NEW!

Vol. 1

OSG NICKEL ALLOY Solutions

NICKEL ALLOY
Index

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.

In recent years, however, nickel-based alloy applications have become increasingly more 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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EXOPRO®-WHR-Ni Spiral Flute, Spiral Point

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EXOPRO®-UVX-Ni Multiple Lengths, 5 Flute, Corner Radius

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PHOENIX®

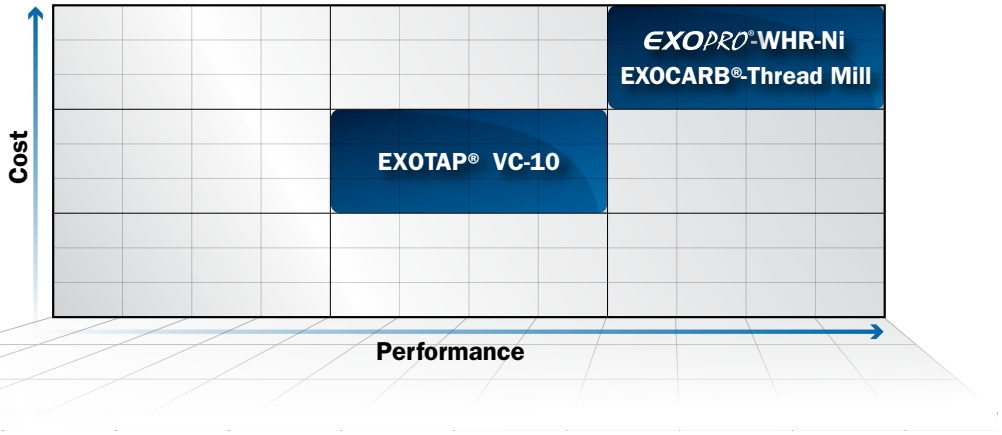
V-Series

EXOTAP® VC-10 Taps

NICKEL ALLOY
Introduction

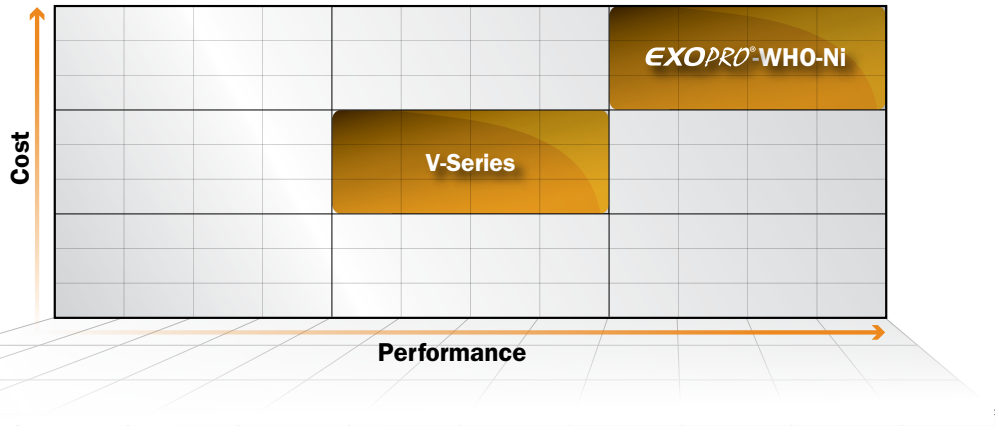
Threading

EXOPRO®-WHR-Ni



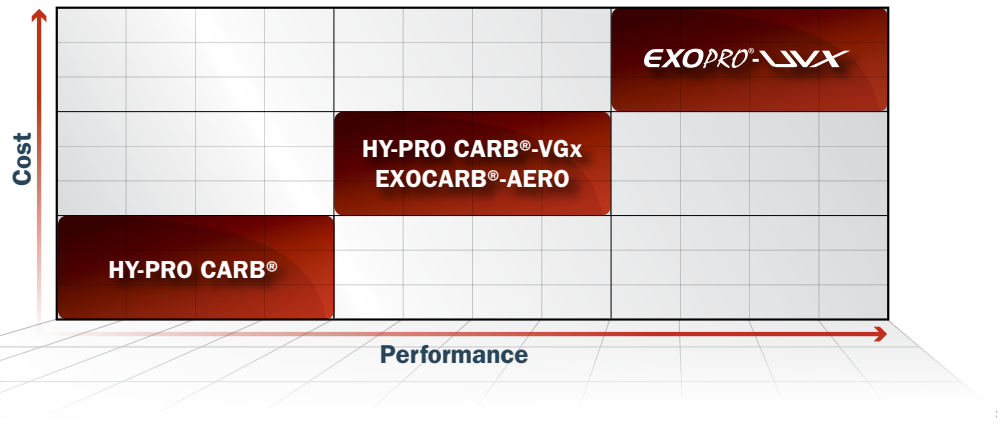
Drilling

EXOPRO®-WHO-Ni



Milling

EXOPRO®-UVX-Ni

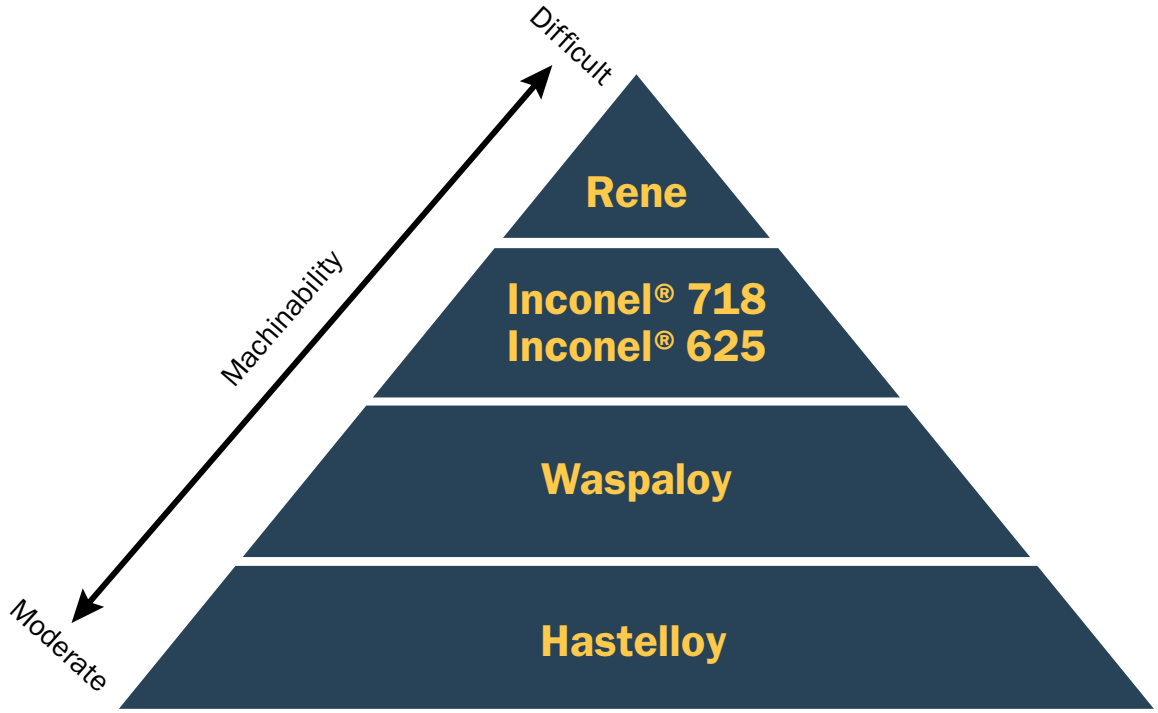


10 Time More Difficult to Machine than Free-Cutting Steel

Machinability Chart

Machinability of Materials												
Material	Free-Cutting Steel	Low Carbon Steel	Med. Carbon Steel	High Carbon Steel	Cast Iron	Stainless Steels			Titanium	Heat Resistant Alloys		
	AISI B1112	1018	1045	1065		Ferritic	Martensitic	Austenitic	6AL4V	Fe-Based	Ni-Based	Co-Based
Machinability	100%	85%	65%	60%	50%	65%	55%	50%	30%	27%	15%	10%

Machinability of Heat Resistant Alloys



EXOPRO®-WHO-Ni

Features & Benefits

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 of 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.

EXOPRO®-WHO-Ni	Competitor
	

4

Excellent Wear Resistance

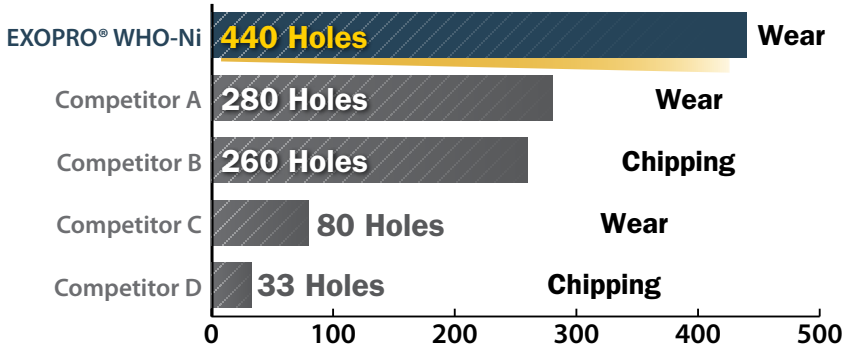
The incredible high hardness and heat resistance of OSG's WXS® coating, coupled with internally-fed coolant, ensures long, stable tool life.

1.5 Times Longer Tool Life vs. Competitors

Performance in Inconel 718

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

Tool	WHO-Ni 3D ϕ6mm
Work Material	Inconel® 718 (43 HRC)
Drilling Speed	98 SFM (1,592 RPM)
Feed	5.63 IPM (0.0035 in/rev)
Depth of Hole	18mm (Blind) No-Step
Coolant	Water Soluble (Internal)
Machine	Vertical Machining Center



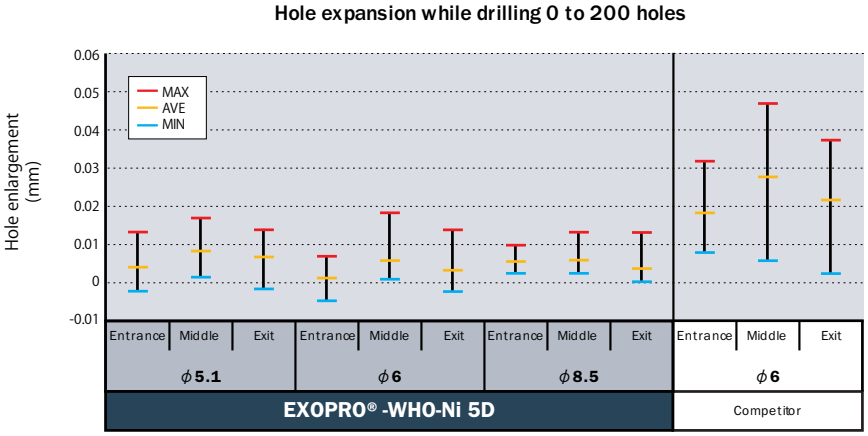
Wear after drilling 440 holes.

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.

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



EXOPRO®-WHO-Ni

Drills Designed for Nickel Alloys

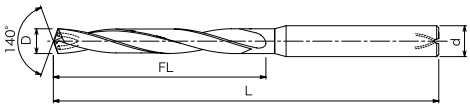
List 5950Ni NEW!

3D, Coolant-Through

SPEED FEED P28 | CARBIDE | WXS® | 12-20° | SHRINK h6

h8 Tolerance for cutting diameter

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	Overall Length	Shank Diameter
	Fractional Size	Wire Gage	Letter Size	mm	Inch	FL	L	d
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.

EP

List 5950Ni (continued) NEW!

SPEED FEED P28 | CARBIDE | WXS® | 12°-20° | SHRINK h6

3D, Coolant-Through

EDP Number	Size					Flute Length	Overall Length	Shank Diameter
	Fractional Size	Wire Gage	Letter Size	mm	Inch	FL	L	d
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® coating only.

EP

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		
5950Ni			▢	▢	▢				◎	◎	▢		◎		

▢ good ◎ best

EXOPRO®-WHO-Ni

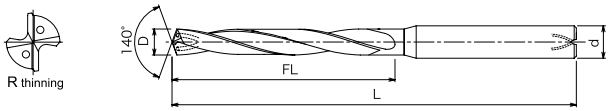
Drills Designed for Nickel Alloys

List 5955Ni NEW!

5D, Coolant-Through

SPEED FEED P28 | CARBIDE | WXS® | 12-20° | SHRINK h6

h8 Tolerance for cutting diameter
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	Overall Length	Shank Diameter
	Fractional Size	Wire Gage	Letter Size	mm	Inch	FL	L	d
595511811	-	-	-	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® coating only.

EP

List 5955Ni (continued) NEW!

SPEED FEED P28 | CARBIDE | WXS® | 12-20° | SHRINK h6

5D, Coolant-Through

EDP Number	Size					Flute Length	Overall Length	Shank Diameter
	Fractional Size	Wire Gage	Letter Size	mm	Inch	FL	L	d
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® coating only.

EP

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			▢	▢	▢				◎	◎	▢		◎		

▢ good ◎ best

EXOPRO®-WHR-Ni
Features & Benefits

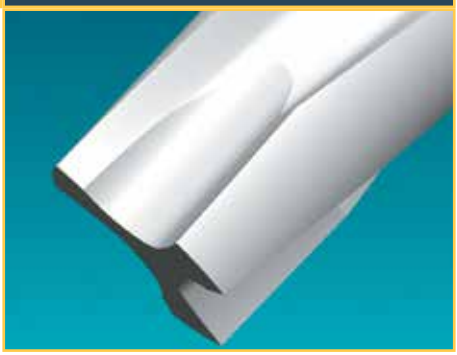
Tapping Nickel-Based Alloys

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.

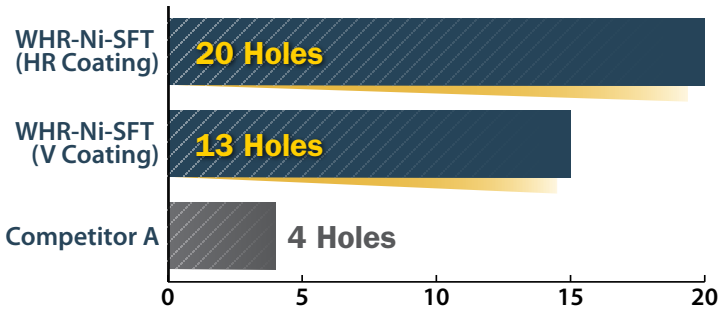
OSG Solution — ***OSG's HR Coating for Nickel-Based Alloys***

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, however, 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

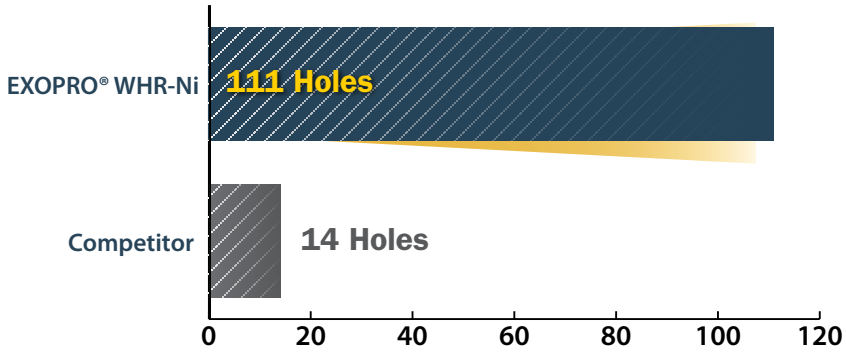


8 Times the Tool Life!

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).

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

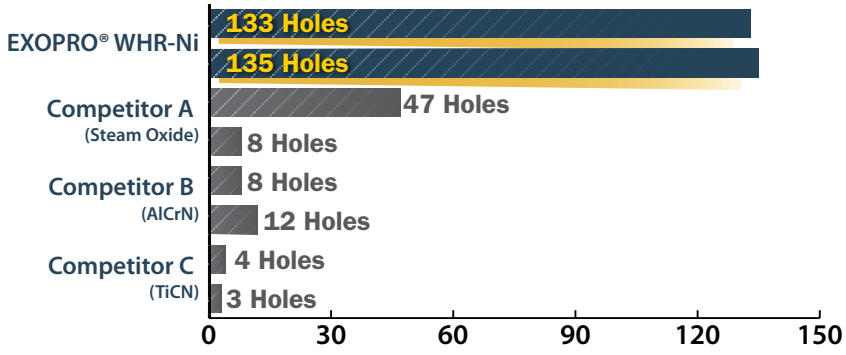


Stable Long Tool Life

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 too.

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



	Tap No. 1		Tap No. 2	
	60 Holes	120 Holes	60 Holes	120 Holes
WHR-Ni				

EXOPRO®-WHR-Ni

Taps Designed for Nickel-Based Alloys

List 335Ni NEW!

VC10 | HR | 11°

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

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

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
Recommended									◎			○		○	○
SFM									8-15			8-20		8-15	3-10

○ good ◎ best

List 336Ni NEW!

VC10 | HR | 11°

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

Tap Size	Pitch	Thread Limit	No. of Flutes	EDP Number
M2.5	0.45	D3	3	3360250453
M3	0.5	D3	3	3360003053
M4	0.7	D4	3	3360004074
M5	0.8	D4	3	3360005084
M6	0.75	D5	3	3360006755
M6	1.0	D5	3	3360006105
M8	1.0	D5	3	3360008105
M8	1.25	D5	3	3360008255
M10	1.25	D5	3	3360010255
M10	1.5	D6	3	3360010156
M12	1.5	D6	3	3360012156
M12	1.75	D6	3	3360012756
M14	1.5	D6	3	3360014156
M14	2.0	D7	3	3360014207
M16	1.5	D6	3	3360016156
M16	2.0	D7	3	3360016207
M18	1.5	D6	3	3360018156
M18	2.5	D7	3	3360018257
M20	1.5	D6	3	3360020156
M20	2.5	D8	3	3360020258
M22	1.5	D6	3	3360022156
M22	2.5	D8	3	3360022258
M24	1.5	D6	4	3360024156
M24	3.0	D8	4	3360024308

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
Recommended									◎			○		○	○
SFM									8-15			8-20		8-15	3-10

○ **good** ◎ **best**

EXOPRO®-WHR-Ni

Taps Designed for Nickel-Based Alloys

List 337Ni NEW!

VC10 HR

Plug (5P), Spiral Point

Tap Size	Threads Per Inch		Thread Limit	Flutes	EDP Number
	UNC	UNF			
2	56	–	H2	2	3370002562
4	40	–	H2	3	3370004402
4	40	–	H3	3	3370004403
4	–	48	H2	2	3370004482
6	32	–	H2	3	3370006322
6	32	–	H3	3	3370006323
8	32	–	H2	3	3370008322
8	32	–	H3	3	3370008323
10	24	–	H2	3	3370010242
10	24	–	H3	3	3370010243
10	–	32	H2	3	3370010322
10	–	32	H3	3	3370010323
1/4	20	–	H3	3	3370014203
1/4	20	–	H5	3	3370014205
1/4	–	28	H3	3	3370014283
1/4	–	28	H4	3	3370014284
5/16	18	–	H3	3	3370516183
5/16	18	–	H5	3	3370516185
5/16	–	24	H3	3	3370516243
5/16	–	24	H5	3	3370516245
3/8	16	–	H3	3	3370038163
3/8	16	–	H5	3	3370038165
3/8	–	24	H3	3	3370038243
3/8	–	24	H5	3	3370038245
7/16	14	–	H3	3	3370716143
7/16	14	–	H5	3	3370716145
7/16	–	20	H3	3	3370716203
7/16	–	20	H5	3	3370716205
1/2	13	–	H3	3	3370012133
1/2	13	–	H5	3	3370012135
1/2	–	20	H3	3	3370012203
1/2	–	20	H5	3	3370012205
9/16	–	18	H3	3	3370916183
9/16	–	18	H5	3	3370916185
5/8	11	–	H3	3	3370058113
5/8	11	–	H5	3	3370058115
5/8	–	18	H3	3	3370058183
5/8	–	18	H5	3	3370058185
3/4	10	–	H3	4	3370034103
3/4	10	–	H5	4	3370034105
3/4	–	16	H3	4	3370034163
3/4	–	16	H5	4	3370034165
7/8	9	–	H3	4	3370078093
7/8	9	–	H5	4	3370078095
7/8	–	14	H3	4	3370078143
7/8	–	14	H5	4	3370078145
1	8	–	H3	4	3370001083
1	8	–	H5	4	3370001085
1	–	12	H3	4	3370001123
1	–	12	H5	4	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
Recommended									◎			○		○	○
SFM									8-15			8-20		8-15	3-10

○ **good** ◎ **best**

List 338Ni NEW!

VC10 HR

Plug (5P), Spiral Point

Tap Size	Pitch	Thread Limit	No. of Flutes	EDP Number
M2.5	0.45	D3	2	3380250453
M3	0.5	D3	3	3380003053
M4	0.7	D4	3	3380004074
M5	0.8	D4	3	3380005084
M6	0.75	D5	3	3380006755
M6	1.0	D5	3	3380006105
M8	1.0	D5	3	3380008105
M8	1.25	D5	3	3380008255
M10	1.25	D5	3	3380010255
M10	1.5	D6	3	3380010156
M12	1.5	D6	3	3380012156
M12	1.75	D6	3	3380012756
M14	1.5	D6	3	3380014156
M14	2.0	D7	3	3380014207
M16	1.5	D6	3	3380016156
M16	2.0	D7	3	3380016207
M18	1.5	D6	3	3380018156
M18	2.5	D7	3	3380018257
M20	1.5	D6	3	3380020156
M20	2.5	D8	3	3380020258
M22	1.5	D6	3	3380022156
M22	2.5	D8	3	3380022258
M24	1.5	D6	4	3380024156
M24	3.0	D8	4	3380024308

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
Recommended									◎			○		○	○
SFM									8-15			8-20		8-15	3-10

○ **good** ◎ **best**

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 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 are no worries about 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	

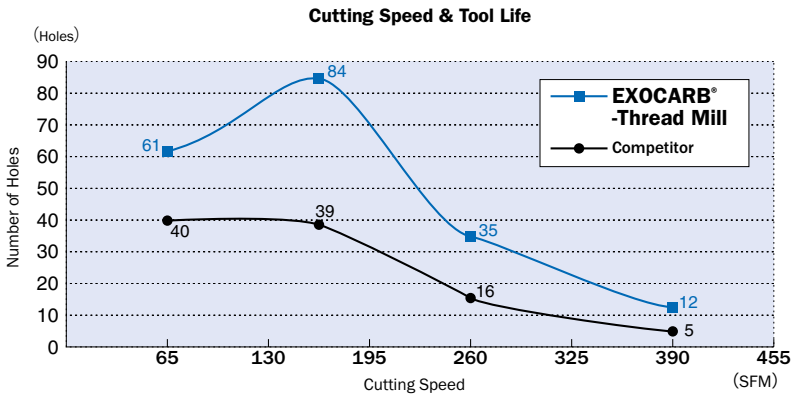
Cutting Speed	Passes	Tool life holes
130 SFM	4	50 Holes
195 SFM	4	60 Holes
	2	40 Holes

Double the Tool Life at Any Cutting Speed

Performance in Inconel 718

At various cutting speeds under 165 SFM, durability is better. The EXOCARB®-Thread Mill achieves 2x 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 NEW SIZES

SPEED FEED P29-30 | CARBIDE | EXO® | 11°-30° | SHRINK h6

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

Size	Threads Per Inch				Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
	UNC	UNF	UNEF	UNS	D	L	Lc	L1	d			
10	24	–	–	–	0.130	2.5	0.396	0.440	3/16	3	1	4100000411
10	–	32	–	–	0.130	2.5	0.391	0.440	3/16	3	1	4100000511
12	24	–	–	–	0.160	3	0.354	0.370	1/4	3	1	4100000611
12	–	28	–	–	0.160	3	0.339	0.360	1/4	3	1	4100000711
1/4	20	–	–	–	0.180	3	0.425	0.450	1/4	3	1	4100000811
1/4	20	–	–	–	0.180	3	0.540	0.560	1/4	3	1	4100003211
1/4	–	28	–	–	0.180	3	0.411	0.430	1/4	3	1	4100000911
1/4	–	28	–	–	0.180	3	0.540	0.560	1/4	3	1	4100003311
1/4	–	–	32	–	0.190	3	0.390	0.410	1/4	3	1	4100002811
5/16	18	–	–	–	0.245	3	0.528	–	1/4	3	2	4100001011
5/16	18	–	–	–	0.245	3	0.740	–	1/4	3	2	4100003411
5/16	–	24	–	–	0.245	3	0.521	–	1/4	3	2	4100001111
5/16	–	24	–	–	0.245	3	0.740	–	1/4	3	2	4100003511
5/16	–	–	32	–	0.250	3	0.484	–	1/4	3	2	4100002911
3/8	16	–	–	–	0.300	3	0.594	–	5/16	3	2	4100001211
3/8	16	–	–	–	0.300	3	0.900	–	5/16	3	2	4100003611
3/8	–	24	–	–	0.300	3	0.604	–	5/16	3	2	4100001311
3/8	–	24	–	–	0.300	3	0.900	–	5/16	3	2	4100003711
3/8	–	–	32	–	0.310	3	0.578	–	5/16	3	2	4100003011
7/16	14	–	–	–	0.350	3	0.750	0.780	3/8	3	1	4100001411
7/16	14	–	–	–	0.350	3	1.050	1.070	3/8	3	1	4100003811
7/16	–	20	–	–	0.350	3	0.725	0.750	3/8	3	1	4100001511
7/16	–	20	–	–	0.350	3	1.050	1.070	3/8	3	1	4100003911
1/2	13	–	–	–	0.370	3	0.808	–	3/8	4	2	4100001611
1/2	13	–	–	–	0.370	3	1.110	–	3/8	4	2	4100004011
1/2	–	20	–	–	0.370	3	0.775	–	3/8	4	2	4100001711
1/2	–	20	–	–	0.370	3	1.110	–	3/8	4	2	4100004111
1/2	–	–	–	32	0.375	3	0.766	–	3/8	4	2	4100003111
9/16	12	–	–	–	0.430	4	0.958	1.000	1/2	4	1	4100001811
9/16	12	–	–	–	0.460	4	1.380	1.400	1/2	4	1	4100004211
9/16	–	18	–	–	0.450	4	0.917	0.990	1/2	4	1	4100001911
9/16	–	18	–	–	0.460	4	1.380	1.400	1/2	4	1	4100004311
5/8	11	–	–	–	0.430	4	1.045	1.090	1/2	4	1	4100002011
5/8	11	–	–	–	0.495	4	1.480	–	1/2	4	2	4100004411
5/8	–	18	–	–	0.495	4	0.972	–	1/2	4	2	4100002111
5/8	–	18	–	–	0.495	4	1.490	–	1/2	4	2	4100004511
3/4	10	–	–	–	0.620	4	1.250	–	5/8	4	2	4100002211
3/4	10	–	–	–	0.620	4	1.670	–	5/8	4	2	4100004611
3/4	–	16	–	–	0.620	4	1.156	–	5/8	4	2	4100002311
3/4	–	16	–	–	0.620	4	1.670	–	5/8	4	2	4100004711
7/8	9	–	–	–	0.745	4	1.389	–	3/4	4	2	4100002411
7/8	9	–	–	–	0.745	4	2.010	–	3/4	4	2	4100004811

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

HTE

List 41000 (Continued)

NEW SIZES

SPEED FEED P29-30 | CARBIDE | EXO® | 11°-30° | SHRINK h6

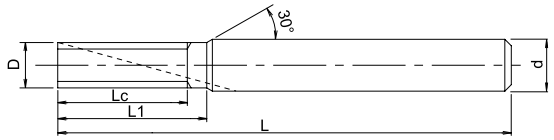
UNC/UNF/UNEF/UNS, Regular & Long Length, Helical Flute

Size	Threads Per Inch				Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
	UNC	UNF	UNEF	UNS	D	L	Lc	L1	d			
7/8	–	14	–	–	0.745	4	1.393	–	3/4	4	2	4100002511
7/8	–	14	–	–	0.745	4	2.010	–	3/4	4	2	4100004911
1	8	–	–	–	0.745	4	1.688	–	3/4	4	2	4100002611
1	8	–	–	–	0.745	4	2.010	–	3/4	4	2	4100005011
1	–	12	–	–	0.745	4	1.625	–	3/4	4	2	4100002711
1	–	12	–	–	0.745	4	2.010	–	3/4	4	2	4100005111

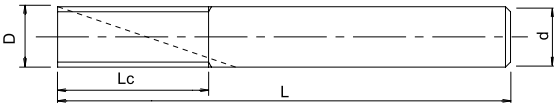
Packed: 1 pc. Available EXO®coating only.
For internal threads only.

HTE

Type 1



Type 2



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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
41000	▢	◎	◎	◎	◎	◎	◎	▢	▢	▢	◎	◎	◎	◎	◎	▢		

▢ **good** ◎ **best**

EXOCARB®-Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

List 41100 NEW SIZES

SPEED FEED P29-30 | CARBIDE | EXO® | 11°-30° | SHRINK h6

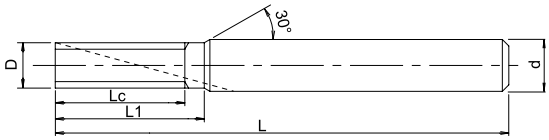
Regular & Long Length, Helical Flute

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

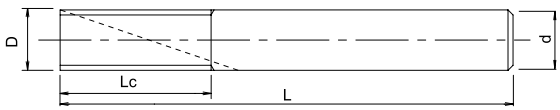
Packed: 1 pc. Available EXO®coating only.
For internal threads only.

HTE

Type 1



Type 2



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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
41100	○	◎	◎	◎	◎	◎	◎	○	○	○	◎	◎	◎	◎	◎	○		

○ **good** ◎ **best**

EXOCARB®-Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

List 41050 NEW!

SPEED FEED P29-30 | CARBIDE | EXO | 11° | SHRINK h6

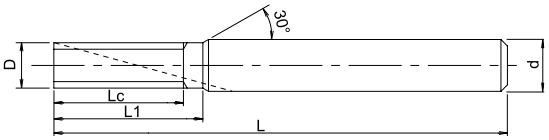
UNC/UNF, Coolant-through, Long Length, Helical Flute

Size	Threads Per Inch		Cutter Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter	No. of Flutes	Type	EDP Number
	UNC	UNF	D	L	Lc	L1	d			
1/4	20	–	0.180	3	0.540	0.560	1/4	4	1	4105000111
1/4	–	28	0.180	3	0.540	0.560	1/4	4	1	4105000211
5/16	18	–	0.245	3	0.735	–	1/4	4	2	4105000311
5/16	–	24	0.245	3	0.735	–	1/4	4	2	4105000411
3/8	16	–	0.300	3	0.900	–	5/16	4	2	4105000511
3/8	–	24	0.300	3	0.900	–	5/16	4	2	4105000611
7/16	14	–	0.350	3	1.050	1.070	3/8	4	1	4105000711
7/16	–	20	0.350	3	1.050	1.070	3/8	4	1	4105000811
1/2	13	–	0.370	3	1.110	–	3/8	5	2	4105000911
1/2	–	20	0.370	3	1.110	–	3/8	5	2	4105001011
9/16	12	–	0.460	4	1.380	1.400	1/2	5	1	4105001111
9/16	–	18	0.460	4	1.380	1.400	1/2	5	1	4105001211
5/8	11	–	0.495	4	1.485	–	1/2	5	2	4105001311
5/8	–	18	0.495	4	1.485	–	1/2	5	2	4105001411
3/4	10	–	0.620	4	1.674	–	5/8	5	2	4105001511
3/4	–	16	0.620	4	1.674	–	5/8	5	2	4105001611
7/8	9	–	0.745	4	2.012	–	3/4	5	2	4105001711
7/8	–	14	0.745	4	2.012	–	3/4	5	2	4105001811
1	8	–	0.745	4	2.012	–	3/4	5	2	4105001911
1	–	12	0.745	4	2.012	–	3/4	5	2	4105002011

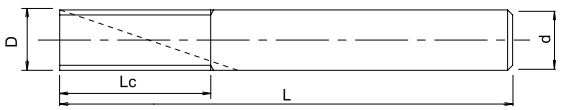
Packed: 1 pc. Available EXO®coating only.
For internal threads only.

HTE

Type 1



Type 2



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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
41050	▢	◎	◎	◎	◎	◎	◎	▢	▢	▢	◎	◎	◎	◎	◎	▢		

▢ **good** ◎ **best**

EXOCARB®-Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

List 41150 NEW!

SPEED FEED P29-30 | CARBIDE | EXO® | 11° | SHRINK h6

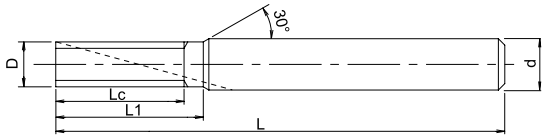
Coolant-through, Long Length, Helical Flute

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	5	2	8304784
M24	3.0	20.0	120	51.0	–	20.0	5	2	8304786

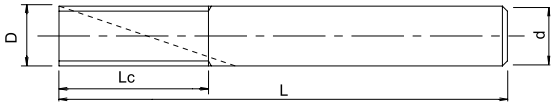
Packed: 1 pc. Available EXO®coating only.
For internal threads only.

HTE

Type 1



Type 2



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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
41150	○	◎	◎	◎	◎	◎	◎	○	○	○	◎	◎	◎	◎	◎	○		

○ **good** ◎ **best**

EXOCARB®-Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

List 41200 NEW!

SPEED FEED P29-30 | CARBIDE | SS | WXS | 11° | SHRINK h6

Miniature, Helical Flute

Size	Threads Per Inch	Cutter Dia. D	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Dia. d	No. of Flutes	Type	EDP Number
0	80	0.045	1.625	0.013	0.165	1/8	3	5	4120000115
1	72	0.055	1.625	0.014	1.960	1/8	3	5	4120000213
1	64	0.055	1.625	0.016	0.198	1/8	3	5	4120000313
2, 3	56	0.064	1.625	0.054	0.190	1/4	3	6	4120000413
2	64	0.064	1.625	0.047	0.187	1/4	3	6	4120000513
3, 4	48	0.074	1.625	0.063	0.219	1/4	3	6	4120000613
4, 5, 6	40	0.083	1.625	0.075	0.249	1/4	3	6	4120000713
5	44	0.096	1.625	0.068	0.273	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	0.356	1/4	3	6	4120001013

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

HTE

List 41300 NEW!

SPEED FEED P29-30 | CARBIDE | SS | WXS | 11° | SHRINK h6

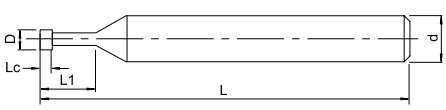
Miniature, Helical Flute

Size	Pitch	Cutter Dia. D	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Dia. d	No. of Flutes	Type	EDP Number
M1	0.25	0.72	40	0.25	2.75	3	3	5	3900495
M1.2	0.25	0.92	40	0.25	3.25	3	3	5	3900496
M1.4	0.3	1.05	40	0.30	3.80	3	3	5	3900497
M1.6	0.35	1.20	40	0.35	4.35	3	3	5	3900498
M1.7, M1.8	0.35	1.30	40	0.35	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	40	1.40	5.60	6	3	6	3900501
M3	0.5	2.50	40	1.50	6.50	6	3	6	3900502
M4	0.7	3.10	40	2.10	8.70	6	3	6	3900503
M5	0.8	4.00	40	2.40	10.80	6	3	6	3900504

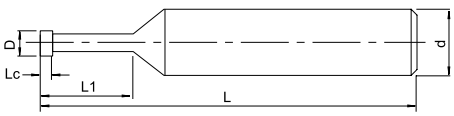
Packed: 1 pc.
Available SS (D ≤ 0.055) and WXS (D ≥ 0.064) only. For internal threads only.

HTE

Type 5
(Lc=1 Thread)



Type 6
(Lc=3 Threads)



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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	▢	◎	◎	◎	◎	◎	◎	▢	▢	▢	◎	◎	◎	◎	◎	▢		
41300	▢	◎	◎	◎	◎	◎	◎	▢	▢	▢	◎	◎	◎	◎	◎	▢		

▢ **good** ◎ **best**

EXOCARB®-Thread Mill

Ideal for Steels, Exotics and Difficult to Machine Materials

List 42000

SPEED FEED P29-30 | CARBIDE | EXO | 30° | SHRINK h6

NPT, Helical Flute

Thread Form	TPI	Tip Diameter D1	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Dia. d	No. of Flutes	Type	EDP Number
1/16	27	0.184	3	0.426	0.44	1/4	3	3	4200000111
1/8	27	0.284	3	0.426	–	5/16	3	4	4200000211
1/4 or 3/8	18	0.331	3	0.639	–	3/8	4	4	4200000311
1/2 or 3/4	14	0.570	4	0.821	–	5/8	4	4	4200000411
1 thru 2	11-1/2	0.780	4	1.000	1.04	1	4	3	4200000511
2-1/2	8	0.910	4	1.438	–	1	4	4	4200000611

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

HTE

List 42001

SPEED FEED P29-30 | CARBIDE | EXO | 30° | SHRINK h6

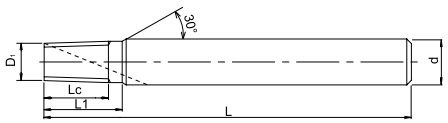
NPTF, Helical Flute

Thread Form	TPI	Tip Diameter D1	Overall Length L	Length of Cut Lc	Neck Length L1	Shank Dia. d	No. of Flutes	Type	EDP Number
1/16	27	0.184	3	0.426	0.44	1/4	3	3	4200100111
1/8	27	0.284	3	0.426	–	5/16	3	4	4200100211
1/4 or 3/8	18	0.331	3	0.639	–	3/8	4	4	4200100311
1/2	14	0.570	4	0.821	–	5/8	4	4	4200100411
3/4	14	0.570	4	0.821	–	5/8	4	4	4200100711
1 or 1-1/4	11-1/2	0.780	4	1.000	1.04	1	4	3	4200100511
1-1/2 or 2	11-1/2	0.780	4	1.000	1.04	1	4	3	4200100811
2-1/2	8	0.910	4	1.438	–	1	4	4	4200100611

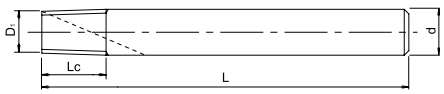
Packed: 1 pc. Available EXO®coating only.
For internal threads only.

HTE

Type 3



Type 4



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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	○	◎	◎	◎	◎	◎	◎	○	○	○	◎	◎	◎	◎	◎	○		
42001	○	◎	◎	◎	◎	◎	◎	○	○	○	◎	◎	◎	◎	◎	○		

○ **good** ◎ **best**

EXOPRO®-UVX-Ni

End Mills Designed for Nickel Based Alloys

UVX-Ni Features

1 Corner Protection

Radius with variable negative rake for strong cutting corners

2 Variable Helix / Variable Index

Vibration absorption enables stable machining

3 Unique Flute Form

For excellent chip shape and evacuation

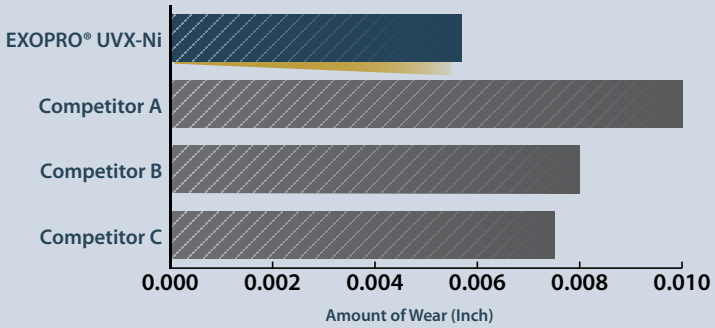
4 Proprietary Cutting Edge Geometry

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.

Tool Dia.	1/2"x1-1/4"x3-1/2" 0.030CR
Work Material	Inconel® 718 (45 HRC)
Speed	764 RPM (100SFM)
Feed	6.02 IPM (0.0015 IPT)
Depth of Cut	a_a: 0.250" / a_r: 0.150"
Coolant	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)

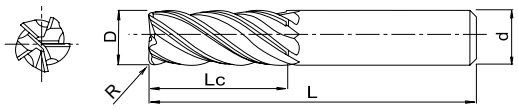
EXOPRO®-UVX-Ni

End Mills Designed for Nickel Based Alloys

List 2055

SPEED FEED P28 | CARBIDE | TiAlN | Var.

5 Flute, Multiple Lengths, Corner Radius



EDP Number	EDP Number w/Weldon Flat	Mill Diameter	Corner Radius	OAL	Length of Cut	Shank Diameter	Number 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.

EP

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	Cast Iron Ductile Cast Iron					
2055		▢	▢			▢						◎

▢ good ◎ best

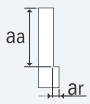
List 5950Ni - EXOPRO® WHO-Ni: 3D
List 5955Ni - EXOPRO® WHO-Ni: 5D

General Drilling Operations

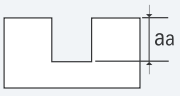
Work Material	Carbon Steels, Mild Steels 1010, 1050, 12L14		Alloy Steels 4140, 4130		Cast Iron		Ductile Cast Iron		Special Alloy Steels, Hardened Steels						Ni-Base Material, Inconel	
									35-40 HRC		40-45 HRC		45-56 HRC		38-43 HRC	
Cutting Speed	260-395 SFM		260-395 SFM		260-395 SFM		195-330 SFM		130-160 SFM		115-150 SFM		65-100 SFM		35-100 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 = ≤ 0.5D a_r = ≤ 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 = ≤ 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

List 41000/41100 - EXOCARB®-Thread Mill
List 41050/41150 - EXOCARB®-Thread Mill Oil
List 41200/41300 - EXOCARB®-Thread Mill Mini
List 42000/42001 - EXOCARB®-Thread Mill NPT/NPTF

Work Material	SFM	Feed Rate (in/t)	No. of Passes
Low Carbon Steel (SS400, 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 (SS400, 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

OSG PHOENIX®-PSE
Multifunctional 90° indexable end mills and facemills.

OSG PHOENIX®-PDR
Deep feed radius end mills and facemills for deeper depths of cut versus conventional high feed cutters.

OSG PHOENIX®-PRC
Button insert end mills and facemills for contour milling applications.

OSG PHOENIX®-PFB
High precision indexable finish ballnose end mills for superior surface finish and tool life.

OSG PHOENIX®-PHC
High feed end mills and facemills for maximum metal removal rates in a variety of milling applications.

OSG PHOENIX®-PHP
High performance indexable drill series.

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)	RPHT1204M0EN-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	ap=0.020" ae=1.181"	
Coolant	Water Soluble	
Machine	Horizontal Machining Center	
Durability	10m	2m

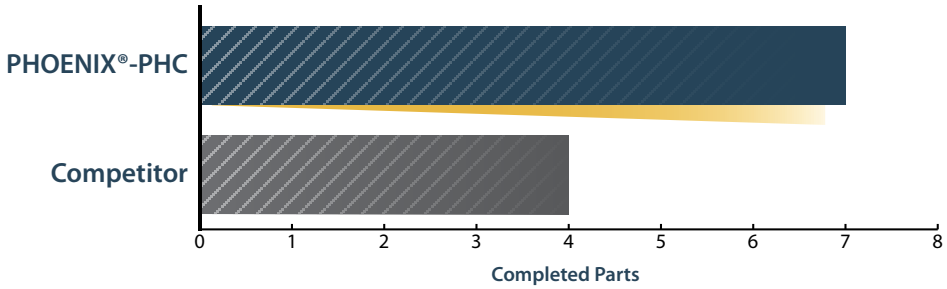
Photo of Insert After Milling 2m

PRC	Competitor
	

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.



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

PHC

Competitor

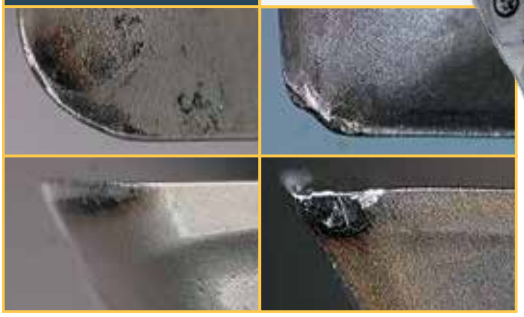
OSG PHOENIX® PSE - 90° Shoulder Cutter

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	aa=0.040" ar=0.787"	
Coolant	Water Soluble	
Machine	Vertical Machining Center	

Photo of Tool After Milling 1.5m



V-Series Drilling Lineup

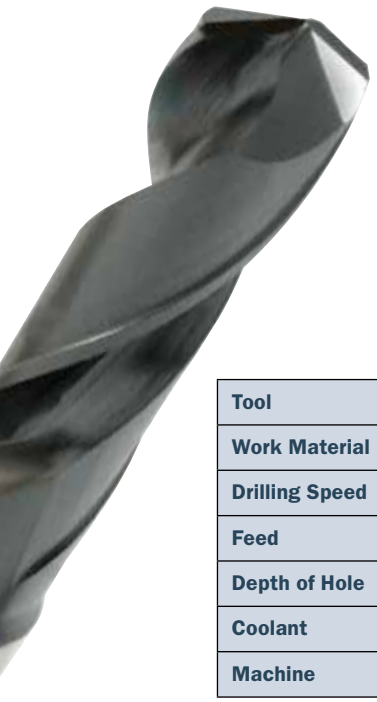
XPM powdered metal drills, V-coated. Ideal for Nickel Alloys and other difficult to machine materials.

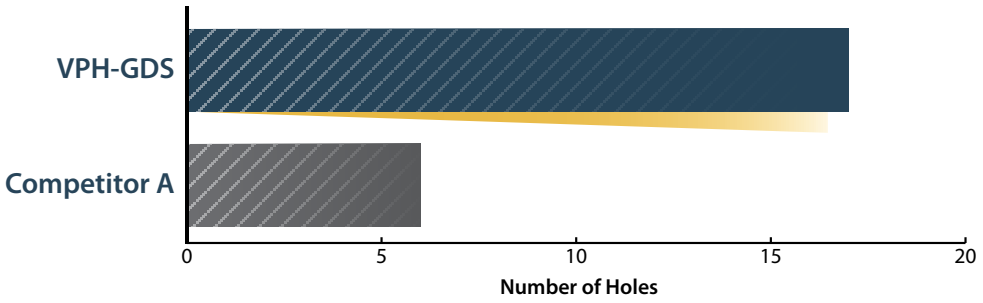
Series	List Number	Style	Size Range	Work Material								
				Alloy Steels	Titamium	Nickel Alloys	Stainless Steels			Hardened Steels		
				4140, 4340	6AL4V	20 HRC	300	400	17-4PH	~35 HRC	34-45 HRC	45-50 HRC
VPH-GDS	1900	Stub	#73 - 3/4" (0.50 - 20mm)	◉	◉	◉		○	○	◉	◉	○
VPH-GDR	1950	Jobbers	#47 - 11/16"	◉	◉	◉		○	○	◉	◉	○

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.





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

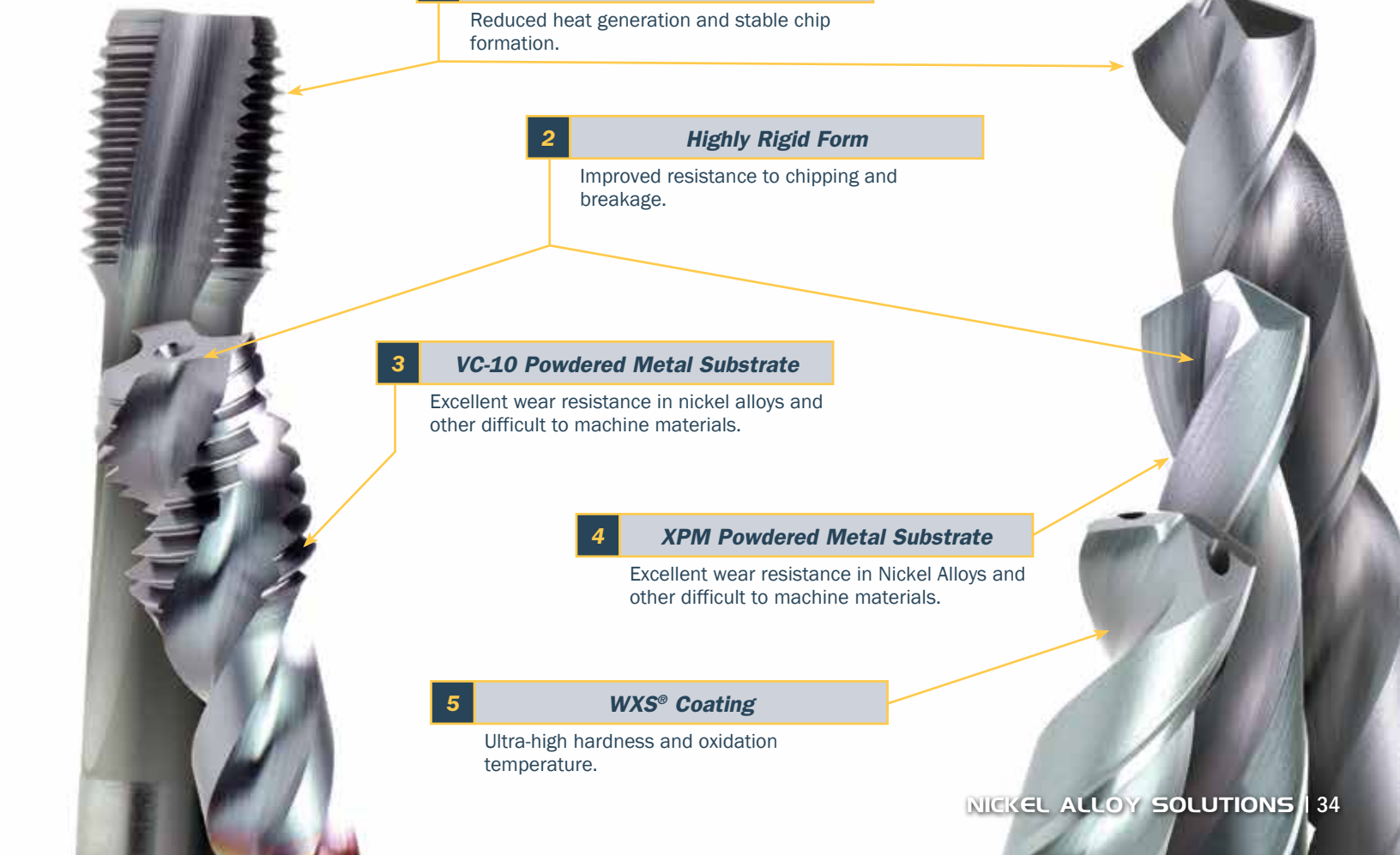
VPH-GDS

Competitor

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	Titamium	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										
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										
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										



1 Sharp Cutting Edge

Reduced heat generation and stable chip formation.

2 Highly Rigid Form

Improved resistance to chipping and breakage.

3 VC-10 Powdered Metal Substrate

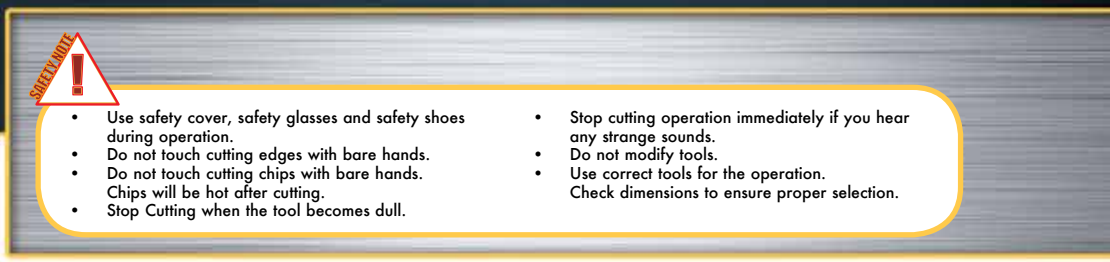
Excellent wear resistance in nickel alloys and other difficult to machine materials.

4 XPM Powdered Metal Substrate

Excellent wear resistance in Nickel Alloys and other difficult to machine materials.

5 WXS® Coating

Ultra-high hardness and oxidation temperature.



- 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 strange sounds.
- Do not modify tools.
- Use correct tools for the operation. Check dimensions to ensure proper selection.

OSG

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