. Available EXO® coating only.  
For internal threads only.



For more information on thread mill applications, including ThreadPro software, visit: [www.osgtool.com/ThreadPro](http://www.osgtool.com/ThreadPro).



List No.	Work Material																	
	Aluminum		Cast Iron	CoCr	Carbon Steel	Alloy & Die Steels	Ductile Cast Iron	MMC	Copper Alloys	Fiberglass	High Heat Material		Stainless Steels			Hardened Steels		
	6061 7075	Casting									Ti-Alloy	Inconel & Waspaloy	300	400	17-4PH	~55 HRC	55-60 HRC	60-65 HRC
41100	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

good  best



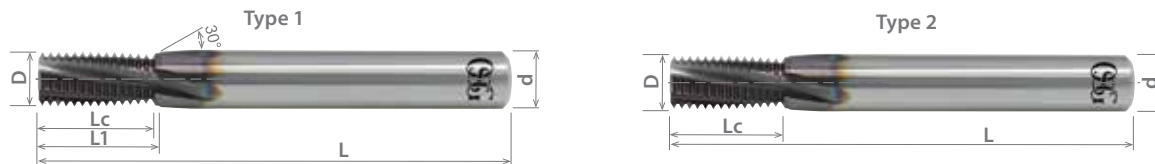
# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 41050 **NEW!**



UNC/UNF, Coolant-Through, Long Length, Helical Flute

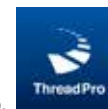


Size	Threads Per Inch		Cutter Diameter D	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Diameter d	No. of Flutes	Type	EDP Number
	UNC	UNF								
1/4	20	-	0.180	3	0.401	0.448	1/4	4	1	4105000111
1/4	-	28	0.180	3	0.393	0.429	1/4	4	1	4105000211
5/16	18	-	0.245	3	0.500	-	1/4	4	2	4105000311
5/16	-	24	0.245	3	0.500	-	1/4	4	2	4105000411
3/8	16	-	0.300	3	0.562	-	5/16	4	2	4105000511
3/8	-	24	0.300	3	0.582	-	5/16	4	2	4105000611
7/16	14	-	0.350	3	0.712	0.783	3/8	4	1	4105000711
7/16	-	20	0.350	3	0.700	0.751	3/8	4	1	4105000811
1/2	13	-	0.370	3	0.767	-	3/8	5	2	4105000911
1/2	-	20	0.370	3	0.750	-	3/8	5	2	4105001011
9/16	12	-	0.430	4	0.917	1.000	1/2	5	1	4105001111
9/16	-	18	0.450	4	0.889	0.944	1/2	5	1	4105001211
5/8	11	-	0.430	4	1.000	1.090	1/2	5	1	4105001311
5/8	-	18	0.495	4	0.944	-	1/2	5	2	4105001411
3/4	10	-	0.620	4	1.200	-	5/8	5	2	4105001511
3/4	-	16	0.620	4	1.125	-	5/8	5	2	4105001611
7/8	9	-	0.745	4	1.330	-	3/4	6	2	4105001711
7/8	-	14	0.745	4	1.358	-	3/4	6	2	4105001811
1	8	-	0.745	4	1.625	-	3/4	6	2	4105001911
1	-	12	0.745	4	1.582	-	3/4	6	2	4105002011

Packed: 1 pc. Available EXO® coating only.  
For internal threads only.



For more information on thread mill applications, including ThreadPro software, visit: [www.osgtool.com/ThreadPro](http://www.osgtool.com/ThreadPro).



List No.	Work Material																	
	Aluminum		Cast Iron	CoCr	Carbon Steel	Alloy & Die Steels	Ductile Cast Iron	MMC	Copper Alloys	Fiberglass	High Heat Material		Stainless Steels			Hardened Steels		
6061 7075	Casting	Ti-Alloy									Inconel & Waspaloy	300	400	17-4PH	~55 HRC	55-60 HRC	60-65 HRC	
41050	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

good  best



# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 41150

Coolant-Through, Long Length, Helical Flute



Size	Pitch	Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
		D	L	Lc	L1	d			
M6	1.0	4.5	60	13.0	15.0	6.0	4	1	8304701
M8	1.0	6.0	65	17.0	—	6.0	4	2	8304711
M8	1.25	6.0	65	17.5	—	6.0	4	2	8304712
M10	1.0	7.5	70	21.0	26.0	8.0	4	1	8304721
M10	1.50	7.5	70	22.5	26.0	8.0	4	1	8304723
M12	1.25	9.5	85	26.3	28.0	10.0	5	1	8304732
M12	1.75	9.5	85	26.3	28.0	10.0	5	1	8304734
M14	1.5	10.0	85	30.0	—	10.0	5	2	8304743
M14	2.0	10.0	85	30.0	—	10.0	5	2	8304744
M16	1.5	12.0	95	34.5	—	12.0	5	2	8304753
M16	2.0	12.0	95	34.0	—	12.0	5	2	8304754
M20	1.5	16.0	105	42.0	—	16.0	5	2	8304773
M20	2.5	16.0	105	42.5	—	16.0	5	2	8304775
M24	2.0	20.0	120	50.0	—	20.0	6	2	8304784
M24	3.0	20.0	120	51.0	—	20.0	6	2	8304786

Packed: 1 pc. Available EXO®coating only.  
For internal threads only.



For more information on thread mill applications, including ThreadPro software, visit: [www.osgtool.com/ThreadPro](http://www.osgtool.com/ThreadPro).



### Work Material

List No.	Aluminum		Cast Iron	CoCr	Carbon Steel	Alloy & Die Steels	Ductile Cast Iron	MMC	Copper Alloys	Fiberglass	High Heat Material		Stainless Steels			Hardened Steels		
	6061 7075	Casting									Ti-Alloy	Inconel & Waspaloy	300	400	17-4PH	~55 HRC	55-60 HRC	60-65 HRC
<b>41150</b>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

good  best

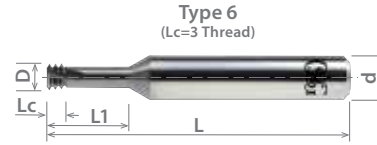


# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 41200

Miniature, Helical Flute



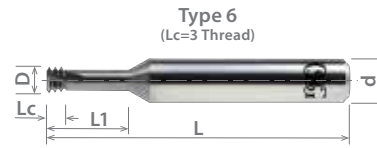
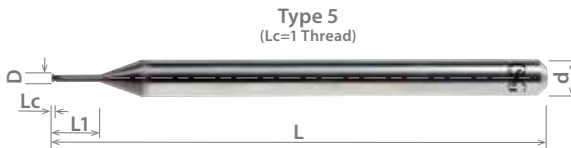
Size	Pitch	Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
		D	L	Lc	L1	d			
0	80	0.045	1.625	0.013	0.162	1/8	3	5	4120000115
1	72	0.055	1.625	0.014	0.196	1/8	3	5	4120000215
1	64	0.055	1.625	0.016	0.198	1/8	3	5	4120000315
2, 3	56	0.064	1.625	0.054	0.189	1/4	3	6	4120000413
2	64	0.064	1.625	0.047	0.189	1/4	3	6	4120000513
3, 4	48	0.074	1.625	0.063	0.220	1/4	3	6	4120000613
4, 5, 6	40	0.083	1.625	0.075	0.248	1/4	3	6	4120000713
5	44	0.096	1.625	0.068	0.272	1/4	3	6	4120000813
6, 8	32	0.103	1.625	0.094	0.307	1/4	3	6	4120000913
8	36	0.129	1.625	0.083	0.354	1/4	3	6	4120001013

Packed: 1 pc.  
Available SS (D ≤ 0.055) and WXS® (D ≥ 0.064) coatings only. For internal threads only.



## List 41300

Miniature, Helical Flute



Size	Pitch	Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
		D	L	Lc	L1	d			
M1	0.25	0.72	40	0.26	2.75	3	3	5	3900495
M1.2	0.25	0.91	40	0.26	3.25	3	3	5	3900496
M1.4	0.3	1.05	40	0.31	3.80	3	3	5	3900497
M1.6	0.35	1.20	40	0.36	4.35	3	3	5	3900498
M1.7, M1.8	0.35	1.30	40	0.36	4.85	3	3	5	3900499
M2	0.4	1.50	40	1.20	4.40	6	3	6	3900500
M2.5, M2.6	0.45	1.90	41	1.35	5.60	6	3	6	3900501
M3	0.5	2.40	41	1.50	6.50	6	3	6	3900502
M4	0.7	3.10	41	2.10	8.70	6	3	6	3900503
M5	0.8	4.00	41	2.40	10.80	6	3	6	3900504

Packed: 1 pc.  
Available SS (D ≤ 0.055) and WXS® (D ≥ 0.064) coatings only. For internal threads only.



For more information on thread mill applications, including ThreadPro software, visit: [www.osgtool.com/ThreadPro](http://www.osgtool.com/ThreadPro).

Work Material																		
List No.	Aluminum		Cast Iron	CoCr	Carbon Steel	Alloy & Die Steels	Ductile Cast Iron	MMC	Copper Alloys	Fiberglass	High Heat Material		Stainless Steels			Hardened Steels		
	6061 7075	Casting									Ti-Alloy	Inconel & Waspaloy	300	400	17-4PH	~55 HRC	55-60 HRC	60-65 HRC
41200	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
41300	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

good  best

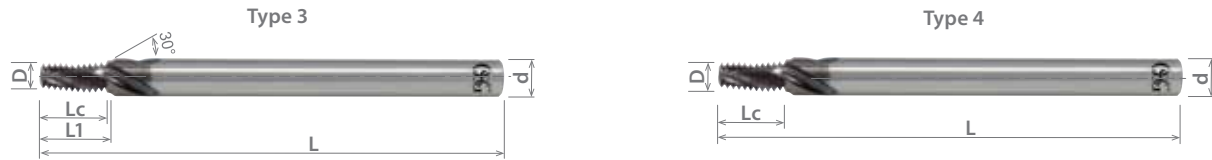


# EXOCARB® Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

## List 42000

NPT, Helical Flute



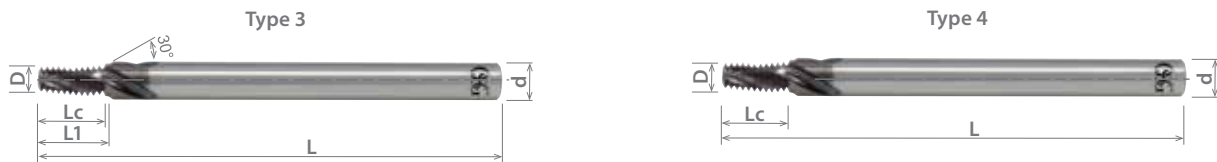
Thread Form	TPI	Tip Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
		D1	L	Lc	L1	d			
1/16	27	0.186	3	0.409	0.44	1/4	3	3	4200000111
1/8	27	0.286	3	0.409	—	5/16	3	4	4200000211
1/4 or 3/8	18	0.334	3	0.610	—	3/8	4	4	4200000311
1/2 or 3/4	14	0.575	4	0.787	—	5/8	4	4	4200000411
1 thru 2	11-1/2	0.785	4	0.957	1.04	1	4	3	4200000511
2-1/2	8	0.917	4	1.358	—	1	4	4	4200000611

Packed: 1 pc. Available EXO® coating only.  
For internal threads only.



## List 42001

NPT, Helical Flute



Thread Form	TPI	Tip Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
		D1	L	Lc	L1	d			
1/16	27	0.186	3	0.409	0.44	1/4	3	3	4200100111
1/8	27	0.286	3	0.409	—	5/16	3	4	4200100211
1/4 or 3/8	18	0.335	3	0.610	—	3/8	4	4	4200100311
1/2	14	0.575	4	0.787	—	5/8	4	4	4200100411
3/4	14	0.575	4	0.787	—	5/8	4	4	4200100711
1 or 1-1/4	11-1/2	0.785	4	0.957	1.04	1	4	3	4200100511
1-1/2 or 2	11-1/2	0.785	4	0.957	1.04	1	4	3	4200100811
2-1/2	8	0.917	4	1.358	—	1	4	4	4200100611

Packed: 1 pc. Available EXO® coating only.  
For internal threads only.



For more information on thread mill applications, including ThreadPro software, visit: [www.osgtool.com/ThreadPro](http://www.osgtool.com/ThreadPro).

### Work Material

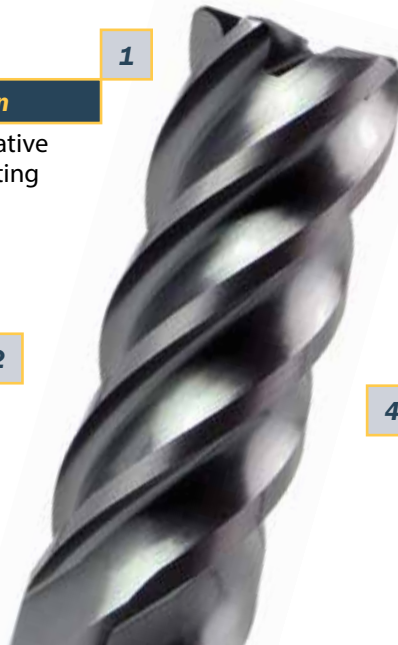
List No.	Aluminum		Cast Iron	CoCr	Carbon Steel	Alloy & Die Steels	Ductile Cast Iron	MMC	Copper Alloys	Fiberglass	High Heat Material		Stainless Steels			Hardened Steels		
	6061 7075	Casting									Ti-Alloy	Inconel & Waspaloy	300	400	17-4PH	~55 HRC	55-60 HRC	60-65 HRC
42000	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
42001	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

good  best





## UVX-Ni Features



1

### Corner Protection

Radius with variable negative rake angle for strong cutting corners

3

### Unique Flute Form

For excellent chip shape and evacuation

2

### Variable Helix / Variable Index

Vibration absorption enables stable machining

4

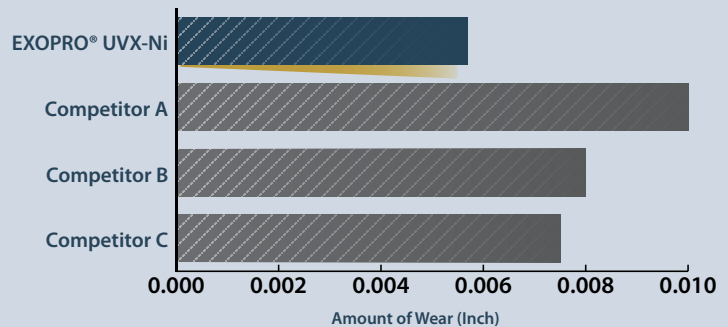
### Proprietary Cutting Edge Geometry

Reduction of cutting heat and forces

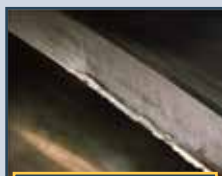
## SIDE MILLING IN 718 INCONEL

Stable performance in Nickel Alloys can be achieved with UVX-Ni's unique cutting geometry and flute design.

<b>Tool Dia.</b>	1/2"x1-1/4"x3-1/2" 0.030CR
<b>Work Material</b>	Inconel® 718 (45 HRC)
<b>Speed</b>	764 RPM (100SFM)
<b>Feed</b>	6.02 IPM (0.0015 IPT)
<b>Depth of Cut</b>	a <sub>a</sub> : 0.250" / a <sub>r</sub> : 0.150"
<b>Coolant</b>	Water Soluble (External)



### Tool Wear After Milling 39 Inches:



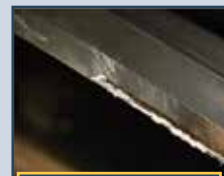
**UVX-Ni**  
(Mild wear, no chipping)



**Comp. A**  
(Severe wear, chipping)



**Comp. B**  
(Heavy wear)



**Comp. C**  
(Heavy wear)

## List 2055

5 Flute, Multiple Lengths, Corner Radius



EDP Number	EDP Number w/Weldon Flat	Mill Diameter	Corner Radius	OAL	Length of Cut	Shank Diameter	No. of Flutes
		D	R	L	Lc	d	
20552501	—	1/4	0.015	2 1/2	5/8	1/4	5
20552502	—	1/4	0.030	2 1/2	5/8	1/4	5
20552503	—	1/4	0.060	2 1/2	5/8	1/4	5
20553121	—	5/16	0.015	2 1/2	3/4	5/16	5
20553122	—	5/16	0.030	2 1/2	3/4	5/16	5
20553123	—	5/16	0.060	2 1/2	3/4	5/16	5
—	20553751	3/8	0.015	2 1/2	7/8	3/8	5
—	20553752	3/8	0.030	2 1/2	7/8	3/8	5
—	20553753	3/8	0.060	2 1/2	7/8	3/8	5
—	20555001	1/2	0.030	2 1/2	5/8	1/2	5
—	20555002	1/2	0.030	3	1	1/2	5
—	20555003	1/2	0.060	3	1	1/2	5
—	20555004	1/2	0.015	3 1/2	1 1/4	1/2	5
—	20555005	1/2	0.030	3 1/2	1 1/4	1/2	5
—	20555006	1/2	0.060	3 1/2	1 1/4	1/2	5
—	20555007	1/2	0.090	3 1/2	1 1/4	1/2	5
—	20555008	1/2	0.120	3 1/2	1 1/4	1/2	5
—	20556251	5/8	0.030	3 1/2	1 1/4	5/8	5
—	20556252	5/8	0.060	3 1/2	1 1/4	5/8	5
—	20556253	5/8	0.090	3 1/2	1 1/4	5/8	5
—	20556254	5/8	0.120	3 1/2	1 1/4	5/8	5
—	20557501	3/4	0.030	4	1 1/2	3/4	5
—	20557502	3/4	0.060	4	1 1/2	3/4	5
—	20557503	3/4	0.090	4	1 1/2	3/4	5
—	20557504	3/4	0.120	4	1 1/2	3/4	5
—	20551001	1	0.030	4	1 1/2	1	5
—	20551002	1	0.060	4	1 1/2	1	5
—	20551003	1	0.090	4	1 1/2	1	5
—	20551004	1	0.120	4	1 1/2	1	5

Weldon Flat 3/8" and above.  
Packed: 1 pc. Available TiAlN coating only.



Work Material											
List No.	Carbon Steel Alloy Steel Tool Steel	Pre-Hardened Steel, Hardened Steel					Copper Alloys	Aluminum Alloys	Graphite	Ti-Alloys	Ni-Alloys
		~45 HRC	55 HRC	60 HRC	65 HRC	Stainless Steel					
2055		<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>				<input checked="" type="checkbox"/>	

good  best



## List 5950Ni - EXOPRO® WHO-Ni: 3D

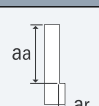
## List 5955Ni - EXOPRO® WHO-Ni: 5D

### General Drilling Operations

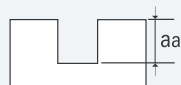
Work Material	Carbon Steels, Mild Steels 1010, 1050, 12L14	Alloy Steels 4140, 4130	Cast Iron	Ductile Cast Iron	Special Alloy Steels, Hardened Steels						Ni-Base Material, Inconel					
					35-40 HRC	40-45 HRC	45-56 HRC	38-43 HRC		35-100 SFM						
Cutting Speed	260-395 SFM	260-395 SFM	260-395 SFM	195-330 SFM	130-160 SFM	115-150 SFM	65-100 SFM									
Drill Dia. (mm)	Speed RPM	Feed IPR	Speed RPM	Feed IPR	Speed RPM	Feed IPR	Speed RPM	Feed IPR	Speed RPM	Feed IPR	Speed RPM	Feed IPR	Speed RPM	Feed IPR	Speed RPM	Feed IPR
3	10,600	0.002-0.005	10,600	0.002-0.005	10,600	0.002-0.005	8,500	0.002-0.005	4,700	0.002 - 0.003	4,200	0.001-0.002	2,675	0.001-0.002	2,100	0.001-0.002
4	8,000	0.003-0.006	8,000	0.003-0.006	8,000	0.003-0.006	6,400	0.003-0.006	3,600	0.003 - 0.004	3,200	0.001-0.003	2,000	0.001-0.003	1,600	0.001-0.003
5	6,400	0.004-0.008	6,400	0.004-0.008	6,400	0.004-0.008	5,100	0.004-0.008	2,900	0.004 - 0.005	2,500	0.002-0.004	1,600	0.002-0.004	1,300	0.002-0.004
6	5,300	0.005-0.009	5,300	0.005-0.009	5,300	0.005-0.009	4,200	0.005-0.009	2,400	0.005 - 0.006	2,100	0.002-0.005	1,300	0.002-0.005	1,100	0.002-0.005
7	4,500	0.006-0.010	4,500	0.006-0.010	4,500	0.006-0.010	3,600	0.006-0.010	2,000	0.006 - 0.007	1,800	0.003-0.005	1,100	0.003-0.005	900	0.003-0.005
8	4,000	0.006-0.011	4,000	0.006-0.011	4,000	0.006-0.011	3,200	0.006-0.011	1,800	0.006 - 0.008	1,600	0.003-0.006	1,000	0.003-0.006	800	0.003-0.006
9	3,500	0.007-0.012	3,500	0.007-0.012	3,500	0.007-0.012	2,800	0.007-0.012	1,650	0.007 - 0.009	1,400	0.003-0.007	900	0.003-0.007	700	0.003-0.007
10	3,200	0.008-0.012	3,200	0.008-0.012	3,200	0.008-0.012	2,500	0.008-0.012	1,400	0.008 - 0.010	1,300	0.004-0.008	800	0.004-0.008	600	0.004-0.008
11	2,900	0.008-0.012	2,900	0.008-0.012	2,900	0.008-0.012	2,300	0.008-0.012	1,300	0.009 - 0.011	1,150	0.004-0.009	720	0.004-0.009	600	0.004-0.009
12	2,700	0.008-0.012	2,700	0.008-0.012	2,700	0.008-0.012	2,100	0.008-0.012	1,200	0.009 - 0.012	1,100	0.005-0.009	700	0.005-0.009	500	0.005-0.009
13	2,400	0.008-0.012	2,400	0.008-0.012	2,400	0.008-0.012	2,000	0.008-0.012	1,100	0.010 - 0.013	1,100	0.005-0.010	625	0.005-0.010	500	0.005-0.010
14	2,300	0.009-0.014	2,300	0.009-0.014	2,300	0.009-0.014	1,800	0.009-0.014	1,000	0.011 - 0.014	925	0.006-0.011	575	0.006-0.011	450	0.006-0.011
16	2,000	0.010-0.014	2,000	0.010-0.014	2,000	0.010-0.014	1,600	0.010-0.014	900	0.013 - 0.016	825	0.006-0.013	500	0.006-0.013	400	0.006-0.013
18	1,800	0.011-0.015	1,800	0.011-0.015	1,800	0.011-0.015	1,400	0.011-0.015	800	0.015 - 0.018	725	0.007-0.014	450	0.007-0.014	350	0.007-0.014
20	1,600	0.012-0.016	1,600	0.012-0.016	1,600	0.012-0.016	1,300	0.012-0.016	700	0.016 - 0.020	650	0.008-0.016	400	0.008-0.016	325	0.008-0.016

## List 2055 - EXOPRO® UVX-Ni - 5 Flute - Corner Radius

### Side Milling

Work Material	Nickel Based Heat Resistant Alloys	
Cutting Speed	125-150	
Depth of Cut	$a_a \leq 0.5D$ $a_r \leq 0.3D$ 	
Mill Dia.	RPM	Feed (in/min)
1/4	2100	11.0
5/16	1600	10.0
3/8	1400	10.0
1/2	1100	9.5
5/8	800	9.0
3/4	650	8.0
1	500	7.0

### Slotting

Work Material	Nickel Based Heat Resistant Alloys	
Cutting Speed	75-100	
Depth of Cut	$a_a \leq 0.5D$ 	
Mill Dia.	RPM	Feed (in/min)
1/4	1300	7.0
5/16	1000	6.5
3/8	900	6.0
1/2	700	5.5
5/8	500	5.0
3/4	400	4.5
1	300	4.0

# Nickel Alloy Solutions

Speeds & Feeds

**List 41000/41100 - EXOCARB® Thread Mill**

**List 41050/41150 - EXOCARB® Thread Mill Oil**

**List 42000/42001 - EXOCARB® Thread Mill NPT/NPTF**

Work Material	SFM	Feed Rate (in/t)	No. of Passes
Low Carbon Steel (S5400, under S25C)	300 - 420	0.0016 - 0.0050	1
Medium Carbon Steel (S3C-S50C)	300 - 420	0.0016 - 0.0050	1
High Carbon Steel (S53C-S58C)	250 - 420	0.0016 - 0.0050	1
Alloy Steel (SCr,SCM,SNC)	180 - 350	0.0008 - 0.0040	1-2
Heat Treated Steel (28-34HRC)	160 - 300	0.0008 - 0.0040	1
Heat Treated Steel (34-40HRC)	130 - 260	0.0004 - 0.0040	1-2
Heat Treated Steel (40-50HRC)	65 - 250	0.0004 - 0.0040	2-4
Stainless Steel (SUS3**,SUS2**)	200 - 450	0.0016 - 0.0060	1-2
Stainless Steel (SUS405,410L,430)	165 - 400	0.0016 - 0.0060	1-2
Stainless Steel (15-5, 17-4PH)	130 - 350	0.0016 - 0.0060	2
Cast Iron (SC)	300 - 450	0.0012 - 0.0040	1
Cast Iron (FC)	250 - 400	0.0008 - 0.0035	1
Ductile Cast Iron (upto FCD500)	210 - 310	0.0012 - 0.0040	1
Ductile Cast Iron (over FCD500)	210 - 280	0.0012 - 0.0040	1
Aluminum Alloy (A****)	300 - 500	0.0012 - 0.0040	1
Aluminum Alloy Casting Si [12]%	280 - 550	0.0012 - 0.0050	1
Aluminum Alloy Casting Si [12-16]%	250 - 460	0.0012 - 0.0040	1
Aluminum Alloy Casting with Si [16-20]%	210 - 400	0.0012 - 0.0040	1
Aluminum Alloy Casting with Si [20-25]%	200 - 350	0.0012 - 0.0040	1
Copper,Copper Casting (C1***,CuC)	300 - 510	0.0012 - 0.0040	1
Brass, Brass Casting (C2***,C3***,Bs,BsC)	300 - 510	0.0012 - 0.0040	1
Bronze,Bronze Casting (C6***,PB,PBC)	300 - 500	0.0012 - 0.0040	1
Magnesium Alloy Casting	210 - 410	0.0012 - 0.0050	1
Zinc Alloy Casting	180 - 380	0.0012 - 0.0050	1
Titanium Alloy (Ti-6Al-4V)	100 - 330	0.0012 - 0.0025	2
High Heat Resistance Alloy (Inconel)	65 - 260	0.0008 - 0.0020	2
High Heat Resistance Alloy (Inconel >40HRC)	65 - 200	0.0008 - 0.0020	4
Thermoplastic	220 - 510	0.0012 - 0.0050	1
Cobalt/Chrome Alloy (Stellite)	65 - 200	0.0016 - 0.0060	3

For chip loads, the smaller cutter diameters use a smaller chip load per tooth within a given range. Larger cutter diameters use the larger chip load per tooth within the given range. For programming help or other information, please contact our engineering department.



## List 41200/41300 - EXOCARB® Thread Mill Mini

Work Material	Thread Sizes under #2 / M2			Thread Sizes #2 / M2 & Larger		
	SFM	"Feed Rate	No. of Passes	SFM	"Feed Rate	No. of Passes
Low Carbon Steel (S5400, under S25C)	200 - 300	0.0008 - 0.0020	2	200 - 300	0.0008 - 0.0030	1
Medium Carbon Steel (S3C-S50C)	200 - 300	0.0008 - 0.0020	2	200 - 300	0.0008 - 0.0030	1
High Carbon Steel (S53C-S58C)	200 - 300	0.0008 - 0.0020	2	200 - 300	0.0008 - 0.0030	1
Alloy Steel (SCr,SCM,SNC)	—	—	—	100 - 200	0.0004 - 0.0012	1-2
Heat Treated Steel (28-34HRC)	—	—	—	100 - 200	0.0004 - 0.0012	1
Heat Treated Steel (34-40HRC)	—	—	—	100 - 200	0.0004 - 0.0012	1-2
Heat Treated Steel (40-50HRC)	—	—	—	100 - 200	0.0004 - 0.0012	2-4
Stainless Steel (SUS3**,SUS2**)	200 - 300	0.0008 - 0.0020	2-3	200 - 300	0.0008 - 0.0030	1-2
Stainless Steel (SUS405,410L,430)	200 - 300	0.0008 - 0.0020	2-3	200 - 300	0.0008 - 0.0030	1-2
Stainless Steel (15-5, 17-4PH)	200 - 300	0.0008 - 0.0020	3	200 - 300	0.0008 - 0.0030	2
Cast Iron (SC)	130 - 200	0.0008 - 0.0020	2	165 - 330	0.0012 - 0.0040	1
Cast Iron (FC)	130 - 200	0.0008 - 0.0020	2	165 - 330	0.0012 - 0.0040	1
Ductile Cast Iron (upto FCD500)	130 - 200	0.0008 - 0.0020	2	165 - 230	0.0012 - 0.0040	1
Ductile Cast Iron (over FCD500)	130 - 300	0.0008 - 0.0020	2	165 - 230	0.0012 - 0.0040	1
Aluminum Alloy (A****)	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Aluminum Alloy Casting Si [12]%	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Aluminum Alloy Casting Si [12-16]%	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Aluminum Alloy Casting with Si [16-20]%	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Aluminum Alloy Casting with Si [20-25]%	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Copper,Copper Casting (C1***,CuC)	—	—	—	—	—	—
Brass, Brass Casting (C2***,C3***,Bs,BsC)	200 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Bronze,Bronze Casting (C6***,PB,PBC)	—	—	—	165 - 330	0.0008 - 0.0025	1
Magnesium Alloy Casting	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Zinc Alloy Casting	230 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Titanium Alloy (Ti-6Al-4V)	65 - 130	0.0004 - 0.0012	3	65 - 200	0.0004 - 0.0012	2
High Heat Resistance Alloy (Inconel)	—	—	—	65 - 200	0.0004 - 0.0012	2
High Heat Resistance Alloy (Inconel >40HRC)	—	—	—	65 - 200	0.0004 - 0.0012	4
Thermoplastic	165 - 330	0.0015 - 0.0030	2	165 - 330	0.0008 - 0.0025	1
Cobalt/Chrome Alloy (Stellite)	—	—	—	—	—	—

For chip loads, the smaller cutter diameters use a smaller chip load per tooth within a given range. Larger cutter diameters use the larger chip load per tooth within the given range.  
For programming help or other information, please contact our engineering department.

## OSG PHOENIX® Product Lineup

### Drilling

#### OSG PHOENIX® PXD

Exchangeable head drill series for efficient, precise hole processing.

#### OSG PHOENIX® PD

Indexable drill series for efficient, stable hole processing.

#### OSG PHOENIX® PHP

High performance 3D indexable drill.

### Milling

#### OSG PHOENIX® PAS

45° indexable facemills with 2-sided square insert.

#### OSG PHOENIX® PAO

45° indexable facemills with 2-sided octagon insert.

#### OSG PHOENIX® PSE

Multifunctional 90° indexable end mills and facemills.

#### OSG PHOENIX® PSF

90° indexable shoulder end mills and facemills.

#### OSG PHOENIX® PSEL

90° indexable roughing end mills and facemills.

#### OSG PHOENIX® PRC

Button insert end mills and facemills for contour milling applications.

#### OSG PHOENIX® PHC

High feed end mills and facemills for maximum metal removal rates in a variety of applications.

#### OSG PHOENIX® PDR

Deep feed radius end mills and facemills for deeper depths of cut versus conventional high feed cutters.

#### OSG PHOENIX® PFB

High precision indexable finish ballnose end mills for superior surface finish and tool life.

#### OSG PHOENIX® PFR

High precision indexable finish radius end mills for superior surface finish and tool life.

#### OSG PHOENIX® SF

Modular indexable end mills for a variety of applications.

#### OSG PHOENIX® PXM

Exchangeable head end mill series for superior surface finish and precision in a variety of applications.

## OSG PHOENIX® PRC - Radius Cutter

Long tool life in Inconel 718 (45HRC)

The competitor tool chipped severely after milling 2 meters with damage extending to other corners, and made the tool unusable. In contrast, the PRC was able to mill 10 meters and resulted in considerably longer tool life.

Tool	PRC12R050M22-5	Competitor
Insert (grade)	RPHT1204MOEN-SM(XC5035)	Coated Carbide Chip
Work Material	Inconel 718 (45HRC)	
Cutting Speed	131 SFM (255 RPM)	196 SFM (382 RPM)
Feed	10.63 IPM (0.008 in/t)	10.63 IPM (0.005 in/t)
Depth of Cut	$a_a=0.020"$ $a_r=1.181"$	
Coolant	Water Soluble	
Machine	Horizontal Machining Center	
Durability	10m	2m



Photo of Insert After Milling 2m



## OSG PHOENIX® PSE - 90° Shoulder Cutter

Long tool life in Inconel 718 (45HRC)

OSG PHOENIX® PSE was able to mill at conditions that were 50% higher than those for conventional tools. It provided double the durability, wore normally and provided longer tool life.

Tool	PSE11R032SS32-5S	Competitor
Insert (grade)	ZDKT11T308ER-SM(XC5040)	Coated Carbide Chip
Work Material	Inconel 718 (45HRC)	
Cutting Speed	98 SFM (298 RPM)	82 SFM (248 RPM)
Feed	4.72 IPM (0.003 in/t)	3.15 IPM (0.003 in/t)
Depth of Cut	$a_a=0.040"$ $a_r=0.787"$	
Coolant	Water Soluble	
Machine	Vertical Machining Center	

Photo of Tool After Milling 1.5m



# Nickel Alloy Solutions

OSG Phoenix Indexable Tooling

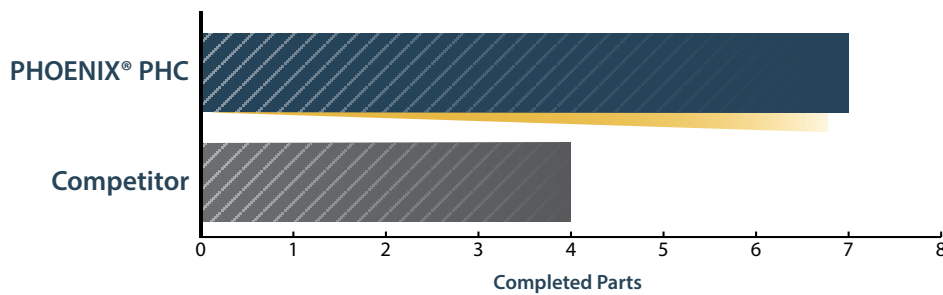
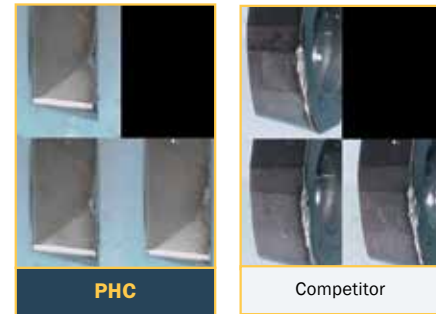
## OSG PHOENIX® PHC - High Feed Radius Cutter

Rough Milling of Blades

A blade was rough-milled under the same conditions for comparison. The PHC provided 1.75 times the durability with more stable milling and with inserts exhibiting normal wear.



<b>Tool</b>	<b>PHC09R032SS32-3S</b>	Competitor
<b>Insert (grade)</b>	SDMT09T308ER-SM(XC5040)	Coated Carbide Chip
<b>Work Material</b>	630 Stainless Steel	
<b>Cutting Speed</b>	262 SFM (796 RPM)	
<b>Feed</b>	31.5 IPM (0.013 in/t)	
<b>Depth of Cut</b>	a <sub>a</sub> =0.020" • a <sub>r</sub> = 1.260"	
<b>Coolant</b>	Water Soluble	
<b>Machine</b>	Vertical Machining Center	



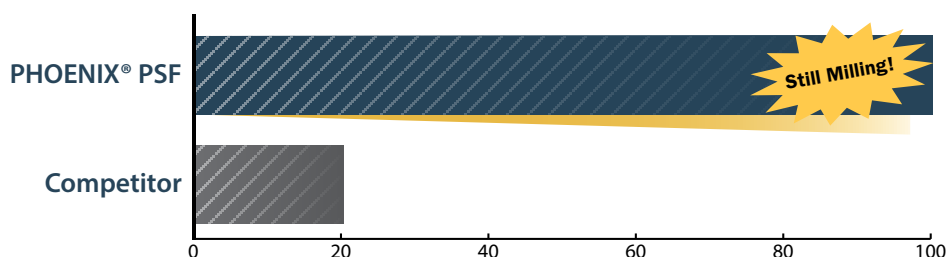
## OSG PHOENIX® PSF - 90° Shoulder Cutter

Long Tool Life in Duplex Stainless Steel

The competitor tool chipped early on, however, the PHOENIX® PSF's stable milling resulted in **5 times the tool life!**



<b>Tool</b>	<b>PSF09R025SS25-3S</b>	Competitor
<b>Insert (grade)</b>	SDKT09T308SR-GL(XC5040)	Coated Carbide Chip
<b>Work Material</b>	Duplex Stainless Steel	
<b>Cutting Speed</b>	262 SFM (800 RPM)	
<b>Feed</b>	11.81 IPM (0.004 ipt)	
<b>Depth of Cut</b>	A <sub>a</sub> = 0.079 in, A <sub>r</sub> = 0.591 in	
<b>Coolant</b>	Water Soluble	
<b>Machine</b>	Vertical Machining Center	





## OSG PHOENIX® PFB - Finishing Ball End Mill

### Wear Resistance in Heat-Resistant Steel

The OSG PHOENIX® PFB demonstrated exceptional wear resistance when machining SUH600 heat-resistant steel.

Tool	<b>PFB-R200SS20-S160</b>
Insert (grade)	PFB200-SP (XP3320)
Workpiece	Blade Sample Model
Work Material	SUH600 Steel
Overall Length	4.331 in
Cutting Speed	308 SFM (1500 RPM)
Feed	78.74 IPM (0.026 ipt)
Milling Method	Profile Milling
Depth of Cut	Aa = 0.008 in, Ar = 0.039 in
Coolant	Water Soluble
Machine	Vertical Machining Center

Time	70 minutes		140 minutes	
Milling Length	4,000 in		8,000 in	
<b>PFB</b>				
	Wear Amount (in)	0.0012	0.0011	0.0016
<b>Competitor</b>				
	Wear Amount (in)	0.0012	0.0013	0.0027

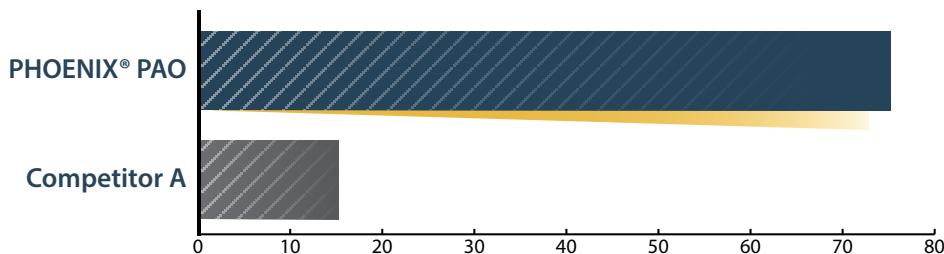


## OSG PHOENIX® PAO - 45° Face Milling Cutter

### Rough Milling of Blades

In Inconel 718, the PHOENIX® PAO demonstrated excellent wear resistance and achieved four times the durability versus the competitor.

Tool	<b>PAO06R125M38.1-12</b>	Competitor
Insert (grade)	OZKU060508SR-GM (XC5040)	Coated Carbide Chip
Work Material	Inconel 718	
Cutting Speed	131 SFM (100 RPM)	
Feed	4.72 IPM (0.004 ipt)	
Depth of Cut	Aa = 0.059 in, Ar = 1.968 in	
Coolant	Water Soluble	
Machine	Vertical Machining Center	



# Nickel Alloy Solutions

V-Series Drills

## V-Series Drilling Lineup

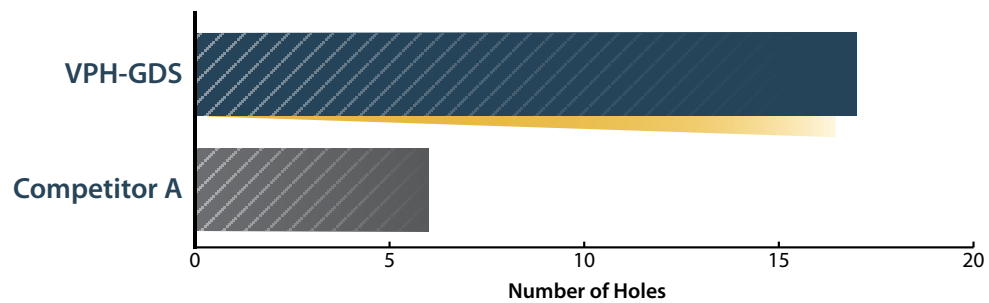
XPM powdered metal drills, V-coated. Ideal for Nickel Alloys and other difficult to machine materials.

Series	List Number	Style	Size Range	Work Material									
				Alloy Steels	Titanium	Nickel Alloys	Stainless Steels			Hardened Steels			
				4140, 4340	6AL4V	20 HRC	300	400	17-4PH	~35 HRC	34-45 HRC	45-50 HRC	
VPH-GDS	1900	Stub	#73 - 3/4" (0.50 - 20mm)	☐	☐	☐		☐	☐	☐	☐	☐	☐
VPH-GDR	1950	Jobbers	#47 - 1 1/16"	☐	☐	☐		☐	☐	☐	☐	☐	☐

## Performance of VPH-GDS

Inconel 718

Made of high-quality powdered HSS, the highly rigid body combined with a sharp cutting edge is able to surpass the competitor's durability when machining Inconel 718. In a general oil-based coolant environment, the VPH-GDS is also able to provide more stable machining.



<b>Tool</b>	φ5.9
<b>Work Material</b>	Inconel 718 (43HrC)
<b>Drilling Speed</b>	6m/min (324min <sup>-1</sup> )
<b>Feed</b>	19mm/min (0.06mm/rev)
<b>Depth of Hole</b>	12mm (Blind) 3mm Step
<b>Coolant</b>	Water Soluble (External)
<b>Machine</b>	Vertical Machining Center



## EXOTAP® VC-10 Taps


VC-10 powdered metal taps, steam-oxide or V-coated. Ideal for Nickel Alloys and other difficult to machine materials.

Series	List Number	Style	Size Range	Features	Work Material									
					Alloy Steels	Titanium	Nickel Alloys	Stainless Steels			Hardened Steels			
					4140, 4340	6AL4V	20 HRC	300	400	17-4PH	~35 HRC	34-45 HRC	45-50 HRC	
EXOTAP® VC-10 Ni	313Ni	Spiral Flute	#2 - 1"	VC-10 Powdered Metal Tap, V-coated Ideal for Ni-Alloys & Difficult to Machine Materials		○	⊗			○	○	○		
	345Ni		M2.5 - M12											
	312Ni	Spiral Point	#2 - 1"											
	344Ni		M2.5 - M12											
	317Ni	Spiral Flute	1/4" - 1"		Coolant-Through VC-10 Powdered Metal Tap, V-coated, Ideal for Ni-Alloys & Difficult to Machine Materials		○	⊗			○	○	○	
	348Ni		M6 - M24											
	316Ni	Spiral Point	1/4" - 1"											
347Ni	M6 - M24													
EXOTAP® VC-10 Ti	313Ti	Spiral Flute	#2 - 1"	VC-10 Powdered Metal Tap, Steam-Oxide or V-coated Ideal for Ti-Alloys & Difficult to Machine Materials		○	⊗	⊗			○	○	○	
	345Ti		M2.5 - M12											
	312Ti	Spiral Point	#2 - 1"											
	344Ti		M3 - M12											
	317Ti	Spiral Flute	1/4" - 1"		Coolant-Through VC-10 Powdered Metal Tap, Steam-Oxide or V-coated, Ideal for Ti-Alloys & Difficult to Machine Materials		○	⊗	⊗			○	○	○
	348Ti		M6 - M24											
	316Ti	Spiral Point	1/4" - 1"											
347Ti	M6 - M24													
EXOTAP® VC-10	313	Spiral Flute	#2 - 3/4"	VC-10 Powdered Metal Tap, Steam-Oxide or V-coated Ideal for Difficult to Machine Materials		⊗	○	○		○	⊗	⊗	○	
	345		M3 - M12											
	312	Spiral Point	#2 - 3/4"											
	344		M3 - M12											
	317	Spiral Flute	1/4" - 1"		Coolant-Through VC-10 Powdered Metal Tap, Steam-Oxide or V-coated, Ideal for Difficult to Machine Materials		○	○		○	⊗	⊗	○	
	351		M6 - M24											
	316	Spiral Point	1/4" - 1"											
350	M6 - M24													





*shaping your dreams*

 **Safe use of cutting tools**

- Use safety cover, safety glasses and safety shoes during operation.
- Do not touch cutting edges with bare hands.
- Do not touch cutting chips with bare hands. Chips will be hot after cutting.
- Stop cutting when the tool becomes dull.
- Stop cutting operation immediately if you hear any abnormal cutting sounds.
- Do not modify tools.
- Please use appropriate tools for the operation. Check dimensions to ensure proper selection.

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