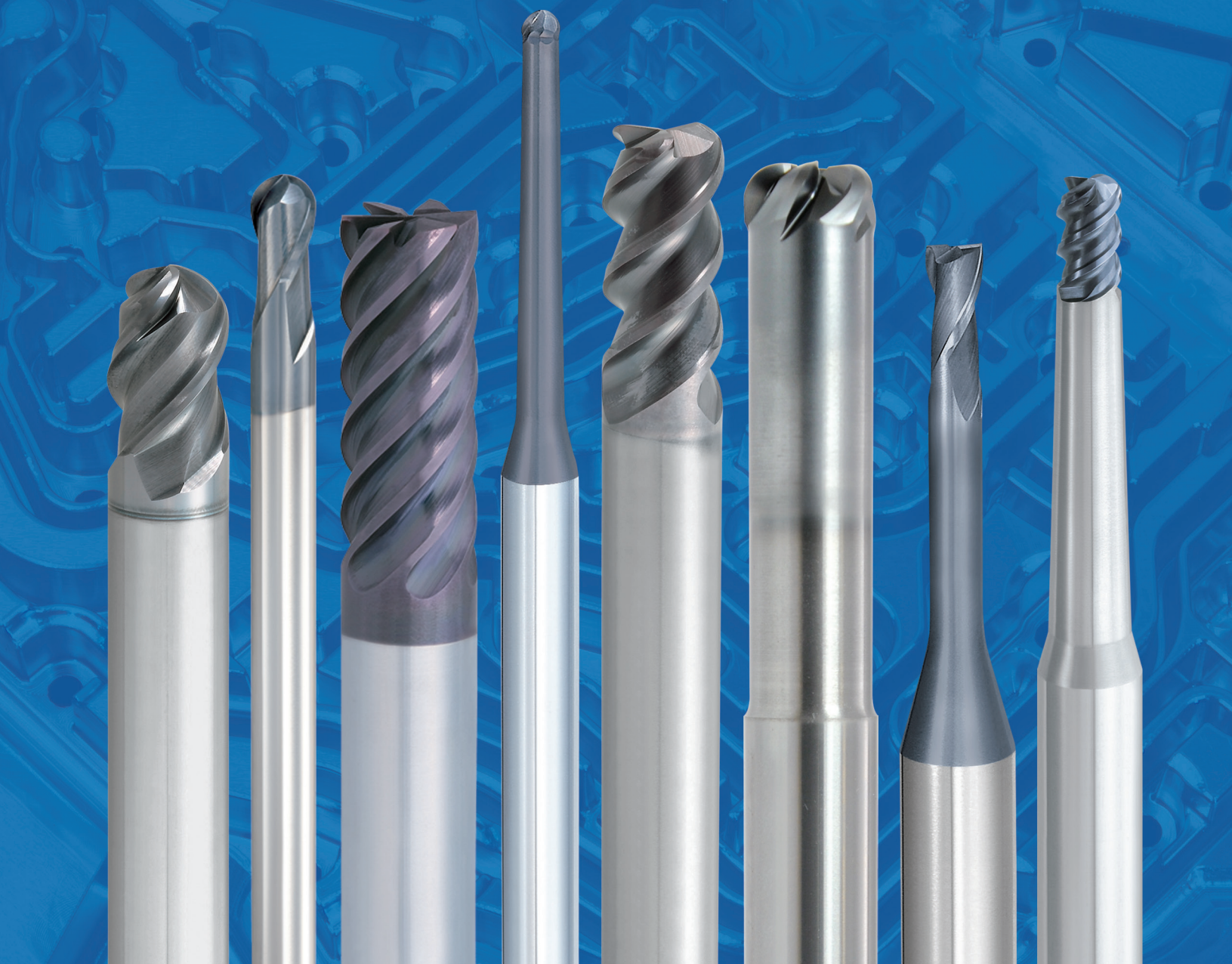
A Comprehensive Lineup of End Mills for Die/Mold Manufacturing

Vol 1

Die/Mold Solutions

EXOPRO® PHX • EXOCARB® WXL • EXOCARB® WXS



Die/Mold Solutions

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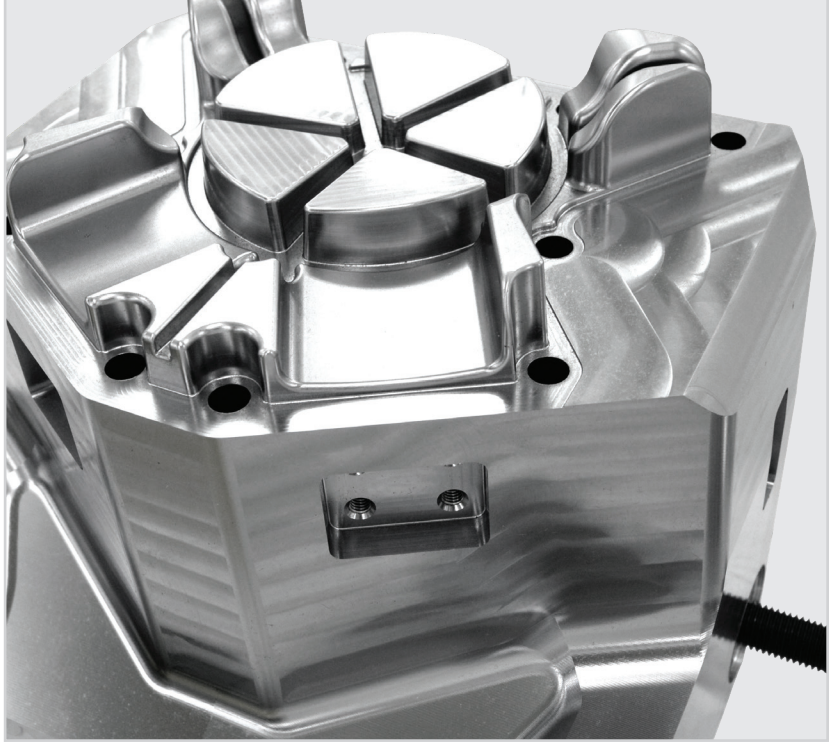
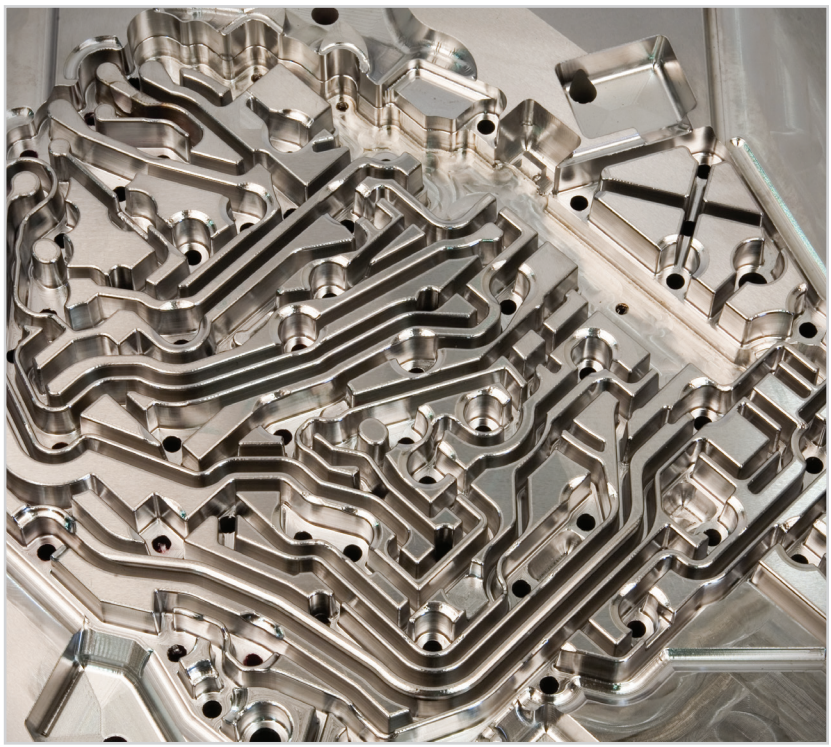
EXOPRO® PHX

EXOCARB® WXL

EXOCARB® WXS





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List	Item	Inch/ Metric	No. of Flutes	Length of Cut	Material	Coating	Size Range	Features	Product Page	Tech Page
EXOPRO® PHX										
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9576		Metric	3	Stub	Carbide	WXS®	4mm - 16mm	Phoenix® Long Neck, Deep Feed, Corner Radius	19	25-26
9580		Metric	3	Stub	Carbide	WXS®	2mm - 12mm	Phoenix® Pencil Neck, Deep Feed, Corner Radius	20-21	25-26
9580		Metric	3	Stub	Carbide	EXO®	1mm - 20mm	Phoenix® High-Feed, Corner Radius	22	25-26
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3710		Metric	2	Regular	Carbide	WXL®	0.1mm - 20mm	Ball End	35	62
3670		Inch	4	Regular	Carbide	WXL®	1/16 - 1/2"	Corner Radius	36	63
3604		Inch	4	Regular	Carbide	WXL®	1/16 - 3/4"		37	64
3690		Inch	2	Regular	Carbide	WXL®	1/64 - 1/4"	Ball End, Long Neck, ±5µm Radius Tolerance	38	65-68
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3620		Inch	2	Stub	Carbide	WXL®	1/16 - 3/4"		41	69
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3704		Metric	4	Regular	Carbide	WXL®	1mm - 12mm		43	70
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3791		Metric	2	Stub	Carbide	WXL®	0.2mm - 5mm	Long Neck	45-46	73-76
3711		Metric	2	Regular	Carbide	WXL®	1mm - 18mm	Ball End, Long Shank	47	72
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3712		Metric	2	Stub	Carbide	WXL®	0.2mm - 6mm	Pencil Neck, Ball End	50-53	81-88
3722		Metric	2	Regular	Carbide	WXL®	0.1mm - 20mm		54	89-90

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC

EXOPRO® PHX

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EXOCARB® WXL®

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EXOCARB® WXS®										
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4540		Metric	4, 6	Regular	Carbide	WXS®	1mm - 12mm		108	126
4471		Inch	4	Regular	Carbide	WXS®	1/16 - 1/2"	Corner Radius	109	127
4571		Metric	4	Regular	Carbide	WXS®	3mm - 12mm	Corner Radius	110	128
4470		Inch	3, 4	Regular	Carbide	WXS®	1/8 - 1/2"	Corner Radius, High Feed	111	129
4570		Metric	3, 4	Regular	Carbide	WXS®	2mm - 13mm	Corner Radius, High Feed	111	130
4472		Inch	5	Regular	Carbide	WXS®	1/8" - 1/2"	Corner Radius, High Feed	112	131
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4581		Metric	4	Variable	Carbide	WXS®	1mm - 2.5mm	Ball End, Tapered	121	139
4541		Metric	4, 6	Regular	Carbide	WXS®	3mm - 12mm	Corner Radius	122	140-141

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
EXOCARB® WXL®																	
3723	◎	◎	◎	◎	◎	○	○	○	◎	○	○			◎	◎	○	
3770	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○
3771	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○
3794	◎	◎	◎	◎	◎	○	○	○	◎	○	○			◎	◎	○	
4445	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎
EXOCARB® WXS®																	
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4572	◎	◎	◎	◎	◎	◎	○		◎			○	○	◎	◎	◎	◎
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4590	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	○
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4581	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	○
4541	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

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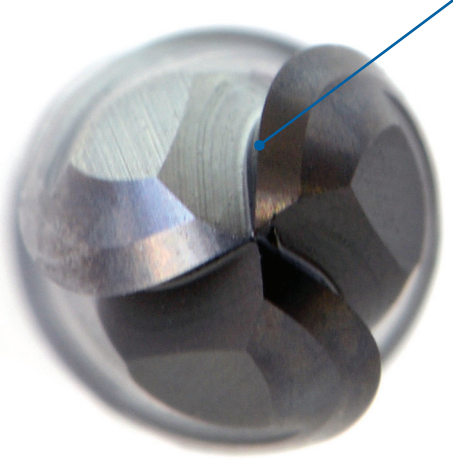


Strong Spiral Gash

Improves chip shape & heat dissipation, enabling stable performance in deep cuts and difficult to machine materials.

Negative Cutting Edge Form

Produces a strong cutting edge and prolongs tool life by increasing chip evacuation and reducing heat buildup

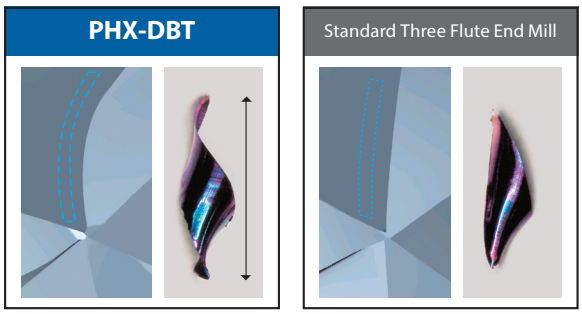
WXS Coating

for superior heat and wear resistance, allowing for high-speed machining of hardened materials up to 65 HRC.

Strong Spiral Gash

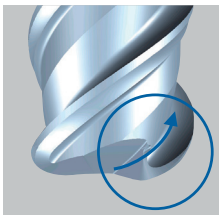
Improved Chip Shape and Heat Dissipation

Elongated cutting edge improves chip shape & heat dissipation, and enables stable performance in deep cuts that are normally susceptible to chattering, and in materials that are difficult to machine.



Negative Cutting Edge Form

Prolonged Tool Life and Improved Chip Evacuation



3-dimensional negative form produces a strong cutting edge and prolongs tool life by increasing chip evacuation and reducing heat buildup.

High Precision Radius Tolerance

Improves Machining Quality and Accuracy

PHX-DBT	±0.01mm
PHX-LN-DBT	±0.007mm
PHX-PC-DBT	±0.01mm

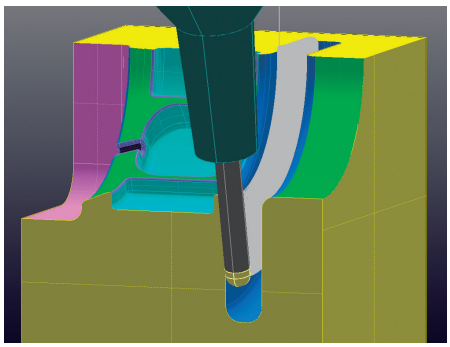
PHX-DFR	±0.03mm
PHX-LN-DFR	±0.03mm
PHX-PC-DFR	±0.03mm

PHX-CRT	±0.01mm
PHX-CRE	±0.007mm

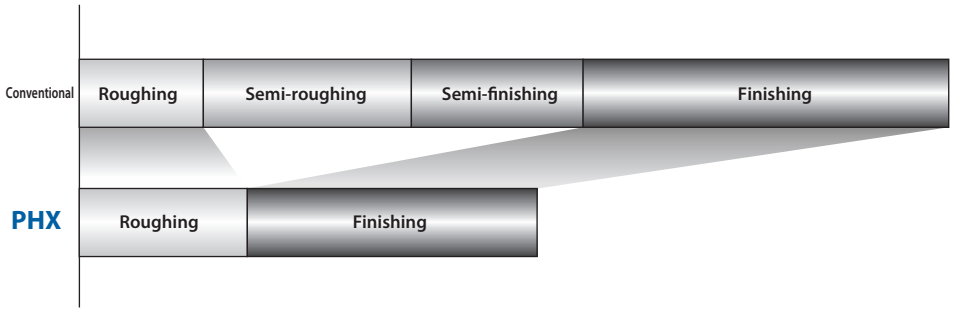
Dramatically Shorten Machining Time with PHX

Machine Time Reduced by 48%

Work Material	NAK80 (40 HRC)
Maximum RPM	18,000
Coolant	Air
Holder	Shrink Fit
Main Spindle	HSK A63
Machine	Five-Axis Machining Center



Operation	Process	Tool	Overhang Length (mm)	Speed (RPM)	Feed (IPM)	Aa (in)	Ar (in)	Stock Remaining (in)	Milling Length (in)	Cycle Time (h:m:s)
1	Contour Roughing	PHX-DFR 10xR2	25	3800	82.7	0.020	0.098	0.004	606	0:07:16
2	Side Finish Milling	PHX-DFR 10xR2	25	3800	23.6	-	0.094	0	14,803	0:00:50
3	Contour Roughing	PHX-DFR 10xR2	25	2400	82.7	0.020	0.098	0.002	791	0:08:37
4	Fixed Inclined Axis Finish Milling	PHX-DFR 10xR2	25	3800	39.4	-	0.008	0	350	0:10:42
5	Contour Surface Roughing	PHX-LN-DBT R2x20	23	7600	61.0	0.010	0.040	0.0004	689	0:13:46
6	Contour Surface Finish Milling	PHX-LN-DBT R2x20	23	5500	53.1	0.005	0.004	0	638	0:10:40
7	Contour Surface Roughing	PHX-LN-DBT R1.5x12	14	12000	66.9	0.012	0.027	0.002	551	0:09:26
8	Contour Surface Finish Milling	PHX-LN-DBT R1.5x12	14	11000	80.7	0.003	0.004	0	374	0:04:31
9	Circumferential Surface Finish Milling	PHX-LN-DBT R1.5x12	14	11000	80.7	-	0.003	0	212	0:02:49
10	Surface Milling (rounded corners)	PHX-LN-DBT R1.5x12	14	11000	80.7	-	0.003	0	212	0:03:12
11	Milling of remaining areas	PHX-LN-DBT R0.75x6	13	16000	37.8	0.001	0.001	0	724	0:24:54
12	Contour Surface Roughing	PHX-LN-DBT R0.5x4	12	18000	39.4	0.002	0.006	0	354	0:09:45
13	Contour Surface Finish Milling	PHX-LN-DBT R0.5x4	12	18000	35.4	-	0.001	0	13346	0:00:29
								Total Cycle Time		1:46:57

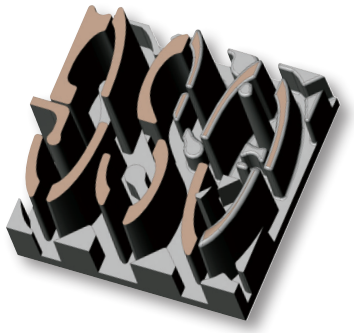


Machining time reduced by 48%!

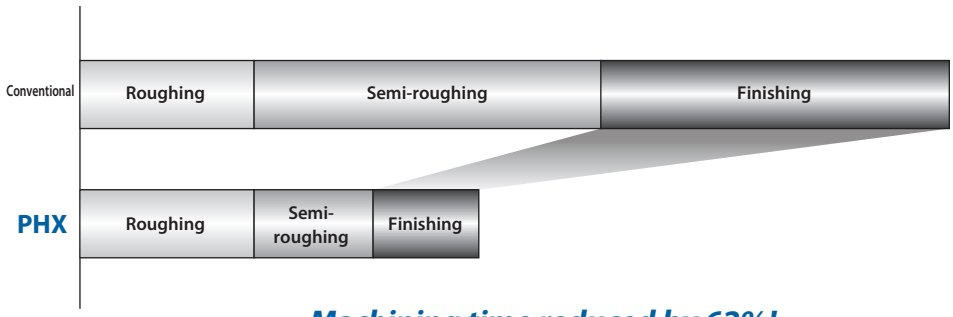
Deep Rib Milling with PHX-DFR

Machine Time Reduced by 62%

Work Material	SKD61 (50 HRC)
Work Size	80 x 80 x 45mm
Maximum RPM	20,000
Coolant	Air
Holder	Shrink Fit
Main Spindle	HSK A63
Machine	Three-Axis Machining Center



Operation	Process	Tool	Overhang Length (mm)	Speed (RPM)	Feed (IPM)	Aa (in)	Ar (in)	Stock Remaining (in)	Milling Length (in)	Cycle Time (h:m:s)
1	3D roughing	PHX-DFR Ø10 x R2	40	1770	78.7	0.012	0.118	0.008	14606	3:39:49
2	Semi-roughing	PHX-LN-DFR Ø6 x R1.5 x 30	30	1770	41.7	0.004	0.060	0.001	2,638	8:33:40
3	Semi-roughing	PHX-PC-DFR Ø3 x R0.8 x 1° x 40	45	3200	26.8	0.002	0.027	0.001	7560	21:07:50
4	Semi-roughing	PHX-PC-DFR Ø2 x R0.5 x 1° x 40	47	1830	8.7	0.0005	0.020	0.001	23030	23:56:50
5	Z-level finishing	PHX-PC-DFR Ø2 x R0.5 x 1° x 40	47	2320	7.1	0.004	0.001	0	22950	45:05:05
								Total Cycle Time		102:23:14

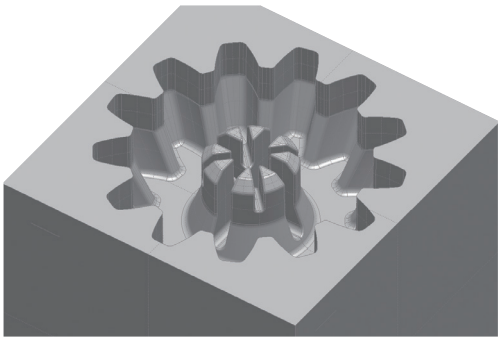


Machining time reduced by 62%!

Superior Processing Efficiency with PHX-LN-DBT

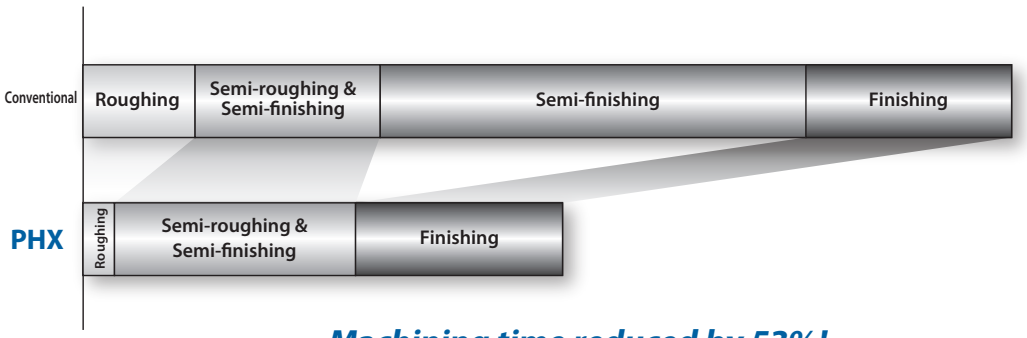
Machine Time Reduced by 53%

Work Material	NAK80 (40 HRC)
Work Size	50 x 50 x 50mm
Maximum RPM	18,000
Coolant	Air
Holder	Shrink Fit
Main Spindle	HSK A63
Machine	Five-Axis Machining Center



Operation	Process	Tool	Overhang Length (mm)	Speed (RPM)	Feed (IPM)	Aa (in)	Ar (in)	Stock Remaining (in)	Milling Length (in)	Cycle Time (h:m:s)
1	3D roughing	PHX-LN-DBT R3 x 20	22	8000	177.2	0.020	0.060	0.004	398	0:06:27
2	Roughing	PHX-LN-DBT R1 x 12	20	12000	47.2	0.006	0.031	0.002	1,114	0:43:19
3*	3D complete machining	PHX-LN-DBT R1 x 12	20	12000	47.2	-	0.016	0.002	30787	
4	3D Z-level finishing	PHX-LN-DBT R1 x 12	20	12000	78.7	0.005	-	0	1315	0:31:31
5	3D profile finishing	PHX-LN-DBT R1 x 12	20	12000	78.7	-	0.005	0	173	
6	3D rest machining	PHX-LN-DBT R1 x 12	20	12000	78.7	0.005	0.005	0	98	
7	3D Z-level finishing	PHX-LN-DBT R0.5 x 6	15	12000	23.6	0.002	-	0	327	0:36:58
8	3D Z-level finishing	PHX-LN-DBT R0.5 x 6	15	12000	31.5	0.002	-	0	264	
9	3D profile finishing	PHX-LN-DBT R0.5 x 6	15	12000	31.5	-	0.002	0	17047	
								Total Cycle Time		1:58:15

*For flat surface milling



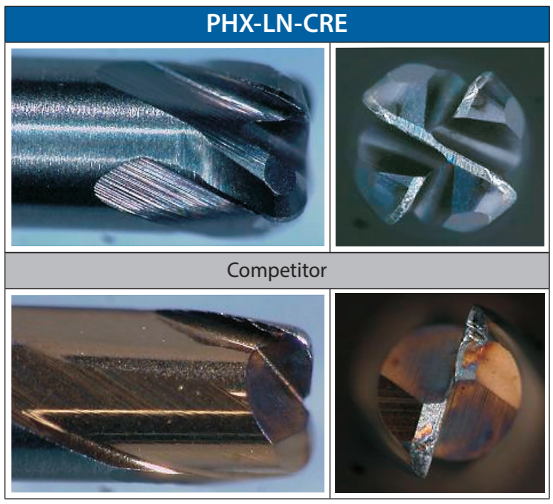
Machining time reduced by 53%!

Stable Slotting in Mold Steel

Slotting in Mold Steels (52 HRC)

PHX-LN-CRE's specially designed cutting edge enables stable milling in mold steels, even at ultra high speed.

Tool	PHX-LN-CRE
Tool Size	Ø1 x R0.2 x 6
Work Material	STAVAX (52HRC)
Milling Method	Slotting
Cutting Speed	206 SFM (20,000 RPM)
Feed	33.1 IPM (0.0004 in/t)
Depth of Cut	Aa=0.0008"
Coolant	Air
Machine	VMC
Miling Length	472 inches

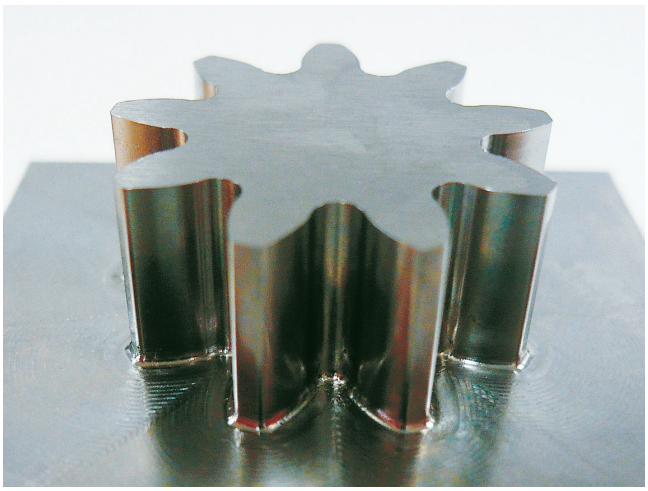


High Precision Machining in Die Steel

Contour Milling in Die Steel (53 HRC)

From semi-roughing to finishing operations, PHX-LN-CRE is capable of high-feed milling even in tight corners, like gear shapes.

Tool	PHX-LN-CRE
Tool Size	Ø2 x R0.5 x 10
Work Material	HPM38 (53 HRC)
Milling Method	Contour Milling
Cutting Speed	370 SFM (18,000 RPM)
Feed	98.4 IPM (0.0014 in/t)
Depth of Cut	Aa=0.004" Ar=0.031"
Coolant	Air
Machine	VMC
Miling Length	3150 inches



List 9510

PHX-DBT, 3 Flute, Deep Feed, Ball End

SPEED FEED P23-24 | CARBIDE | EXO® | 45° | SHANK h6

Milling Diameter Tolerance	
1≤D≤5	+0 / -0.015mm
6<D≤20	+0.01mm / -0.005mm

Radius Tolerance	
0.5≤R≤10	+0.01 / -0.01mm

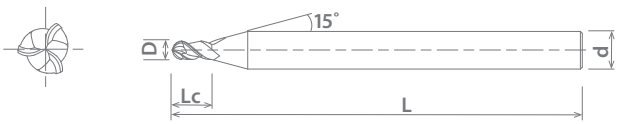
EDP Number	Mill Diameter D	OAL L	Length of Cut Lc	Shank Diameter d	Type
3090202	1	60	1.5	6	1
3090204	2	60	3.0	6	1
3090206	3	70	4.5	6	1
3090208	4	70	6.0	6	1
3090210	5	70	7.5	6	1
3090212	6	80	9.0	6	2
3090312	6	110	9.0	6	2
3090216	8	90	12.0	8	2

EDP Number	Mill Diameter D	OAL L	Length of Cut Lc	Shank Diameter d	Type
3090316	8	120	12.0	8	2
3090220	10	100	15.0	10	2
3090320	10	130	15.0	10	2
3090222	12	100	18.0	12	2
3090322	12	140	18.0	12	2
3090226	16	150	24.0	16	2
3090230	20	150	30.0	20	2
3090330	20	200	30.0	20	2

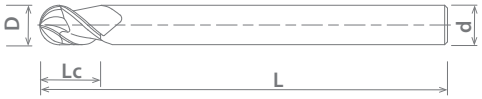
Packed: 1 pc. Available EXO® coating only.

EP

Type 1



Type 2



Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9510	▢	▢	▢	▢	▢	○	○	○	▢					▢	▢	▢	○

○ good ▢ best

List 9590

PHX-LN-DBT, 3 Flute, Long Neck, Ball End

SPEED FEED P23-24 | CARBIDE | WXS | 45° | SHANK h6

Milling Diameter Tolerance	
0.6≤D≤6	+0.007mm / -0.007mm

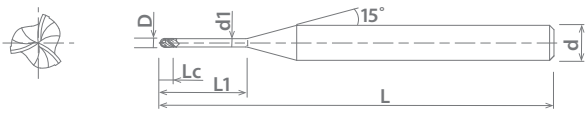
Radius Tolerance	
0.3≤R≤3	+0.007mm / -0.007mm

EDP Number	Mill Diameter	OAL	Length of Cut	Neck Length	Neck Diameter	Effective Neck Length (Based on Inclined Angle)						Shank Diameter	Type
	D	L	Lc	L1	d1	α						d	
						0.5°	1°	1.5°	2°	2.5°	3°		
3194901	0.6	50	0.45	1	0.55	1.02	1.05	1.08	1.11	1.14	1.17	4	1
3194902	0.6	50	0.45	2	0.55	2.06	2.12	2.18	2.26	2.33	2.42	4	1
3194903	0.6	50	0.45	3	0.55	3.09	3.19	3.29	3.41	3.53	3.66	4	1
3194904	0.6	50	0.45	4	0.55	4.12	4.26	4.4	4.56	4.72	4.9	4	1
3194906	0.6	50	0.45	6	0.55	6.19	6.4	6.62	6.86	7.11	7.39	4	1
3195004	1.0	50	0.75	4	0.95	4.26	4.50	4.74	4.96	5.18	5.39	4	1
3195006	1.0	50	0.75	6	0.95	6.39	6.72	7.03	7.32	7.95	7.88	4	1
3195008	1.0	50	0.75	8	0.95	8.50	8.92	9.28	9.62	9.98	10.36	4	1
3195010	1.0	50	0.75	10	0.95	10.61	11.09	11.51	11.92	12.37	12.85	4	1
3195012	1.0	50	0.75	12	0.95	12.71	13.25	13.71	14.12	14.49	14.83	4	1
3195014	1.0	50	0.75	14	0.95	14.81	15.40	15.90	16.34	16.73	17.82	4	1
3195016	1.0	50	0.75	16	0.95	16.90	17.54	18.07	18.54	19.53	20.31	4	1
3195106	1.5	50	1.12	6	1.45	6.37	6.70	7.00	7.28	7.54	7.82	4	1
3195108	1.5	50	1.12	8	1.45	8.49	8.89	9.25	9.58	9.93	10.30	4	1
3195110	1.5	50	1.12	10	1.45	10.60	11.07	11.48	11.88	12.32	12.79	4	1
3195112	1.5	50	1.12	12	1.45	12.70	13.23	13.69	14.09	14.46	14.80	4	1
3195116	1.5	50	1.12	16	1.45	16.89	17.52	18.05	18.51	18.93	19.31	4	1
3195206	2.0	50	1.50	6	1.95	6.35	6.65	6.94	7.21	7.46	7.73	4	1
3195208	2.0	50	1.50	8	1.95	8.46	8.85	9.20	9.52	9.85	10.21	4	1
3195210	2.0	50	1.50	10	1.95	10.57	11.03	11.43	11.82	12.24	12.70	4	1
3195212	2.0	50	1.50	12	1.95	12.67	13.19	13.64	14.12	14.63	15.19	4	1
3195214	2.0	50	1.50	14	1.95	14.77	15.34	15.86	16.42	17.02	17.67	4	1
3195216	2.0	50	1.50	16	1.95	16.86	17.48	18.08	18.72	19.41	–	4	1
3195218	2.0	60	1.50	18	1.95	18.94	19.62	20.29	21.02	21.80	–	4	1
3195220	2.0	60	1.50	20	1.95	21.03	21.76	22.51	23.18	–	–	4	1
3195222	2.0	60	1.50	22	1.95	23.13	23.89	24.50	25.03	–	–	4	1
3195312	3.0	60	2.25	12	2.85	12.61	13.10	13.57	14.08	–	–	4	1
3195316	3.0	60	2.25	16	2.85	16.77	17.38	17.01	–	–	–	4	1
3195320	3.0	60	2.25	20	2.85	20.92	21.65	–	–	–	–	4	1
3195325	3.0	60	2.25	25	2.85	26.10	–	–	–	–	–	4	1
3195416	4.0	60	3.00	16	3.85	–	–	–	–	–	–	4	2
3195420	4.0	60	3.00	20	3.85	–	–	–	–	–	–	4	2
3195425	4.0	60	3.00	25	3.85	–	–	–	–	–	–	4	2
3195520	6.0	70	4.50	20	5.85	–	–	–	–	–	–	6	2
3195530	6.0	70	4.50	30	5.85	–	–	–	–	–	–	6	2

Packed: 1 pc. Available WXS® coating only.

EP

Type 1



Type 2

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9590	◎	◎	◎	◎	◎	○	○	○	◎					◎	◎	◎	○

○ good ◎ best

List 9581

PHX-PC-DBT, 3 Flute, Pencil Neck, Deep Feed, Ball End

SPEED FEED P23-24 | CARBIDE | WXS | 45° | SHANK h6

Milling Diameter Tolerance	
1≤D≤12	+ 0 / -0.015mm

Radius Tolerance	
0.5≤R≤6	+0.01mm / -0.01mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Min. Neck Diameter	Max. Neck Diameter	Neck Length	Effective Draft Angle	Neck Draft Angle	Shank Diameter	Type
	D	L	Lc	d1	d2	L1	α	β	d	
3095125	1.0	60	1.50	0.95	1.20	16.0	0.38°	0.5°	6	1
3095141	1.0	60	1.50	0.95	1.10	6.0	0.56°	1.0°	6	1
3095142	1.0	60	1.50	0.95	1.17	8.0	0.68°	1.0°	6	1
3095143	1.0	60	1.50	0.95	1.24	10.0	0.75°	1.0°	6	1
3095144	1.0	60	1.50	0.95	1.31	12.0	0.79°	1.0°	6	1
3095145	1.0	60	1.50	0.95	1.45	16.0	0.85°	1.0°	6	1
3095146	1.0	60	1.50	0.95	1.59	20.0	0.88°	1.0°	6	1
3095147	1.0	70	1.50	0.95	1.77	25.0	0.91°	1.0°	6	1
3095155	1.0	60	1.50	0.95	1.65	15.0	1.30°	1.5°	6	1
3095157	1.0	70	1.50	0.95	2.18	25.0	1.39°	1.5°	6	1
3095191	1.0	70	1.50	0.95	5.43	30.0	4.30°	4.5°	6	1
3095211	1.5	60	2.25	1.45	1.58	6.0	0.45°	1.0°	6	1
3095212	1.5	60	2.25	1.45	1.68	9.0	0.65°	1.0°	6	1
3095213	1.5	60	2.25	1.45	1.79	12.0	0.74°	1.0°	6	1
3095214	1.5	60	2.25	1.45	1.89	15.0	0.80°	1.0°	6	1
3095215	1.5	60	2.25	1.45	2.10	21.0	0.86°	1.0°	6	1
3095216	1.5	70	2.25	1.45	2.41	30.0	0.90°	1.0°	6	1
3095223	2.0	60	3.00	1.95	2.24	20.0	0.38°	0.5°	6	1
3095241	2.0	60	3.00	1.95	2.19	10.0	0.62°	1.0°	6	1
3095242	2.0	60	3.00	1.95	2.36	15.0	0.76°	1.0°	6	1
3095243	2.0	60	3.00	1.95	2.54	20.0	0.82°	1.0°	6	1
3095244	2.0	70	3.00	1.95	2.71	25.0	0.86°	1.0°	6	1
3095245	2.0	80	3.00	1.95	2.89	30.0	0.89°	1.0°	6	1
3095246	2.0	80	3.00	1.95	3.24	40.0	0.92°	1.0°	6	1
3095247	2.0	100	3.00	1.95	3.59	50.0	0.93°	1.0°	6	1
3095251	2.0	80	3.00	1.95	3.88	40.0	1.39°	1.5°	6	1
3095262	2.0	100	3.00	1.95	5.81	60.3	1.94°	2.0°	6	2
3095273	2.0	80	3.00	1.95	5.75	41.2	2.85°	3.0°	6	2
3095281	2.0	80	3.00	1.95	5.67	30.0	3.95°	3.8°	6	2
3095321	3.0	80	4.50	2.90	3.17	20.0	0.27°	0.5°	6	1
3095341	3.0	80	4.50	2.90	3.44	20.0	0.69°	1.0°	6	1
3095342	3.0	80	4.50	2.90	3.61	25.0	0.76°	1.0°	6	1
3095343	3.0	80	4.50	2.90	3.79	30.0	0.80°	1.0°	6	1
3095344	3.0	80	4.50	2.90	4.13	40.0	0.85°	1.0°	6	1
3095345	3.0	100	4.50	2.90	4.48	50.0	0.88°	1.0°	6	1
3095346	3.0	100	4.50	2.90	4.83	60.0	0.90°	1.0°	6	1
3095356	3.0	100	4.50	2.90	5.74	60.8	1.45°	1.5°	6	2
3095365	3.0	100	4.50	2.90	5.70	46.5	1.92°	2.0°	6	2
3095374	3.0	80	4.50	2.90	5.60	32.1	2.81°	3.0°	6	2
3095421	4.0	80	6.00	3.90	4.23	25.0	0.29°	0.5°	6	1
3095441	4.0	80	6.00	3.90	4.73	30.0	0.76°	1.0°	6	1
3095442	4.0	80	6.00	3.90	5.08	40.0	0.82°	1.0°	6	1
3095443	4.0	100	6.00	3.90	5.43	50.0	0.86°	1.0°	6	1
3095444	4.0	100	6.00	3.90	5.76	61.3	0.97°	1.0°	6	2
3095445	4.0	120	6.00	3.90	6.48	80.0	0.92°	1.0°	8	1
3095453	4.0	80	6.00	3.90	5.70	42.2	1.43°	1.5°	6	2
3095454	4.0	120	6.00	3.90	7.69	80.4	1.47°	1.5°	8	2
3095462	4.0	120	6.00	3.90	7.63	61.3	1.94°	2.0°	8	2
3095472	4.0	100	6.00	3.90	7.50	42.2	2.85°	3.0°	8	2
3095541	5.0	100	7.50	4.90	5.86	35.0	0.76°	1.0°	8	1
3095542	5.0	100	7.50	4.90	6.38	50.0	0.84°	1.0°	8	1
3095543	5.0	130	7.50	4.90	7.08	70.0	0.89°	1.0°	8	1
3095544	5.0	130	7.50	4.90	7.72	90.4	0.98°	1.0°	8	2
3095553	5.0	130	7.50	4.90	7.64	61.8	1.45°	1.5°	8	2
3095562	5.0	130	7.50	4.90	7.56	47.5	1.91°	2.0°	8	2
3095641	6.0	100	9.00	5.90	6.98	40.0	0.77°	1.0°	8	1
3095642	6.0	100	9.00	5.90	7.33	50.0	0.82°	1.0°	8	1
3095643	6.0	130	9.00	5.90	7.69	62.3	0.97°	1.0°	8	2
3095644	6.0	130	9.00	5.90	8.72	90.0	0.90°	1.0°	10	1
3095651	6.0	100	9.00	5.90	7.60	43.2	1.43°	1.5°	8	2

Packed: 1 pc. Available WXS® coating only.

continued on next page

EP

List 9581 (Continued)

PHX-PC-DBT, 3 Flute, Pencil Neck, Deep Feed, Ball End

SPEED FEED	CARBIDE	WXS		45°	SHANK
P23-24					h6

Milling Diameter Tolerance	
1≤D≤12	+ 0 / -0.015mm

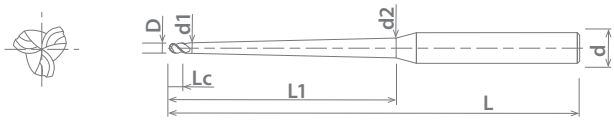
Radius Tolerance	
0.5≤R≤6	+0.01mm / -0.01mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Min. Neck Diameter	Max. Neck Diameter	Neck Length	Effective Draft Angle	Neck Draft Angle	Shank Diameter	Type
	D	L	Lc	d1	d2	L1	α	β	d	
3095653	6.0	130	9.00	5.90	9.59	81.4	1.47°	1.5°	10	2
3095661	6.0	100	9.00	5.90	7.50	33.6	1.87°	2.0°	8	2
3095662	6.0	130	9.00	5.90	9.49	62.3	1.94°	2.0°	10	2
3095841	8.0	120	12.00	7.90	9.22	50.0	0.77°	1.0°	10	1
3095842	8.0	120	12.00	7.90	9.62	63.3	0.97°	1.0°	10	2
3095843	8.0	150	12.00	7.90	10.62	90.0	0.88°	1.0°	12	1
3095844	8.0	180	12.00	7.90	11.62	120.6	0.99°	1.0°	12	2
3095851	8.0	120	12.00	7.90	9.50	44.2	1.43°	1.5°	10	2
3095853	8.0	150	12.00	7.90	11.49	82.4	1.47°	1.5°	12	2
3095862	8.0	120	12.00	7.90	11.35	63.3	1.94°	2.0°	12	2
3096041	10.0	120	15.00	9.90	11.56	64.3	0.97°	1.0°	12	2
3096042	10.0	160	15.00	9.90	12.16	80.0	0.83°	1.0°	16	1
3096043	10.0	160	15.00	9.90	12.86	100.0	0.87°	1.0°	16	1
3096044	10.0	180	15.00	9.90	13.56	120.0	0.89°	1.0°	16	1
3096045	10.0	200	15.00	9.90	14.26	140.0	0.91°	1.0°	16	1
3096046	10.0	220	15.00	9.90	14.96	160.0	0.92°	1.0°	16	1
3096051	10.0	120	15.00	9.90	11.40	45.2	1.43°	1.5°	12	2
3096053	10.0	180	15.00	9.90	15.38	121.6	1.48°	1.5°	16	2
3096061	10.0	120	15.00	9.90	11.24	35.6	1.87°	2.0°	12	2
3096064	10.0	160	15.00	9.90	15.21	92.9	1.96°	2.0°	16	2
3096241	12.0	120	18.00	11.90	13.36	60.0	0.73°	1.0°	16	1
3096242	12.0	180	18.00	11.90	14.76	100.0	0.85°	1.0°	16	1
3096243	12.0	180	18.00	11.90	15.48	122.6	0.99°	1.0°	16	2
3096244	12.0	220	18.00	11.90	16.85	160.0	0.91°	1.0°	20	1
3096254	12.0	220	18.00	11.90	19.27	160.8	1.48°	1.5°	20	2

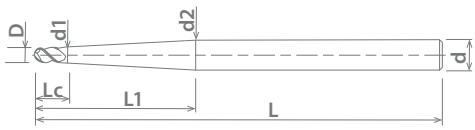
Packed: 1 pc. Available WXS® coating only.

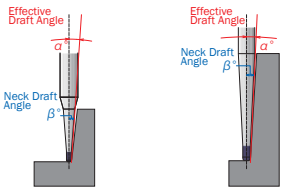
EP

Type 1



Type 2





* The tool may deflect and interfere with the draft area depending on the milling condition.

* For convenience, the Neck Draft Angle (α°) is shown the same as the Effective Draft Angle (α°), but actually it is different. (It does not interfere with the Effective Draft Angle (α°)

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9581	◎	◎	◎	◎	◎	○	○	○	◎					◎	◎	◎	○

○ good ◎ best

List 9592

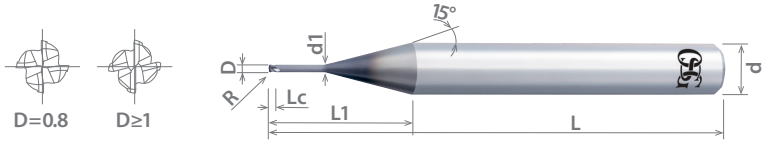
PHX-LN-CRE, 4 Flute, Pencil Neck, Deep Feed, Corner Radius, Rib Processor

SPEED FEED P27 | CARBIDE | WXS | 30° | SHANK h6

Milling Diameter Tolerance	
0.8≤D≤3	+0 / -0.01mm

Radius Tolerance	
0.4≤R≤1.5	+0.007mm / -0.007mm

Neck Length Tolerance	
0.8≤D≤3	+0 / -0.1mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Dia.	Effective Neck Length (le)			Shank Diameter
	D	R	L	Lc	L1	d1	α 0°	α 0.5°	α 1°	d
3190800	0.8	0.1	50	0.32	2	0.75	2.00	2.16	2.32	4
3190801	0.8	0.1	50	0.32	4	0.75	4.00	4.29	4.57	4
3190802	0.8	0.1	50	0.32	6	0.75	6.00	6.42	6.78	4
3190803	0.8	0.1	50	0.32	8	0.75	8.00	8.54	8.97	4
3191006	1.0	0.1	50	0.40	4	0.95	4.00	4.29	4.56	4
3191007	1.0	0.1	50	0.40	6	0.95	6.00	6.41	6.77	4
3191008	1.0	0.1	50	0.40	8	0.95	8.00	8.53	8.96	4
3191009	1.0	0.1	50	0.40	10	0.95	10.00	10.63	11.13	4
3191010	1.0	0.1	50	0.40	12	0.95	12.00	12.73	13.29	4
3191011	1.0	0.2	50	0.40	4	0.95	4.00	4.29	4.56	4
3191012	1.0	0.2	50	0.40	6	0.95	6.00	6.41	6.77	4
3191013	1.0	0.2	50	0.40	8	0.95	8.00	8.53	8.96	4
3191014	1.0	0.2	50	0.40	10	0.95	10.00	10.63	11.13	4
3191015	1.0	0.2	50	0.40	12	0.95	12.00	12.73	13.29	4
3191018	1.0	0.3	50	0.40	4	0.95	4.00	4.29	4.56	4
3191019	1.0	0.3	50	0.40	6	0.95	6.00	6.41	6.77	4
3191501	1.5	0.1	50	0.60	4	1.45	4.00	4.29	4.56	4
3191503	1.5	0.1	50	0.60	8	1.45	8.00	8.53	8.96	4
3191505	1.5	0.1	50	0.60	12	1.45	12.00	12.73	13.29	4
3191506	1.5	0.2	50	0.60	4	1.45	4.00	4.29	4.56	4
3191507	1.5	0.2	50	0.60	6	1.45	6.00	6.41	6.77	4
3191508	1.5	0.2	50	0.60	8	1.45	8.00	8.53	8.96	4
3192001	2.0	0.1	50	0.80	8	1.95	8.00	8.53	8.96	4
3192002	2.0	0.1	50	0.80	10	1.95	10.00	10.63	11.13	4
3192003	2.0	0.1	50	0.80	12	1.95	12.00	12.73	13.29	4
3192004	2.0	0.1	50	0.80	16	1.95	16.00	16.92	17.57	4
3192013	2.0	0.3	50	0.80	8	1.95	8.00	8.53	8.96	4
3192015	2.0	0.3	50	0.80	12	1.95	12.00	12.73	13.29	4
3192019	2.0	0.5	50	0.80	6	1.95	6.00	6.41	6.77	4
3192020	2.0	0.5	50	0.80	8	1.95	8.00	8.53	8.96	4
3192021	2.0	0.5	50	0.80	10	1.95	10.00	10.63	11.13	4
3192022	2.0	0.5	50	0.80	12	1.95	12.00	12.73	13.29	4
3193008	3.0	0.3	50	1.20	12	2.85	12.00	12.73	13.29	4

Packed: 1 pc. Available WXS® coating only.
Center Cutting applies only to diameter sizes over 0.8mm.

EP

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9592	◎	◎	◎	◎	◎	◎	◎	◎	◎					◎	◎	◎	◎

○ good ◎ best

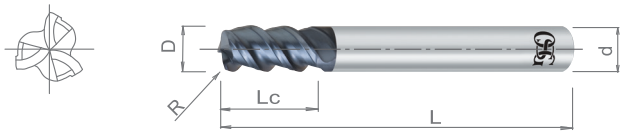
List 9575

PHX-DFR, 3 Flute, Deep Feed, Corner Radius

SPEED FEED P25-26 | CARBIDE | WXS | 55° | SHANK h6

Milling Diameter Tolerance	
6≤D≤20	+0.01mm / -0.01mm

Radius Tolerance	
3≤R≤10	+0.03mm / -0.03mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Shank Diameter
	D	R	L	Lc	d
3090512	6	1.5	80	12	6
3090516	8	2.0	90	16	8
3090520	10	2.0	100	20	10
3090522	12	2.0	120	24	12
3090526	16	3.0	130	32	16
3090530	20	3.0	150	40	20

Packed: 1 pc. Available WXS® coating only.

EP

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9575	▢	▢	▢	▢	▢	▢	▢	▢	▢					▢	▢	▢	▢

▢ good ▢ best

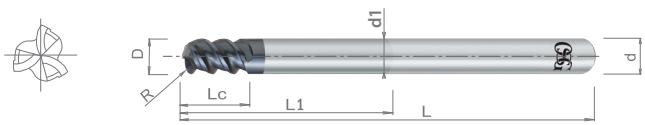
List 9576

PHX-LN-DFR, 3 Flute, Long Neck, Deep Feed, Corner Radius

SPEED FEED P25-26 | CARBIDE | WXS | 55° | SHANK h6

Milling Diameter Tolerance	
4≤D≤16	+0.01mm / -0.01mm

Radius Tolerance	
2≤R≤8	+0.03mm / -0.03mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	R	L	Lc	L1	D1	d
3092041	4	1.0	70	6	20	3.8	4
3092042	4	1.0	70	6	28	3.8	4
3092061	6	1.5	80	9	30	5.8	6
3092062	6	1.5	90	9	42	5.8	6
3092063	6	1.5	100	9	54	5.8	6
3092081	8	2.0	85	12	40	7.7	8
3092082	8	2.0	100	12	56	7.7	8
3092083	8	2.0	120	12	72	7.7	8
3092101	10	2.0	100	15	50	9.7	10
3092102	10	2.0	120	15	70	9.7	10
3092103	10	2.0	140	15	90	9.7	10
3092121	12	2.0	110	18	60	11.7	12
3092122	12	2.0	135	18	84	11.7	12
3092123	12	2.0	160	18	108	11.7	12
3092161	16	3.0	140	24	80	15.5	16
3092162	16	3.0	175	24	120	15.5	16

Packed: 1 pc. Available WXS® coating only.

EP

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9576	◎	◎	◎	◎	◎	○	○	○	◎					◎	◎	◎	○

○ good ◎ best

List 9580

PHX-PC-DFR, 3 Flute, Pencil Neck, Deep Feed, Corner Radius

SPEED FEED P25-26 | CARBIDE | WXS | 55° | SHANK h6

Milling Diameter Tolerance	
2≤D≤12	+0 / -0.015mm

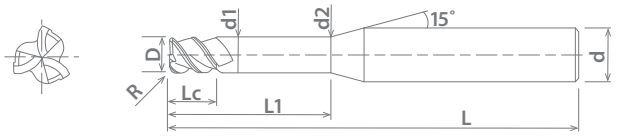
Radius Tolerance	
0.5≤R≤2	+0.03mm / -0.03mm

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Min. Neck Diameter	Maximum Neck Diameter	Neck Length	Effective Draft Angle	Neck Draft Angle	Shank Diameter	Type
	D	R	L	Lc	d1	d2	L1	α	β	d	
3097223	2	0.5	60	3.0	1.95	2.25	20.0	0.36°	0.5°	6	1
3097224	2	0.5	70	3.0	1.95	2.33	25.0	0.39°	0.5°	6	1
3097225	2	0.5	80	3.0	1.95	2.42	30.0	0.41°	0.5°	6	1
3097226	2	0.5	80	3.0	1.95	2.51	35.0	0.42°	0.5°	6	1
3097227	2	0.5	80	3.0	1.95	2.60	40.0	0.43°	0.5°	6	1
3097241	2	0.5	60	3.0	1.95	2.19	10.0	0.59°	1°	6	1
3097242	2	0.5	60	3.0	1.95	2.37	15.0	0.73°	1°	6	1
3097243	2	0.5	60	3.0	1.95	2.54	20.0	0.80°	1°	6	1
3097244	2	0.5	70	3.0	1.95	2.72	25.0	0.84°	1°	6	1
3097245	2	0.5	80	3.0	1.95	2.89	30.0	0.87°	1°	6	1
3097246	2	0.5	80	3.0	1.95	3.07	35.0	0.89°	1°	6	1
3097247	2	0.5	80	3.0	1.95	3.24	40.0	0.90°	1°	6	1
3097248	2	0.5	100	3.0	1.95	3.42	45.0	0.91°	1°	6	1
3097249	2	0.5	100	3.0	1.95	3.59	50.0	0.92°	1°	6	1
3097251	2	0.5	80	3.0	1.95	3.89	40.0	1.37°	1.5°	6	1
3097262	2	0.5	100	3.0	1.95	6.00	60.3	2.00°	2°	6	2
3097273	2	0.5	100	3.0	1.95	6.00	41.2	3.00°	3°	6	2
3097321	3	0.8	80	4.5	2.90	3.17	20.0	0.25°	0.5°	6	1
3097341	3	0.8	80	4.5	2.90	3.44	20.0	0.66°	1°	6	1
3097342	3	0.8	80	4.5	2.90	3.62	25.0	0.73°	1°	6	1
3097343	3	0.8	80	4.5	2.90	3.79	30.0	0.78°	1°	6	1
3097344	3	0.8	80	4.5	2.90	4.14	40.0	0.83°	1°	6	1
3097345	3	0.8	100	4.5	2.90	4.49	50.0	0.87°	1°	6	1
3097346	3	0.8	100	4.5	2.90	4.84	60.0	0.89°	1°	6	1
3097356	3	0.8	100	4.5	2.90	6.00	60.8	1.50°	1.5°	6	2
3097365	3	0.8	100	4.5	2.90	6.00	46.5	2.00°	2°	6	2
3097374	3	0.8	100	4.5	2.90	6.00	32.1	3.00°	3°	6	2
3097421	4	1.0	80	6.0	3.90	4.23	25.0	0.28°	0.5°	6	1
3097422	4	1.0	80	6.0	3.90	4.32	30.0	0.31°	0.5°	6	1
3097423	4	1.0	80	6.0	3.90	4.41	35.0	0.34°	0.5°	6	1
3097424	4	1.0	80	6.0	3.90	4.49	40.0	0.36°	0.5°	6	1
3097425	4	1.0	80	6.0	3.90	4.58	45.0	0.38°	0.5°	6	1
3097426	4	1.0	100	6.0	3.90	4.67	50.0	0.39°	0.5°	6	1
3097441	4	1.0	80	6.0	3.90	4.74	30.0	0.73°	1°	6	1
3097442	4	1.0	80	6.0	3.90	5.09	40.0	0.80°	1°	6	1
3097443	4	1.0	100	6.0	3.90	5.44	50.0	0.84°	1°	6	1
3097444	4	1.0	100	6.0	3.90	6.00	61.3	1.00°	1°	6	2

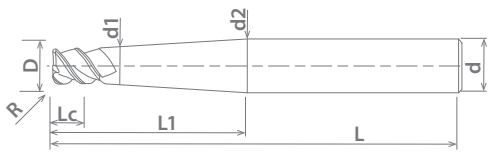
Packed: 1 pc. Available WXS® coating only.

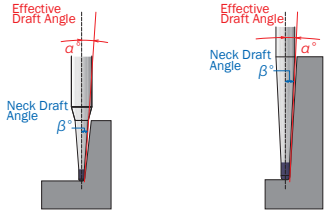
continued on next page EP

Type 1



Type 2





* The tool may deflect and interfere with the draft area depending on the milling condition.

* For convenience, the Neck Draft Angle (α°) is shown the same as the Effective Draft Angle (α°), but actually it is different. (It does not interfere with the Effective Draft Angle (α°)

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9580	◉	◉	◉	◉	◉	○	○	○	◉					◉	◉	◉	○

○ good ◉ best

List 9580 (Continued)

PHX-PC-DFR, 3 Flute, Pencil Neck, Deep Feed, Corner Radius

SPEED FEED	CARBIDE	WXS		55°	SHANK
P25-26					h6

Milling Diameter Tolerance	
2≤D≤12	+0 / -0.015mm

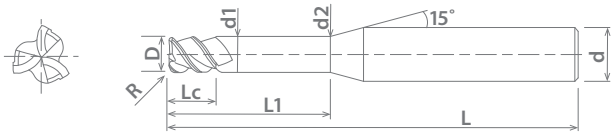
Radius Tolerance	
0.5≤R≤2	+0.03mm / -0.03mm

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Min. Neck Diameter	Maximum Neck Diameter	Neck Length	Effective Draft Angle	Neck Draft Angle	Shank Diameter	Type
	D	R	L	Lc	d1	d2	L1	α	β	d	
3097453	4	1.0	80	6.0	3.90	6.00	42.2	1.50°	1.5°	6	2
3097454	4	1.0	120	6.0	3.90	8.00	80.4	1.50°	1.5°	8	2
3097461	4	1.0	80	6.0	3.90	6.00	32.6	2.00°	2°	6	2
3097462	4	1.0	120	6.0	3.90	8.00	61.3	2.00°	2°	8	2
3097472	4	1.0	100	6.0	3.90	8.00	42.2	3.00°	3°	8	2
3097627	6	1.5	130	9.0	5.90	6.79	60.0	0.39°	0.5°	8	1
3097641	6	1.5	100	9.0	5.90	6.98	40.0	0.73°	1°	8	1
3097642	6	1.5	100	9.0	5.90	7.33	50.0	0.79°	1°	8	1
3097643	6	1.5	130	9.0	5.90	8.00	62.3	1.00°	1°	8	2
3097651	6	1.5	100	9.0	5.90	8.00	43.2	1.50°	1.5°	8	2
3097653	6	1.5	130	9.0	5.90	10.00	81.4	1.50°	1.5°	10	2
3097661	6	1.5	100	9.0	5.90	8.00	33.6	2.00°	2°	8	2
3097662	6	1.5	130	9.0	5.90	10.00	62.3	2.00°	2°	10	2
3097826	8	2.0	150	12.0	7.90	9.09	80.0	0.40°	0.5°	10	1
3097841	8	2.0	120	12.0	7.90	9.23	50.0	0.73°	1°	10	1
3097842	8	2.0	150	12.0	7.90	10.00	63.3	1.00°	1°	10	2
3097844	8	2.0	180	12.0	7.90	12.00	120.6	1.00°	1°	12	2
3097851	8	2.0	120	12.0	7.90	10.00	44.2	1.50°	1.5°	10	2
3097853	8	2.0	150	12.0	7.90	12.00	82.4	1.50°	1.5°	12	2
3097861	8	2.0	120	12.0	7.90	10.00	34.6	2.00°	2°	10	2
3097862	8	2.0	120	12.0	7.90	12.00	63.3	2.00°	2°	12	2
3098026	10	2.0	150	15.0	9.90	11.38	100.0	0.40°	0.5°	12	1
3098041	10	2.0	120	15.0	9.90	12.00	64.3	1.00°	1°	12	2
3098042	10	2.0	160	15.0	9.90	12.17	80.0	0.80°	1°	16	1
3098043	10	2.0	160	15.0	9.90	12.87	100.0	0.84°	1°	16	1
3098044	10	2.0	180	15.0	9.90	13.57	120.0	0.87°	1°	16	1
3098045	10	2.0	200	15.0	9.90	14.26	140.0	0.88°	1°	16	1
3098046	10	2.0	220	15.0	9.90	14.96	160.0	0.90°	1°	16	1
3098051	10	2.0	120	15.0	9.90	12.00	45.2	1.50°	1.5°	12	2
3098053	10	2.0	180	15.0	9.90	16.00	121.6	1.50°	1.5°	16	2
3098061	10	2.0	120	15.0	9.90	12.00	35.6	2.00°	2°	12	2
3098064	10	2.0	220	15.0	9.90	16.00	92.9	2.00°	2°	16	2
3098224	12	2.0	180	18.0	11.90	13.68	120.0	0.41°	0.5°	16	1
3098241	12	2.0	120	18.0	11.90	13.37	60.0	0.67°	1°	16	1
3098242	12	2.0	180	18.0	11.90	14.76	100.0	0.81°	1°	16	1
3098243	12	2.0	180	18.0	11.90	16.00	122.6	1.00°	1°	16	2
3098244	12	2.0	220	18.0	11.90	16.86	160.0	0.88°	1°	20	1
3098254	12	2.0	220	18.0	11.90	20.00	160.8	1.50°	1.5°	20	2

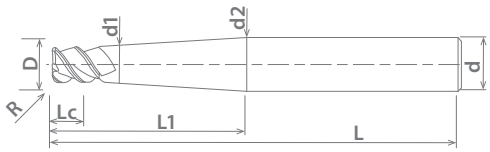
Packed: 1 pc. Available WXS® coating only.

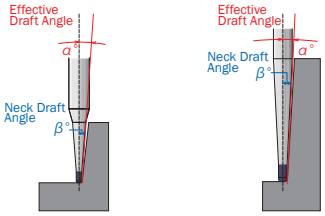
EP

Type 1



Type 2





* The tool may deflect and interfere with the draft area depending on the milling condition.

* For convenience, the Neck Draft Angle (α°) is shown the same as the Effective Draft Angle (α°), but actually it is different. (It does not interfere with the Effective Draft Angle (α°)

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9580	◎	◎	◎	◎	◎	○	○	○	◎					◎	◎	◎	○

○ good ◎ best

List 9570

PHX-CRT, 3 Flute, High Feed, Corner Radius

SPEED FEED P25-26 | CARBIDE | EXO® | 55° | SHANK h6

Milling Diameter Tolerance	
1≤D≤5	+0 / -0.015mm
6≤D≤20	+0.01mm / -0.005mm

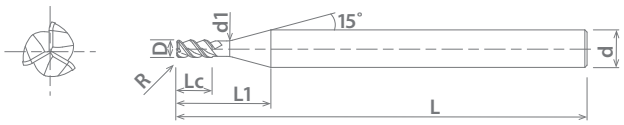
Radius Tolerance	
0.3≤R≤3	+0.01mm / -0.01mm

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Effective Neck Length (Le) (Based on Inclined Angle)				Shank Diameter	Type
	D	R	L	Lc	L1	d1	α				d	
							0.5°	1°	2°	3°		
3090002	1	0.3	60	2	4.0	0.95	4.29	4.56	5.05	5.50	6	1
3090003	1.5	0.3	60	3	4.5	1.45	4.82	5.11	5.64	6.12	6	1
3090004	2	0.5	60	4	6.0	1.95	6.41	6.77	7.39	7.89	6	1
3090006	3	0.8	70	6	9.0	2.85	9.46	9.87	10.62	11.48	6	1
3090008	4	1.0	70	8	12.0	3.85	12.60	13.09	14.07	15.21	6	1
3090010	5	1.0	70	10	15.0	4.85	15.72	16.30	–	–	6	1
3090012	6	1.5	80	12	–	–	–	–	–	–	6	2
3090016	8	2.0	90	16	–	–	–	–	–	–	8	2
3090020	10	2.0	100	20	–	–	–	–	–	–	10	2
3090022	12	2.0	120	24	–	–	–	–	–	–	12	2
3090026	16	3.0	130	32	–	–	–	–	–	–	16	2
3090030	20	3.0	150	40	–	–	–	–	–	–	20	2

Packed: 1 pc. Available EXO® coating only.

EP

Type 1



Type 2

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
9570	◎	◎	◎	◎	◎	○	○	○	◎					◎	◎	◎	○

○ good ◎ best

List 9510 - EXOPRO® PHX : Deep Feed, Ball Nose
List 9590 - EXOPRO® PHX : 3 Flute, Long Neck, Ball Nose
List 9581 - EXOPRO® PHX : Pencil-Neck, Deep-Feed, Ball Nose

Side Milling

Hardness			Up to 38 HRC				38~53 HRC				Up to 53 HRC				Up to 55 HRC				
Work Material			Hardened and Pre-hardened Steels																
Cutting Speed			62 ~ 397 SFM				62 ~ 309 SFM				105 ~ 248 SFM				62 ~ 402 SFM				
R (mm)	L/D	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Clearance (in)
					Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar	
0.5	6	0.3°	18,000	39.4	0.002	0.006	18,000	35.4	0.002	0.006	18,000	11.0	0.0003	0.001	18,000	47.2	0.001	0.001	0.002
0.5	10	0.3°	16,000	31.5	0.002	0.006	16,000	31.5	0.002	0.006	16,000	4.7	0.0001	0.012	16,000	39.4	0.001	0.001	0.001
0.5	15	0.3°	8,000	16.5	0.001	0.006	8,000	16.5	0.001	0.006	-	-	-	-	8,000	19.7	0.001	0.001	0.001
0.5	20	0.3°	6,000	11.8	0.001	0.005	6,000	11.8	0.001	0.005	-	-	-	-	6,000	15.0	0.001	0.001	0.001
0.5	25	0.3°	6,000	5.1	0.001	0.003	6,000	5.1	0.001	0.003	-	-	-	-	6,000	13.8	0.001	0.001	0.001
0.5	30	0.3°	6,000	3.5	0.000	0.002	6,000	3.5	0.000	0.002	-	-	-	-	6,000	9.8	0.001	0.001	0.001
0.75	6	0.3°	18,000	59.1	0.004	0.012	16,000	51.2	0.004	0.012	16,000	25.6	0.0028	0.006	18,000	43.3	0.002	0.002	0.002
0.75	10	0.3°	15,000	43.3	0.002	0.010	15,000	37.4	0.002	0.010	15,000	12.6	0.0004	0.004	15,000	35.4	0.002	0.002	0.001
0.75	16	0.3°	7,500	9.1	0.001	0.008	7,500	7.9	0.001	0.008	7,500	11.8	0.0003	0.002	7,500	17.7	0.002	0.002	0.001
1.0	6	0.3°	18,000	63.0	0.008	0.024	15,000	55.1	0.008	0.016	12,000	23.6	0.006	0.006	15,000	708.7	0.002	0.002	0.004
1.0	10	0.3°	12,000	49.2	0.006	0.016	12,000	43.3	0.006	0.016	12,000	23.6	0.004	0.002	12,000	59.1	0.002	0.002	0.003
1.0	15	0.3°	7,800	32.3	0.006	0.016	7,800	30.7	0.006	0.016	7,800	17.7	0.003	0.002	7,800	38.6	0.002	0.002	0.003
1.0	20	0.3°	6,200	25.6	0.005	0.016	6,200	23.6	0.005	0.012	6,200	13.4	0.002	0.002	6,200	23.6	0.002	0.002	0.002
1.0	25	0.3°	4,700	19.7	0.005	0.012	4,700	19.7	0.005	0.012	-	-	-	-	4,700	17.7	0.002	0.002	0.002
1.0	30	0.3°	3,500	15.7	0.004	0.012	3,500	15.7	0.004	0.012	-	-	-	-	3,500	17.7	0.002	0.002	0.002
1.0	35	0.3°	3,500	15.7	0.003	0.012	3,500	15.7	0.003	0.012	-	-	-	-	3,500	17.7	0.002	0.002	0.001
1.0	40	0.3°	3,500	11.8	0.003	0.010	3,500	11.8	0.003	0.010	-	-	-	-	3,500	17.7	0.002	0.002	0.001
1.0	45	0.3°	3,500	7.9	0.003	0.008	3,500	7.9	0.003	0.008	-	-	-	-	3,500	17.7	0.002	0.002	0.001
1.0	50	0.3°	3,500	5.9	0.002	0.004	3,500	5.9	0.002	0.004	-	-	-	-	3,500	17.7	0.002	0.002	0.001
1.0	60	0.3°	3,500	5.9	0.002	0.004	3,500	5.9	0.002	0.004	-	-	-	-	3,500	17.7	0.002	0.002	0.001
1.5	10	0.3°	12,000	74.8	0.008	0.020	8,000	47.2	0.008	0.020	8,000	27.6	0.005	0.004	11,000	80.7	0.004	0.003	0.004
1.5	15	0.3°	10,000	61.0	0.008	0.020	8,000	47.2	0.008	0.020	8,000	21.7	0.004	0.004	10,000	74.8	0.004	0.003	0.003
1.5	20	0.3°	7,500	45.3	0.007	0.020	7,200	43.3	0.007	0.020	7,200	18.9	0.002	0.003	7,500	55.1	0.004	0.003	0.003
1.5	25	0.3°	4,800	29.5	0.007	0.020	4,600	27.6	0.007	0.020	4,600	12.6	0.002	0.002	4,800	35.4	0.004	0.003	0.002
1.5	30	0.3°	4,000	24.8	0.006	0.016	3,400	19.7	0.006	0.016	3,400	9.4	0.001	0.001	3,800	28.3	0.004	0.003	0.001
1.5	40	0.3°	2,800	17.3	0.005	0.016	2,600	15.7	0.005	0.016	-	-	-	-	2,600	19.7	0.004	0.003	0.001
1.5	50	0.3°	2,200	13.8	0.004	0.016	2,200	11.8	0.004	0.016	-	-	-	-	2,200	15.7	0.004	0.003	0.001
1.5	60	0.3°	2,200	13.8	0.003	0.016	2,200	11.8	0.003	0.016	-	-	-	-	2,200	15.7	0.004	0.003	0.001
2.0	10	0.5°	9,600	78.7	0.012	0.024	6,000	49.2	0.012	0.024	6,000	31.5	0.006	0.004	9,500	94.5	0.005	0.004	0.004
2.0	15	0.5°	9,300	74.8	0.011	0.024	6,000	47.2	0.011	0.024	6,000	31.5	0.005	0.004	9,000	88.6	0.005	0.004	0.004
2.0	20	0.5°	7,600	61.0	0.010	0.024	6,000	45.3	0.010	0.024	6,000	27.6	0.004	0.003	8,200	80.7	0.005	0.004	0.004
2.0	25	0.5°	6,100	49.2	0.009	0.024	5,500	43.3	0.009	0.024	5,500	17.7	0.002	0.003	5,500	53.1	0.005	0.004	0.003
2.0	30	0.5°	5,000	41.3	0.008	0.024	4,500	31.5	0.008	0.024	4,500	13.8	0.001	0.002	4,500	43.3	0.005	0.004	0.003
2.0	35	0.5°	3,600	29.5	0.006	0.020	3,600	25.6	0.006	0.020	3,600	11.0	0.000	0.001	3,600	35.4	0.005	0.004	0.002
2.0	40	0.5°	3,000	24.8	0.005	0.020	3,000	21.7	0.005	0.020	3,000	5.9	0.000	0.000	3,000	29.5	0.005	0.004	0.002
2.0	45	0.5°	2,700	21.7	0.004	0.016	2,700	19.7	0.004	0.016	-	-	-	-	2,700	26.8	0.005	0.004	0.001
2.0	50	0.5°	2,500	20.5	0.004	0.016	2,500	17.7	0.004	0.016	-	-	-	-	2,500	24.8	0.005	0.004	0.001
2.0	60	0.5°	2,100	16.9	0.003	0.016	2,100	15.7	0.003	0.016	-	-	-	-	2,100	20.9	0.005	0.004	0.001
2.5	10	0.5°	7,700	74.8	0.014	0.031	4,800	43.3	0.014	0.031	4,800	35.4	0.008	0.004	7,700	94.5	0.006	0.047	0.004
2.5	15	0.5°	7,700	74.8	0.012	0.031	4,800	39.4	0.012	0.031	4,800	33.5	0.006	0.004	6,100	74.8	0.006	0.047	0.004
2.5	20	0.5°	7,700	70.9	0.012	0.031	4,800	37.4	0.012	0.031	4,800	27.6	0.005	0.003	6,100	74.8	0.006	0.047	0.004
2.5	25	0.5°	5,100	51.2	0.010	0.031	4,800	35.4	0.010	0.031	4,800	25.6	0.002	0.002	5,100	63.0	0.006	0.047	0.003
2.5	30	0.5°	5,100	47.2	0.008	0.024	4,800	33.5	0.008	0.024	4,800	19.7	0.001	0.002	5,100	63.0	0.006	0.047	0.003
2.5	35	0.5°	4,400	43.3	0.006	0.024	4,400	29.5	0.006	0.024	4,400	15.7	0.001	0.001	4,400	53.1	0.006	0.047	0.002

1. The above mentioned conditions according to projection lengths are intended as general guidelines for reference only. Adjustments should be made based on actual milling conditions.
2. For 0.5R - 2.5R, the machining conditions are based on chucking the tool up to the base of the neck.
3. Highly rigid machines and tool holders should be used.
4. Tool vibrations should be kept at a minimum level for maximum accuracy.
5. In the case of linear machining, do not use the Ar value, instead refer to the Aa value.
6. More stable high-feed machining in the corners can be attained by setting an R insertion or decelleration on the CAM or machine side.
7. When cutting load fluctuates (in the corners, etc.) or when high-precision is required, be sure to control the rotational speed.
8. When cutting at greater than the recommended cutting angle, reduce the feed.

continued on next page

List 9510 - EXOPRO® PHX : Deep Feed, Ball Nose (Continued)
List 9590 - EXOPRO® PHX : 3 Flute, Long Neck, Ball Nose (Continued)
List 9581 - EXOPRO® PHX : Pencil-Neck, Deep-Feed, Ball Nose (Continued)

Side Milling

Hardness			Up to 38 HRC				38~53 HRC				Up to 53 HRC				Up to 55 HRC				
Work Material			Hardened and Pre-hardened Steels																
Cutting Speed			62 ~ 397 SFM				62 ~ 309 SFM				105 ~ 248 SFM				62 ~ 402 SFM				
R (mm)	L/D	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Clearance (in)
					Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar	
2.5	40	0.5°	3,100	29.5	0.004	0.024	3,100	25.6	0.004	0.024	3,100	10.2	0.000	0.001	3,100	37.4	0.006	0.047	0.002
3.0	24	0.5°	6,400	74.8	0.017	0.047	4,000	47.2	0.012	0.039	4,000	35.4	0.012	0.004	6,500	57.1	0.007	0.006	0.004
3.0	30	0.5°	5,100	59.1	0.013	0.047	4,000	45.3	0.012	0.039	4,000	35.4	0.010	0.004	5,100	76.8	0.007	0.006	0.004
3.0	36	0.5°	4,200	49.2	0.015	0.047	4,000	43.3	0.012	0.039	4,000	29.5	0.008	0.003	4,200	62.2	0.007	0.006	0.003
3.0	42	0.5°	3,700	41.3	0.008	0.035	3,700	39.4	0.008	0.039	3,700	19.7	0.006	0.002	3,700	55.1	0.007	0.006	0.003
3.0	48	0.5°	3,600	29.5	0.006	0.035	2,600	27.6	0.006	0.031	2,600	15.7	0.004	0.001	2,600	38.6	0.007	0.006	0.002
3.0	54	0.5°	2,100	24.8	0.004	0.031	2,100	23.6	0.004	0.031	2,100	9.4	0.002	0.001	2,100	31.5	0.007	0.006	0.002
3.0	66	0.5°	1,900	21.7	0.003	0.028	1,900	19.7	0.003	0.028	-	-	-	-	1,900	27.6	0.007	0.006	0.001
3.0	80	0.5°	1,700	17.7	0.003	0.024	1,700	15.7	0.003	0.024	-	-	-	-	1,700	25.6	0.007	0.006	0.001
4.0	30	0.5°	4,800	90.6	0.018	0.059	3,000	49.6	0.012	0.059	3,000	41.3	0.012	0.006	4,800	94.5	0.009	0.008	0.004
4.0	40	0.5°	3,800	70.9	0.015	0.051	3,000	47.2	0.012	0.051	3,000	41.3	0.012	0.004	3,800	74.8	0.009	0.008	0.004
4.0	48	0.5°	3,200	59.1	0.011	0.047	3,000	43.3	0.010	0.047	3,000	35.4	0.010	0.004	3,200	63.0	0.009	0.008	0.003
4.0	56	0.5°	2,700	51.2	0.008	0.043	2,700	39.4	0.008	0.043	2,700	31.5	0.008	0.003	2,700	53.1	0.009	0.008	0.003
4.0	64	0.5°	1,900	35.4	0.008	0.039	1,900	27.6	0.007	0.039	1,900	19.7	0.007	0.003	1,900	37.4	0.009	0.008	0.002
4.0	80	0.5°	1,500	27.6	0.006	0.031	1,500	21.7	0.006	0.031	-	-	-	-	1,500	29.5	0.009	0.008	0.001
4.0	100	0.5°	1,200	23.6	0.006	0.031	1,200	15.7	0.004	0.031	-	-	-	-	1,200	23.6	0.009	0.008	0.001
4.0	120	0.5°	1,000	19.7	0.004	0.028	1,000	13.8	0.003	0.028	-	-	-	-	1,000	19.7	0.009	0.008	0.001
5.0	35	0.5°	3,800	90.6	0.026	0.071	2,400	39.4	0.016	0.063	2,400	33.5	0.016	0.006	3,800	94.5	0.012	0.011	0.004
5.0	50	0.5°	3,100	74.8	0.022	0.071	2,400	39.4	0.012	0.063	2,400	33.5	0.012	0.006	3,100	76.8	0.012	0.011	0.004
5.0	60	0.5°	2,500	59.1	0.018	0.063	2,400	39.4	0.012	0.059	2,400	33.5	0.012	0.004	2,500	61.0	0.012	0.011	0.004
5.0	70	0.5°	2,200	51.2	0.013	0.063	2,200	35.4	0.012	0.059	2,200	31.5	0.012	0.004	2,200	53.1	0.012	0.011	0.003
5.0	80	0.5°	1,500	31.5	0.009	0.063	1,500	23.6	0.008	0.059	1,500	23.6	0.008	0.003	1,500	37.4	0.012	0.011	0.003
5.0	100	0.5°	1,200	23.6	0.006	0.059	1,200	19.7	0.005	0.059	1,200	19.7	0.005	0.003	1,200	29.5	0.012	0.011	0.002
5.0	120	0.5°	1,050	19.7	0.004	0.051	1,000	15.7	0.004	0.051	-	-	-	-	1,050	25.6	0.012	0.011	0.002
5.0	140	0.5°	850	15.7	0.003	0.051	800	13.8	0.003	0.051	-	-	-	-	850	19.7	0.012	0.011	0.001
5.0	160	0.5°	700	12.6	0.003	0.039	700	11.8	0.003	0.039	-	-	-	-	700	17.7	0.012	0.011	0.001
6.0	45	0.5°	3,200	66.9	0.031	0.079	2,000	31.5	0.031	0.071	2,000	31.5	0.024	0.006	3,200	94.5	0.014	0.013	0.006
6.0	60	0.5°	2,500	51.2	0.026	0.079	2,000	31.5	0.026	0.071	2,000	31.5	0.020	0.006	2,500	74.8	0.014	0.013	0.006
6.0	70	0.5°	2,100	43.3	0.022	0.079	2,000	31.5	0.022	0.071	2,000	31.5	0.020	0.004	2,100	63.0	0.014	0.013	0.004
6.0	85	0.5°	1,800	37.4	0.017	0.071	1,500	23.6	0.017	0.067	1,500	23.6	0.016	0.004	1,800	53.1	0.014	0.013	0.004
6.0	100	0.5°	1,300	27.2	0.012	0.071	1,200	19.7	0.012	0.067	1,200	19.7	0.012	0.004	1,300	38.6	0.014	0.013	0.004
6.0	120	0.5°	1,000	20.9	0.010	0.059	1,000	16.5	0.010	0.059	-	-	-	-	1,000	29.5	0.014	0.013	0.002
6.0	140	0.5°	900	18.5	0.008	0.059	900	15.0	0.008	0.059	-	-	-	-	900	26.8	0.014	0.013	0.002
6.0	160	0.5°	700	14.6	0.006	0.051	700	11.8	0.006	0.051	-	-	-	-	700	20.9	0.014	0.013	0.002
8.0	55	0.5°	2,400	63.0	0.039	0.087	1,500	23.6	0.039	0.071	1,500	23.6	0.031	0.006	2,400	94.5	0.019	0.016	0.008
8.0	80	0.5°	1,900	49.2	0.035	0.087	1,500	23.6	0.035	0.071	1,500	23.6	0.031	0.006	1,900	74.8	0.019	0.016	0.006
8.0	90	0.5°	1,600	41.3	0.030	0.087	1,500	23.6	0.030	0.071	1,500	23.6	0.028	0.004	1,600	63.0	0.019	0.016	0.004
8.0	105	0.5°	1,400	35.4	0.022	0.079	1,400	22.4	0.022	0.067	1,400	22.4	0.020	0.003	1,400	55.1	0.019	0.016	0.003
8.0	120	0.5°	1,000	25.6	0.016	0.079	1,000	16.5	0.016	0.067	1,000	16.5	0.016	0.002	1,000	39.4	0.019	0.016	0.002
10.0	70	0.5°	1,900	59.1	0.047	0.142	1,200	19.7	0.047	0.071	1,200	19.7	0.031	0.006	1,900	94.5	0.024	0.020	0.008
10.0	90	0.5°	1,500	47.2	0.043	0.142	1,200	19.7	0.043	0.071	1,200	19.7	0.031	0.006	1,500	74.8	0.024	0.020	0.006
10.0	110	0.5°	1,300	39.4	0.035	0.138	1,200	19.7	0.035	0.071	1,200	19.7	0.031	0.004	1,300	63.0	0.024	0.020	0.004
10.0	130	0.5°	1,100	33.5	0.028	0.134	1,100	17.7	0.028	0.071	1,100	17.7	0.028	0.004	1,100	55.1	0.024	0.020	0.003
10.0	150	0.5°	760	23.6	0.020	0.130	760	12.6	0.020	0.071	760	12.6	0.020	0.003	760	37.4	0.024	0.020	0.002

1. The above mentioned conditions according to projection lengths are intended as general guidelines for reference only.
   Adjustments should be made based on actual milling conditions.
2. For 0.5R - 2.5R, the machining conditions are based on chucking the tool up to the base of the neck.
3. Highly rigid machines and tool holders should be used.
4. Tool vibrations should be kept at a minimum level for maximum accuracy.
5. In the case of linear machining, do not use the Ar value, instead refer to the Aa value.
6. More stable high-feed machining in the corners can be attained by setting an R insertion or decelleration on the CAM or machine side.
7. When cutting load fluctuates (in the corners, etc.) or when high-precision is required, be sure to control the rotational speed.
8. When cutting at greater than the recommended cutting angle, reduce the feed.

List 9570 - EXOPRO® PHX: High Feed, Corner Radius
List 9575 - EXOPRO® PHX: Deep Feed, Corner Radius
List 9576 - EXOPRO® PHX: Long Neck, Deep Feed, Corner Radius
List 9580 - EXOPRO® PHX: Pencil Neck, Deep Feed, Corner Radius

Side Milling

Hardness				Up to 40 HRC				40~55 HRC				55~60 HRC				
Work Material				Mild Steels and Carbon Steels				Hardened Steels and Prehardened Steels								
				High Feed Roughing				Semi-Finishing				Finishing				
D (mm)	r (mm)	L1	Rec'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Stock to Remove (in)
						Aa	Ar			Aa	Ar			Aa	Ar	
1.0	R3	10	0.3°	16,000	35.4	0.0012	0.0055	16,000	35.4	0.0012	0.0055	16,000	35.4	0.0016	0.0055	0.0020
1.0	R3	15	0.3°	8,000	17.7	0.0012	0.0055	8,000	17.7	0.0012	0.0055	8,000	17.7	0.0016	0.0055	0.0020
1.0	R3	20	0.3°	6,000	13.8	0.0008	0.0055	6,000	13.8	0.0008	0.0055	6,000	13.8	0.0016	0.0055	0.0012
1.0	R3	25	0.3°	6,000	11.8	0.0004	0.0051	6,000	11.8	0.0004	0.0051	6,000	11.8	0.0016	0.0055	0.0012
1.0	R3	30	0.3°	6,000	9.8	0.0004	0.0047	6,000	9.8	0.0004	0.0047	6,000	9.8	0.0016	0.0055	0.0012
1.5	R3	10	0.3°	16,000	55.1	0.0020	0.0118	16,000	47.2	0.0020	0.0118	16,000	55.1	0.0016	0.0138	0.0028
1.5	R3	15	0.3°	8,000	31.5	0.0020	0.0118	8,000	23.6	0.0020	0.0118	8,000	31.5	0.0016	0.0138	0.0020
1.5	R3	20	0.3°	5,500	21.7	0.0016	0.0118	5,500	19.7	0.0016	0.0118	5,500	21.7	0.0016	0.0138	0.0020
1.5	R3	25	0.3°	5,000	19.7	0.0016	0.0118	5,000	17.7	0.0016	0.0118	5,000	19.7	0.0016	0.0138	0.0012
1.5	R3	30	0.3°	4,500	17.7	0.0016	0.0118	4,500	15.7	0.0016	0.0118	4,500	17.7	0.0016	0.0138	0.0012
2.0	R0.5	10	0.3°	12,000	57.1	0.0059	0.0157	12,000	43.3	0.0059	0.0157	12,000	43.3	0.0024	0.0157	0.0028
2.0	R0.5	15	0.3°	7,800	35.4	0.0047	0.0157	7,800	27.6	0.0039	0.0157	7,800	27.6	0.0024	0.0157	0.0028
2.0	R0.5	20	0.3°	6,200	29.5	0.0039	0.0118	6,200	23.6	0.0028	0.0118	6,200	23.6	0.0024	0.0157	0.0020
2.0	R0.5	25	0.3°	4,700	21.7	0.0028	0.0118	4,700	19.7	0.0024	0.0118	4,700	19.7	0.0024	0.0157	0.0020
2.0	R0.5	30	0.3°	3,500	15.7	0.0028	0.0118	3,500	15.7	0.0020	0.0118	3,500	15.7	0.0024	0.0157	0.0020
2.0	R0.5	35	0.3°	3,500	15.7	0.0028	0.0079	3,500	15.7	0.0016	0.0079	3,500	15.7	0.0024	0.0157	0.0012
2.0	R0.5	40	0.3°	3,500	11.8	0.0028	0.0079	3,500	11.8	0.0016	0.0079	3,500	11.8	0.0024	0.0157	0.0012
2.0	R0.5	45	0.3°	3,500	7.9	0.0028	0.0079	3,500	7.9	0.0012	0.0079	3,500	7.9	0.0024	0.0157	0.0012
2.0	R0.5	50	0.3°	3,500	5.9	0.0024	0.0039	3,500	5.9	0.0012	0.0039	3,500	7.9	0.0024	0.0157	0.0012
2.0	R0.5	60	0.3°	3,500	5.9	0.0020	0.0039	3,500	5.9	0.0012	0.0039	3,500	7.9	0.0024	0.0157	0.0012
3.0	R0.8	10	0.3°	11,000	65.0	0.0051	0.0236	8,000	47.2	0.0051	0.0236	11,000	82.7	0.004	0.020	0.0039
3.0	R0.8	15	0.3°	10,000	59.1	0.0051	0.0236	8,000	47.2	0.0051	0.0236	10,000	74.8	0.004	0.020	0.0028
3.0	R0.8	20	0.3°	7,500	43.3	0.0005	0.0197	7,200	39.4	0.0005	0.0197	7,500	55.1	0.004	0.020	0.0028
3.0	R0.8	25	0.3°	4,800	27.6	0.0047	0.0157	4,600	25.6	0.0047	0.0157	4,800	35.4	0.004	0.020	0.0020
3.0	R0.8	30	0.3°	3,800	21.7	0.0039	0.0157	3,400	19.7	0.0039	0.0157	3,800	29.5	0.004	0.020	0.0012
3.0	R0.8	40	0.3°	2,600	17.7	0.0031	0.0118	2,600	15.7	0.0031	0.0118	2,600	21.7	0.004	0.020	0.0012
3.0	R0.8	50	0.3°	2,200	13.8	0.0024	0.0118	2,200	11.8	0.0024	0.0118	2,200	17.7	0.004	0.020	0.0012
3.0	R0.8	60	0.3°	2,200	13.8	0.0016	0.0118	2,200	11.8	0.0016	0.0118	2,200	15.7	0.004	0.020	0.0012
4.0	R1	10	0.5°	9,500	82.7	0.0079	0.0354	6,000	49.2	0.0079	0.0354	9,500	88.6	0.0047	0.0315	0.0039
4.0	R1	15	0.5°	9,000	78.7	0.0079	0.0315	6,000	49.2	0.0079	0.0315	9,000	84.6	0.0047	0.0315	0.0039
4.0	R1	20	0.5°	8,200	66.9	0.0079	0.0276	6,000	49.2	0.0055	0.0276	8,200	78.7	0.0047	0.0276	0.0039
4.0	R1	25	0.5°	5,500	55.1	0.0059	0.0276	5,500	45.3	0.0043	0.0276	5,500	53.1	0.0047	0.0276	0.0028
4.0	R1	30	0.5°	4,500	45.3	0.0059	0.0276	4,500	35.4	0.0035	0.0276	4,500	43.3	0.0047	0.0276	0.0028
4.0	R1	35	0.5°	3,600	43.3	0.0047	0.0236	3,600	29.5	0.0035	0.0236	3,600	35.4	0.0047	0.0276	0.0020
4.0	R1	40	0.5°	3,000	35.4	0.0047	0.0236	3,000	25.6	0.0035	0.0236	3,000	31.5	0.0047	0.0276	0.0020
4.0	R1	45	0.5°	2,700	33.5	0.0039	0.0197	2,700	23.6	0.0031	0.0197	2,700	29.5	0.0047	0.0276	0.0012
4.0	R1	50	0.5°	2,500	31.5	0.0039	0.0197	2,500	21.7	0.0031	0.0197	2,500	23.6	0.0047	0.0276	0.0012
4.0	R1	60	0.5°	2,100	27.6	0.0031	0.0197	2,100	17.7	0.0024	0.0197	2,100	19.7	0.0047	0.0276	0.0012
5.0	R1	10	0.5°	7,700	98.4	0.0079	0.0472	4,800	141.7	0.0079	0.0472	7,700	70.9	0.0047	0.0472	0.0039
5.0	R1	15	0.5°	7,700	94.5	0.0079	0.0472	4,800	133.9	0.0063	0.0472	6,100	57.1	0.0047	0.0472	0.0039
5.0	R1	20	0.5°	7,700	94.5	0.0079	0.0472	4,800	133.9	0.0063	0.0472	6,100	57.1	0.0047	0.0472	0.0039
5.0	R1	25	0.5°	5,100	86.6	0.0067	0.0394	4,800	118.1	0.0051	0.0394	5,100	47.2	0.0047	0.0472	0.0028
5.0	R1	30	0.5°	5,100	86.6	0.0067	0.0394	4,800	118.1	0.0051	0.0394	5,100	47.2	0.0047	0.0472	0.0028
5.0	R1	35	0.5°	4,400	66.9	0.0059	0.0394	4,400	94.5	0.0035	0.0394	4,400	39.4	0.0047	0.0472	0.0020
5.0	R1	40	0.5°	3,100	43.3	0.0059	0.0394	3,100	59.1	0.0031	0.0394	3,100	29.5	0.0047	0.0472	0.0020
6.0	R1.5	24	0.5°	6,500	255.9	0.0138	0.0512	4,000	66.9	0.0094	0.0512	6,500	74.8	0.0059	0.0472	0.0039
6.0	R1.5	30	0.5°	5,100	200.8	0.0094	0.0472	4,000	66.9	0.0091	0.0472	5,100	59.1	0.0059	0.0472	0.0039
6.0	R1.5	36	0.5°	4,200	165.4	0.0079	0.0394	4,000	66.9	0.0075	0.0394	4,200	49.2	0.0059	0.0472	0.0028
6.0	R1.5	42	0.5°	3,700	145.7	0.0059	0.0394	3,700	55.1	0.0055	0.0394	3,700	43.3	0.0059	0.0472	0.0028

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List 9570 - EXOPRO® PHX: High Feed, Corner Radius (Continued)
List 9575 - EXOPRO® PHX: Deep Feed, Corner Radius (Continued)
List 9576 - EXOPRO® PHX: Long Neck, Deep Feed, Corner Radius (Continued)
List 9580 - EXOPRO® PHX: Pencil Neck, Deep Feed, Corner Radius (Continued)

Side Milling

Hardness				Up to 40 HRC				40~55 HRC				55~60 HRC				
Work Material				Mild Steels and Carbon Steels				Hardened Steels and Prehardened Steels								
				High Feed Roughing				Semi-Finishing				Finishing				
D (mm)	r (mm)	L1	Rec'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Stock to Remove (in)
						Aa	Ar			Aa	Ar			Aa	Ar	
6.0	R1.5	48	0.5°	2,600	102.4	0.0051	0.0354	2,600	35.4	0.0055	0.0354	2,600	31.5	0.0059	0.0472	0.0020
6.0	R1.5	54	0.5°	2,100	82.7	0.0039	0.0354	2,100	31.5	0.0039	0.0354	2,100	25.6	0.0059	0.0472	0.0020
6.0	R1.5	66	0.5°	1,900	74.8	0.0031	0.0354	1,900	27.6	0.0031	0.0354	1,900	21.7	0.0059	0.0472	0.0012
6.0	R1.5	80	0.5°	1,700	66.9	0.0020	0.0354	1,700	23.6	0.0020	0.0354	1,700	17.7	0.0059	0.0472	0.0012
8.0	R2	30	0.5°	4,800	78.7	0.0197	0.0669	3,000	49.2	0.0118	0.0630	4,800	70.9	0.0071	0.0630	0.0039
8.0	R2	40	0.5°	3,800	74.8	0.0157	0.0630	3,000	49.2	0.0118	0.0630	3,800	55.1	0.0071	0.0630	0.0039
8.0	R2	48	0.5°	3,200	66.9	0.0106	0.0551	3,000	49.2	0.0102	0.0551	2,300	45.3	0.0071	0.0630	0.0028
8.0	R2	56	0.5°	2,700	51.2	0.0079	0.0551	2,700	43.3	0.0079	0.0551	2,700	39.4	0.0071	0.0630	0.0028
8.0	R2	64	0.5°	1,900	34.6	0.0079	0.0512	1,900	31.5	0.0079	0.0512	1,900	27.6	0.0071	0.0630	0.0020
8.0	R2	80	0.5°	1,500	27.6	0.0059	0.0512	1,500	27.6	0.0059	0.0512	1,500	21.7	0.0071	0.0630	0.0012
8.0	R2	100	0.5°	1,200	25.6	0.0059	0.0512	1,200	25.6	0.0059	0.0512	1,200	19.7	0.0071	0.0630	0.0012
8.0	R2	120	0.5°	1,000	21.7	0.0039	0.0512	1,000	21.7	0.0039	0.0512	1,000	17.7	0.0071	0.0630	0.0012
10.0	R2	35	0.5°	3,800	82.7	0.0197	0.0984	2,400	94.5	0.0118	0.0630	3,800	149.6	0.0079	0.0945	0.0039
10.0	R2	50	0.5°	3,100	76.8	0.0157	0.0945	2,400	94.5	0.0118	0.0630	3,100	122.0	0.0079	0.0945	0.0039
10.0	R2	60	0.5°	2,500	68.9	0.0106	0.0787	2,400	94.5	0.0106	0.0630	2,500	98.4	0.0079	0.0945	0.0039
10.0	R2	70	0.5°	2,200	53.1	0.0079	0.0787	2,200	86.6	0.0079	0.0630	2,200	86.6	0.0079	0.0945	0.0028
10.0	R2	80	0.5°	1,500	35.4	0.0075	0.0787	1,500	59.1	0.0075	0.0630	1,500	59.1	0.0079	0.0945	0.0028
10.0	R2	100	0.5°	1,200	28.3	0.0063	0.0787	1,200	47.2	0.0063	0.0630	1,200	47.2	0.0079	0.0945	0.0020
10.0	R2	120	0.5°	1,050	25.6	0.0051	0.0787	1,000	39.4	0.0051	0.0630	1,050	41.3	0.0079	0.0945	0.0020
10.0	R2	140	0.5°	850	21.7	0.0039	0.0591	800	31.5	0.0039	0.0551	850	33.5	0.0079	0.0945	0.0012
10.0	R2	160	0.5°	700	19.7	0.0028	0.0591	700	27.6	0.0028	0.0551	700	27.6	0.0079	0.0945	0.0012
12.0	R2	45	0.5°	3,200	86.6	0.0236	0.1339	2,000	78.7	0.0118	0.0630	3,200	126.0	0.0094	0.1260	0.0059
12.0	R2	60	0.5°	2,500	82.7	0.0197	0.1260	2,000	78.7	0.0118	0.0630	2,500	98.4	0.0094	0.1260	0.0059
12.0	R2	70	0.5°	2,100	74.8	0.0157	0.1102	2,000	78.7	0.0110	0.0630	2,100	82.7	0.0094	0.1260	0.0039
12.0	R2	85	0.5°	1,800	59.1	0.0118	0.1063	1,500	59.1	0.0087	0.0630	1,800	70.9	0.0094	0.1260	0.0039
12.0	R2	100	0.5°	1,300	39.4	0.0079	0.1024	1,200	47.2	0.0079	0.0630	1,300	51.2	0.0094	0.1260	0.0039
12.0	R2	120	0.5°	1,000	27.6	0.0059	0.0984	1,000	39.4	0.0059	0.0630	1,000	39.4	0.0094	0.1260	0.0020
12.0	R2	140	0.5°	900	23.6	0.0059	0.0787	900	35.4	0.0039	0.0630	900	35.4	0.0094	0.1260	0.0020
12.0	R2	160	0.5°	700	19.7	0.0039	0.0787	700	27.6	0.0039	0.0630	700	27.6	0.0094	0.1260	0.0020
16.0	R3	55	0.5°	2,400	78.7	0.0197	0.1654	1,500	59.1	0.0118	0.0630	2,400	94.5	0.0118	0.1575	0.0079
16.0	R3	80	0.5°	1,900	74.8	0.0185	0.1575	1,500	59.1	0.0118	0.0630	1,900	74.8	0.0118	0.1575	0.0059
16.0	R3	90	0.5°	1,600	66.9	0.0157	0.1339	1,500	59.1	0.0118	0.0630	1,600	63.0	0.0118	0.1575	0.0039
16.0	R3	105	0.5°	1,400	51.2	0.0114	0.1299	1,400	55.1	0.0110	0.0630	1,400	55.1	0.0118	0.1575	0.0028
16.0	R3	120	0.5°	1,000	33.5	0.0079	0.1260	1,000	39.4	0.0079	0.0630	1,000	39.4	0.0118	0.1575	0.0020
20.0	R3	70	0.5°	1,900	78.7	0.0197	0.2165	1,200	47.2	0.0118	0.0630	1,900	74.8	0.0165	0.2165	0.0079
20.0	R3	90	0.5°	1,500	74.8	0.0185	0.2087	1,200	47.2	0.0118	0.0630	1,500	59.1	0.0165	0.2165	0.0059
20.0	R3	110	0.5°	1,300	66.9	0.0165	0.1654	1,200	47.2	0.0118	0.0630	1,300	51.2	0.0165	0.2165	0.0039
20.0	R3	130	0.5°	1,100	51.2	0.0122	0.1496	1,100	43.3	0.0118	0.0630	1,100	43.3	0.0165	0.2165	0.0028
20.0	R3	150	0.5°	760	29.9	0.0098	0.1339	760	29.9	0.0091	0.0630	760	29.9	0.0165	0.2165	0.0020

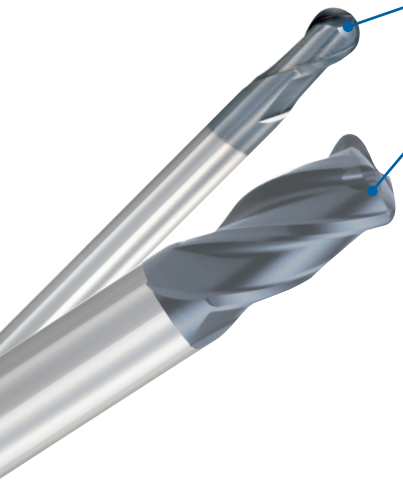
1. The above mentioned conditions according to projection lengths are intended as general guidelines for reference only. Adjustments should be made based on actual milling conditions.
2. Highly rigid machines and tool holders should be used.
3. Tool vibrations should be kept at a minimum level for maximum accuracy.
4. In the case of linear machining, do not use the Ar value, instead refer to the Aa value.
5. Under general machining conditiona, air-blow cutting method is recommended.
6. More stable high-feed machining in the corners can be attained by setting an R insertion or deceleration on the CAM or machine side.
7. When cutting load fluctuates (in the corners, etc.) or when high-precision is required, be sure to control the rotational speed.
8. When cutting at greater than the recommended cutting angle, reduce the feed.
9. When the depth of cut is less than the specified amount as listed above, the feed rate can be increased up to 150%.
10. When the depth of cut is greater than the specified amount as listed above, the feed rate can be reduced by no more than 60% to ensure stable milling.

List 9592 - EXOPRO® PHX : Pencil-Neck, Deep Feed, Corner Radius

Side Milling

Hardness			Up to 41 HRC					42~55 HRC					49~55 HRC		
Work Material			Hardened and Pre-hardened Steels												
Cutting Speed			108~393 SFM					108~248 SFM					108~402 SFM		
D (mm)	r (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)		Depth of Cut (in)		Speed (RPM)	Feed (in/min)		Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)
				Slotting	Contouring	Aa	Ar		Slotting	Contouring	Aa	Ar	Contour Finishing		Aa
0.8	0.1	2	18,000	28.3	36.6	0.0008	0.008	18,000	28.3	36.6	0.0008	0.008	18,000	45.3	0.0006
0.8	0.1	4	18,000	28.3	36.6	0.0008	0.008	18,000	28.3	36.6	0.0008	0.008	18,000	45.3	0.0006
0.8	0.1	6	18,000	28.3	36.6	0.0008	0.008	18,000	28.3	36.6	0.0008	0.008	18,000	45.3	0.0006
0.8	0.1	8	15,000	21.3	26.8	0.0006	0.008	15,000	21.3	24.8	0.0005	0.008	16,000	27.6	0.0005
1.0	0.1	4	18,000	32.7	43.3	0.0012	0.009	18,000	32.7	34.6	0.0012	0.009	18,000	56.7	0.0006
1.0	0.1	6	18,000	32.7	43.3	0.0009	0.009	18,000	32.7	34.6	0.0009	0.009	18,000	56.7	0.0006
1.0	0.1	8	15,000	29.5	39.4	0.0005	0.009	15,000	29.5	31.5	0.0005	0.009	15,000	47.2	0.0006
1.0	0.1	10	12,000	11.8	19.7	0.0003	0.008	12,000	11.8	15.7	0.0003	0.008	12,000	37.8	0.0006
1.0	0.1	12	10,500	8.7	14.2	0.0002	0.007	10,500	8.7	11.3	0.0002	0.007	10,500	33.1	0.0006
1.0	0.2	4	18,000	32.7	43.3	0.0012	0.009	18,000	32.7	34.6	0.0012	0.009	18,000	56.7	0.0007
1.0	0.2	6	18,000	32.7	43.3	0.0009	0.009	18,000	32.7	34.6	0.0009	0.009	18,000	56.7	0.0007
1.0	0.2	8	15,000	29.5	39.4	0.0005	0.009	15,000	29.5	31.5	0.0005	0.009	15,000	47.2	0.0007
1.0	0.2	10	12,000	11.8	19.7	0.0003	0.008	12,000	11.8	15.7	0.0003	0.008	12,000	37.8	0.0007
1.0	0.2	12	10,500	8.7	14.2	0.0002	0.007	10,500	8.7	11.4	0.0002	0.007	10,500	33.1	0.0007
1.0	0.3	4	18,000	32.7	49.6	0.0012	0.009	18,000	32.7	39.4	0.0012	0.009	18,000	56.7	0.0009
1.0	0.3	6	18,000	32.7	44.1	0.0009	0.009	18,000	32.7	35.0	0.0009	0.009	18,000	56.7	0.0009
1.5	0.1	4	18,000	48.4	65.0	0.0012	0.013	16,000	42.5	51.2	0.0012	0.013	18,000	63.8	0.0006
1.5	0.1	8	18,000	48.4	65.0	0.0010	0.013	16,000	42.5	51.2	0.0010	0.013	18,000	63.8	0.0006
1.5	0.1	12	10,000	18.9	31.5	0.0005	0.012	10,000	17.7	29.5	0.0005	0.012	10,000	35.4	0.0006
1.5	0.2	4	18,000	48.4	65.0	0.0012	0.013	16,000	42.5	51.2	0.0012	0.013	18,000	63.8	0.0007
1.5	0.2	6	18,000	48.4	65.0	0.0011	0.013	16,000	42.5	51.2	0.0011	0.013	18,000	63.8	0.0007
1.5	0.2	8	18,000	48.4	65.0	0.0010	0.013	16,000	42.5	51.2	0.0010	0.013	18,000	63.8	0.0007
2.0	0.1	8	18,000	69.3	87.0	0.0012	0.018	12,000	39.4	51.2	0.0012	0.018	18,000	63.8	0.0006
2.0	0.1	10	15,000	63.8	85.0	0.0012	0.018	12,000	39.4	47.2	0.0012	0.018	15,000	53.1	0.0006
2.0	0.1	12	13,000	52.0	69.3	0.0009	0.018	12,000	37.4	45.3	0.0009	0.018	13,000	46.1	0.0006
2.0	0.1	16	7,600	29.5	39.4	0.0005	0.018	7,600	23.6	30.7	0.0005	0.018	7,000	24.8	0.0006
2.0	0.3	8	18,000	63.8	87.0	0.0020	0.018	12,000	39.4	51.2	0.0020	0.018	18,000	63.8	0.0009
2.0	0.3	12	13,000	52.0	69.3	0.0016	0.018	12,000	37.4	45.3	0.0016	0.018	13,000	46.1	0.0009
2.0	0.5	6	18,000	69.3	87.0	0.0031	0.018	12,000	33.5	51.2	0.0031	0.018	18,000	63.8	0.0010
2.0	0.5	8	18,000	69.3	87.0	0.0030	0.018	12,000	33.5	51.2	0.0030	0.018	18,000	63.8	0.0010
2.0	0.5	10	15,000	63.8	85.0	0.0028	0.018	12,000	31.5	47.2	0.0028	0.018	15,000	53.1	0.0010
2.0	0.5	12	13,000	52.0	69.3	0.0024	0.018	12,000	27.6	45.3	0.0024	0.018	13,000	46.1	0.0010
3.0	0.3	12	12,700	55.1	91.3	0.0018	0.028	8,000	33.1	47.2	0.0018	0.028	13,000	46.1	0.0009

1. Adjust the speed, feed, and plunge depth in accordance with operating conditions, including the machining shape, machine rigidity, holder rigidity, and work holding force.
2. If the speed and feed rates cannot increase due to equipment performance, operate by reducing the speed and feed rates at the same ratio.
3. High cutting speeds and feed rates can cause cutter wear or reduce machining precision. Therefore, operate by reducing the feed rate as needed.
4. Depending on the shape to be machined, if the end mill chatters during machining, it can bite into the shape. Therefore, operate by reducing the speed and feed rates at the same ratio.
5. For precise, detailed machining, use a dedicated machine that operates quietly.
6. Operate by keeping the runout at the tip of the end mill below 5 microns (.0002").
7. To perform finish machining with a high level of efficiency, keep the speed and feed rates below 2 times.
8. To finish a flat surface, operate at a speed range with a minimal amount of equipment vibration, making sure than the feed rate does not cause the equipment to wobble.
9. To finish machine a curved surface using the corner radius tool, operate by changing the machining pitch.
10. Set the inclined cut angle approximately between 0.3° and 0.5°.



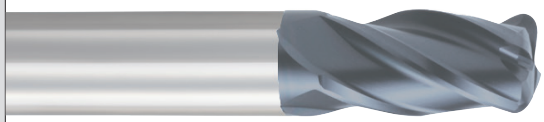
Multiple End Cuts
covers a wide range of machining requirements.

WXL Coating
for extreme heat and wear resistance, allowing high-speed machining in materials up to 55 HRC.

Premium Carbide Substrate
for exceptional performance in a wide range of applications in tough materials.

Multiple End Cut Varieties

Versatile Offering Covers Wide Range of Machining Requirements

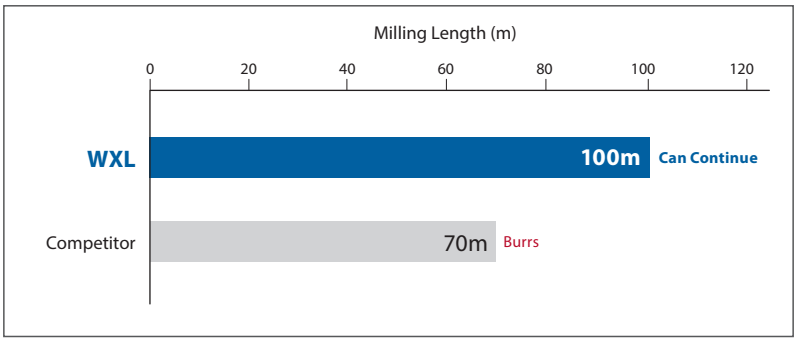
Square	
Corner Radius	
Ball Nose	
Rib Processing	

Stable Milling and Long Tool Life

Milling in Steel (SS400)

WXL's coating allowed for stable milling at high speeds with emulsion coolant, thus prolonging tool life and reducing tool usage by 25%.

Tool	WXL-2D-DE	Competitor
Tool Size	Ø0.5	
Work Material	SS400	
Milling Method	Slotting	
Cutting Speed	98 SFM (20,000 RPM)	
Feed Rate	23.6 IPM (0.0006 in/t)	
Depth of Cut	Aa=0.001" • Ar=0.020"	
Coolant	Water Soluble	
Machine	Vertical Machining Center	



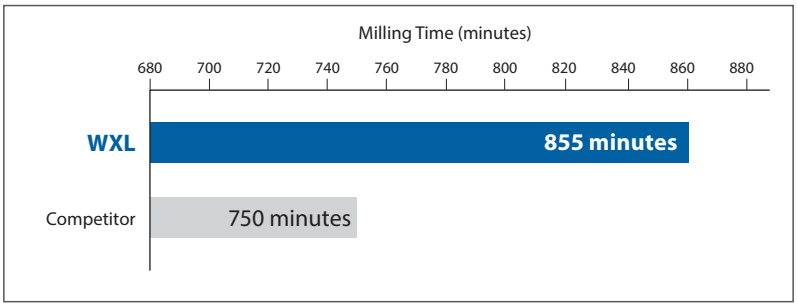
The competitor tool created burrs after milling 70 meters. The tool had to be replaced almost every two hours. The WXL-2D-DE, on the other hand, did not create burrs even after milling 100 meters, and was in good enough condition to continue milling.

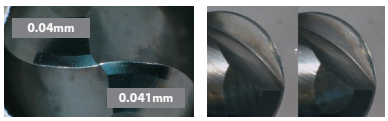
High Wear Resistance

Milling in Copper

The incredible wear resistance of OSG's WXL coating increased tool life from 750 minutes to 855 minutes, a 14% increase!

Tool	WXL-EBD	Competitor
Tool Size	R3	
Work Material	Copper	
Milling Method	Contour Milling	
Cutting Speed	590 SFM (9,600 RPM)	
Feed Rate	118.1 IPM (0.006 in/t)	
Depth of Cut	Aa=0.020" • Ar=0.050"	
Coolant	Water Soluble	
Machine	Vertical Machining Center	





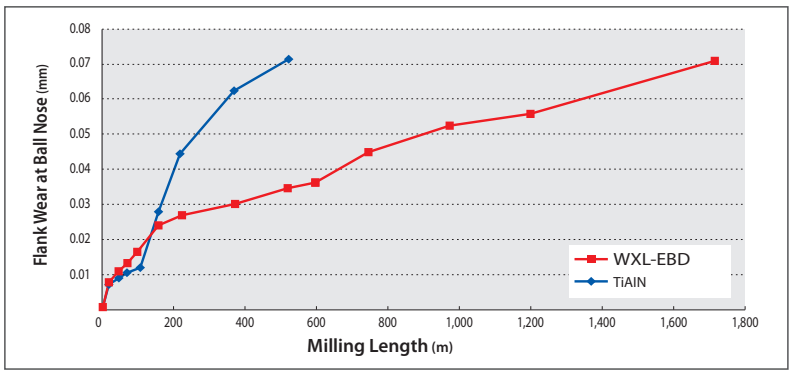
The amount of wear on the WXL after 855 minutes of use was in the range of 0.04 to 0.041mm, demonstrating the incredible wear resistance of the WXL coating.

Durability in Many Materials

Milling in Copper (C1100)

The WXL series is capable of performing in a wide range of materials. In copper, its durability is 3 times greater than TiAlN-coated tools.

Tool	WXL-EBD	Competitor
Tool Size	R3x12	
Work Material	C1100	
Milling Method	Pick Milling	
Cutting Speed	803 SFM (13,000 RPM)	
Feed Rate	153.5 IPM (0.006 in/t)	
Depth of Cut	Aa=0.012" • Ar=0.024"	
Coolant	Water Soluble	
Machine	Vertical Machining Center	



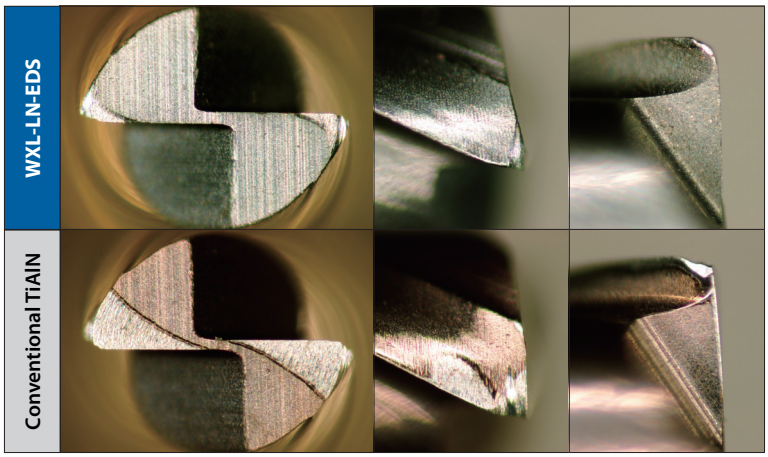
Longer Tool Life and Better Surface Finish than TiAlN

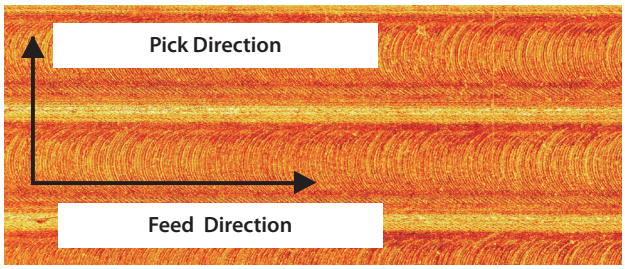
Milling in Copper (C1100)

After over 4 hours of machining, WXL exhibited both longer tool life and better surface roughness than a conventional TiAlN-coated tool.

Tool	WXL-LN-EDS	Conventional
Tool Size	Ø1 x 6	
Work Material	C1100	
Milling Method	Pick Milling	
Cutting Speed	206 SFM (20,000 RPM)	
Feed Rate	34.0 IPM (0.0008 in/t)	
Depth of Cut	Aa=0.002" • Ar=0.035"	
Coolant	Water Soluble	
Machine	Vertical Machining Center	

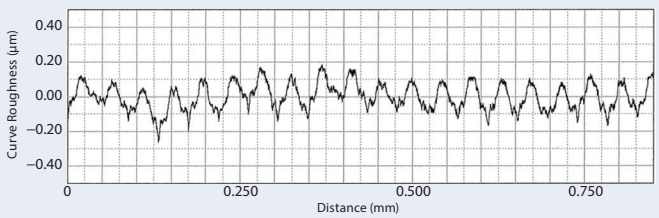
Tool wear after milling 4 hours



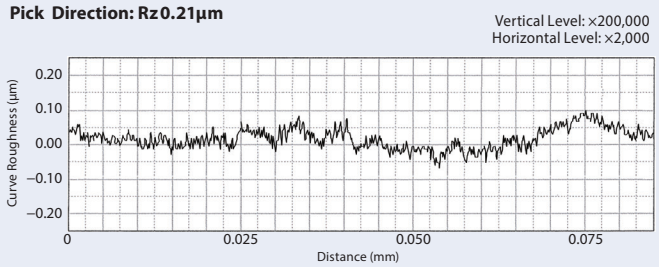


WXL-LN-EDS

Feed Direction: Rz0.32µm

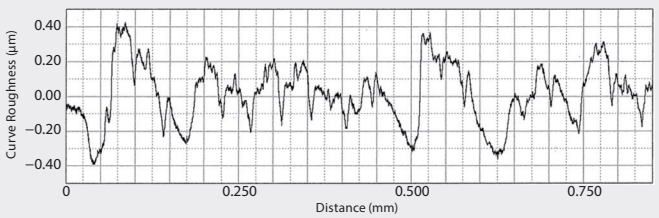


Pick Direction: Rz0.21µm

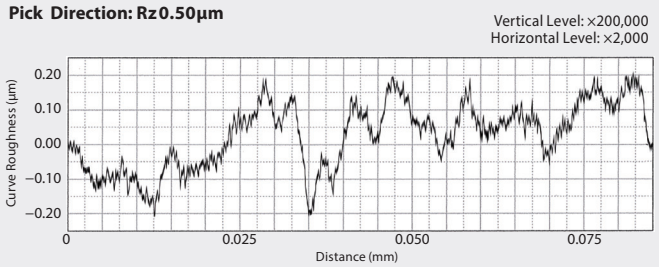


Conventional TiAlN

Feed Direction: Rz0.64µm



Pick Direction: Rz0.50µm

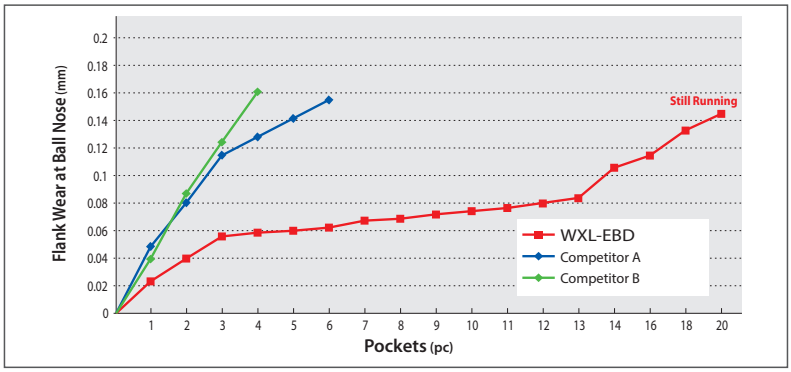


Superior Durability in Dry Applications

Milling in Carbon Steel (1050)

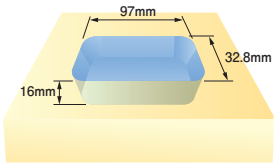
The WXL exhibited 3 times the durability of the competitors when milling carbon steel with air.

Tool	WXL-EBD	Competitors
Tool Size	R5 x 18	
Work Material	1050 Carbon Steel	
Milling Method	Pocket Milling	
Cutting Speed	656 SFM (6,366 RPM)	
Feed Rate	63.1 IPM (0.005 in/t)	
Depth of Cut	Aa=0.039" • Ar=0.079"	
Coolant	Air	
Machine	Vertical Machining Center	



Tool wear after milling

WXL-EBD	Competitor A	Competitor B
		
20 Holes	6 Holes	4 Holes



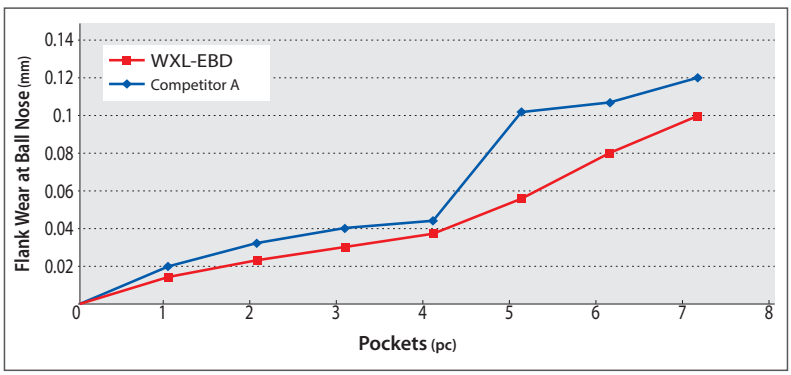
Wall Taper	3°
Corner Radius	R6
Pocket Size	97 × 32.8mm
Pocket Depth	16mm

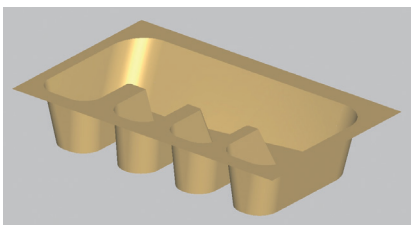
High Performance in Many Materials

Milling in Die Steel (DH31S)

The WXL series handles a wide range of materials and applications.

Tool	WXL-EBD	Competitor
Tool Size	R5 x 18	
Work Material	DH31S (48 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	590 SFM (5,700 RPM)	
Feed Rate	53.1 IPM (0.0046 in/t)	
Depth of Cut	Aa=0.039" • Ar=0.078"	
Coolant	Air	
Machine	Horizontal Machining Center	





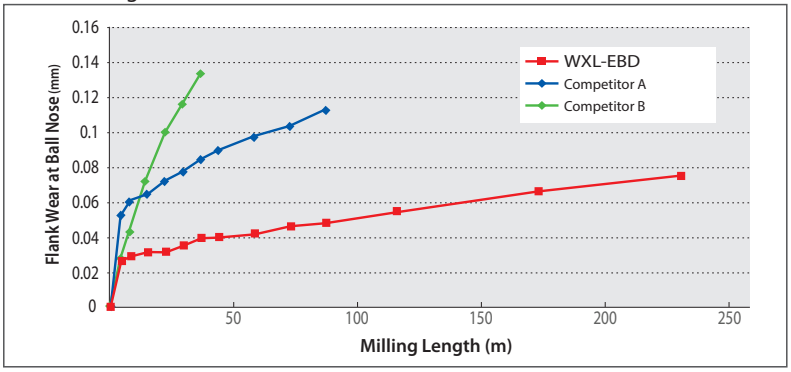
Wall Taper	3°	Pocket Size	86.25 × 48.75mm
Corner Radius	R6	Pocket Depth	16mm

Superior Durability in Wet Applications

Milling in Carbon Steel (1050)

The WXL exhibited 3 times the durability of the competitirs when milling carbon steel with water soluble coolant.

Tool	WXL-EBD	Competitors
Tool Size	R3 x 12	
Work Material	1050 Carbon Steel	
Milling Method	Pick Milling	
Cutting Speed	655 SFM (10,600 RPM)	
Feed Rate	101.2 IPM (0.005 in/t)	
Depth of Cut	Aa=0.012" • Ar=0.024"	
Coolant	Water Soluble	
Machine	Vertical Machining Center	

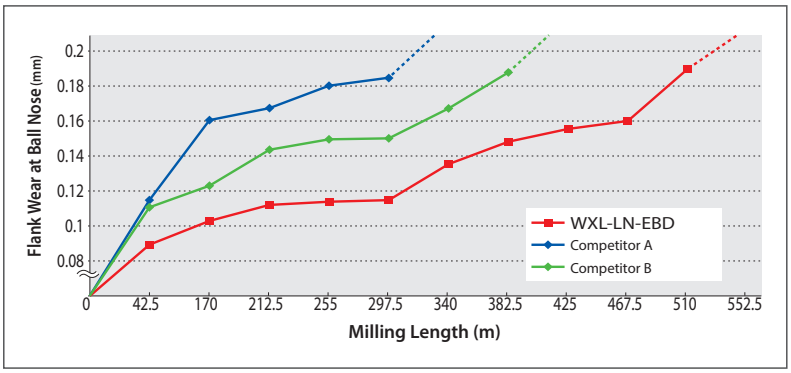


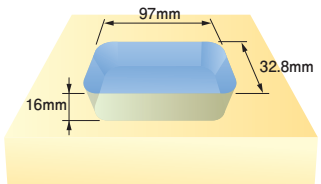
Long Tool Life in Mold Steel

Milling in Mold Steel (NAK80 40HRC)

OSG's WXL coating prevents cutting edge wear to prolong tool life; in 40 HRC mold steel, tool life was 30% longer than the nearest competitor.

Tool	WXL-LN-EBD	Competitors
Tool Size	R1 x 10	
Work Material	NAK80 (40 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	413 SFM (20,000 RPM)	
Feed Rate	78.7 IPM (0.002 in/t)	
Depth of Cut	Aa=0.004" • Ar=0.016"	
Coolant	Air	
Machine	Vertical Machining Center	





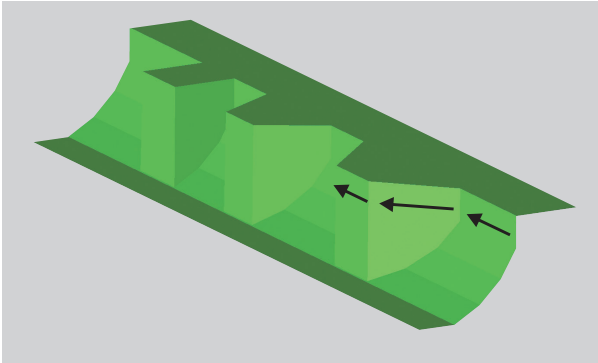
Wall Taper	0.4°	Pocket Size	97 × 32.8mm
Corner Radius	R1	Pocket Depth	16mm

Superior Wear Resistance in Mold Steel

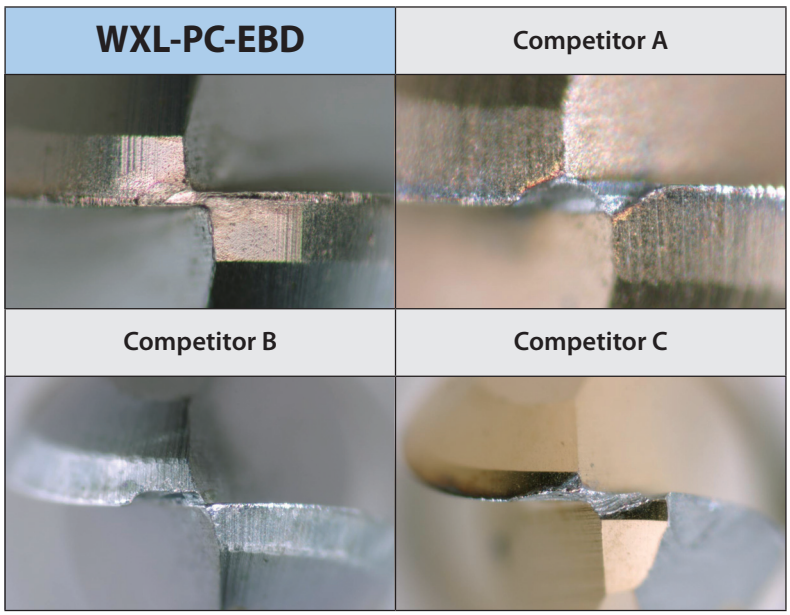
Milling in Mold Steel (STAVAX 52 HRC)

OSG's WXL coating minimizes wear on the center portion of the tool, prolonging tool life and enhancing machining quality.

Tool	WXL-PC-EBD	Competitors
Tool Size	R1 x 1° x 20	
Work Material	STAVAX (52 HRC)	
Milling Method	Contour Milling	
Cutting Speed	206 SFM (10,000 RPM)	
Feed Rate	78.7 IPM (0.004 in/t)	
Depth of Cut	Aa=0.002" • Ar=0.002"	
Coolant	Mist	
Machine	Vertical Machining Center	



Tool wear after milling 240m



List 3610

SPEED FEED P61 | CARBIDE | WXL | REG | 30° | SHANK h6

WXL-EBD, 2 Flute, Regular Length, Ball End

Radius Tolerance	
1/32≤D≤3/16	+0.0002" / -0.0002"
1/4≤D≤1/2	+0.0001" / -0.0003"

EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
36100111	1/32	2-1/2	1/32	1/4
36100211	1/16	2-1/2	1/16	1/4
36100311	3/32	2-1/2	3/32	1/4
36100411	1/8	3	1/8	1/4
36100511	3/16	3	3/16	1/4

EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
36100611	1/4	3	1/4	1/4
36100711	5/16	4	5/16	5/16
36100811	3/8	4	3/8	3/8
36100911	1/2	4	1/2	1/2

HTE

Packed: 1 pc. Available WXL® coating only.

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low 1010 1018	Med. 1035 1045	High 1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3610	◎	◎	◎	◎	◎	○	○	○	◎	○		○	○	◎	◎	◎	

○ good ◎ best

List 3710

WXL-EBD, 2 Flute, Regular Length, Ball End

SPEED FEED	CARBIDE	WXL		REG	30°	SHANK
P62						h6

Radius Tolerance	
0.1≤D<6	+0.005mm / -0.005mm
6≤D≤12	+0.003mm / -0.007mm
12<D≤20	+0.01mm / -0.01mm

EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
3105010	0.1	40	0.2	4
3105020	0.2	40	0.4	4
3105030	0.3	40	0.6	4
3105040	0.4	40	0.8	4
3105050	0.5	40	1.1	4
3105060	0.6	40	1.1	4
3105080	0.8	40	2.0	4
3105100	1.0	50	1.5	4
3106100	1.0	60	2.5	6
3105120	1.2	50	3.0	4
3105140	1.4	50	3.5	4
3105150	1.5	50	2.0	4
3106150	1.5	50	4.0	6
3105160	1.6	50	4.0	4
3105200	2.0	50	3.0	4
3106200	2.0	50	5.0	6
3105250	2.5	50	3.0	4
3106250	2.5	60	6.0	6
3105300	3.0	60	4.5	4
3106301	3.0	60	8.0	6

EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
3106350	3.5	70	8.0	6
3105400	4.0	60	8.0	4
3106400	4.0	70	6.0	6
3106500	5.0	80	8.0	6
3106502	5.0	80	12.0	6
3106600	6.0	90	10.0	6
3106601	6.0	90	12.0	6
3106610	7.0	90	14.0	6
3106620	8.0	100	12.0	8
3106621	8.0	100	14.0	8
3106630	9.0	100	18.0	8
3106640	10.0	100	15.0	10
3106641	10.0	100	18.0	10
3106650	11.0	100	22.0	10
3106660	12.0	110	18.0	12
3106661	12.0	110	22.0	12
3106670	14.0	110	26.0	12
3106680	16.0	140	30.0	16
3106690	18.0	140	34.0	16
3106700	20.0	160	38.0	20

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3710	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

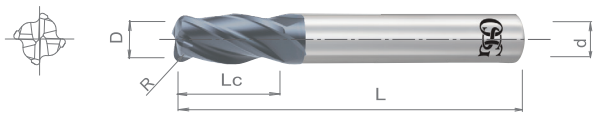
○ good ◎ best

List 3670

WXL-CR-EMS, 4 Flute, Regular Length, Corner Radius

SPEED FEED P63 | CARBIDE | WXL | REG | 30° | SHANK h6

Milling Diameter Tolerance	
1/16≤D≤1/2	+0 / -0.0008"



EDP Number	Mill Diameter D	Corner Radius R	Overall Length L	Length of Cut Lc	Shank Diameter d
36700111	1/16	0.010	1-1/2	3/16	1/8
36700211	5/64	0.010	1-1/2	1/4	1/8
36700311	3/32	0.010	1-1/2	3/8	1/8
36700411	7/64	0.010	1-1/2	3/8	1/8
36700511	1/8	0.010	1-1/2	1/2	1/8
36700611	1/8	0.020	1-1/2	1/2	1/8
36700711	1/8	0.030	1-1/2	1/2	1/8
36700811	5/32	0.020	2	9/16	3/16
36700911	5/32	0.030	2	9/16	3/16
36701011	3/16	0.020	2	5/8	3/16
36701111	3/16	0.030	2	5/8	3/16
36701211	7/32	0.020	2-1/2	5/8	1/4
36701311	7/32	0.030	2-1/2	5/8	1/4
36701411	1/4	0.020	2-1/2	3/4	1/4
36701511	1/4	0.030	2-1/2	3/4	1/4

EDP Number	Mill Diameter D	Corner Radius R	Overall Length L	Length of Cut Lc	Shank Diameter d
36701611	1/4	0.045	2-1/2	3/4	1/4
36701711	1/4	0.060	2-1/2	3/4	1/4
36701811	5/16	0.020	2-1/2	13/16	5/16
36701911	5/16	0.030	2-1/2	13/16	5/16
36702011	3/8	0.020	2-1/2	1	3/8
36702111	3/8	0.030	2-1/2	1	3/8
36702211	3/8	0.045	2-1/2	1	3/8
36702311	3/8	0.060	2-1/2	1	3/8
36702411	7/16	0.020	2-3/4	1	7/16
36702511	7/16	0.030	2-3/4	1	7/16
36702611	1/2	0.020	3	1	1/2
36702711	1/2	0.030	3	1	1/2
36702811	1/2	0.045	3	1	1/2
36702911	1/2	0.060	3	1	1/2

HTE

Packed: 1 pc. Available WXL® coating only.

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3670	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

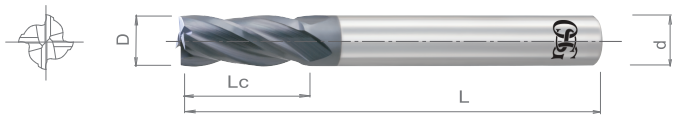
○ good ◎ best

List 3604

WXL-EMS, 4 Flute, Regular Length

SPEED FEED P64 | CARBIDE | WXL | REG | 30° | SHANK h6

Milling Diameter Tolerance	
1/16≤D≤3/4	+0 / -0.0008"



EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
36040111	1/16	1-1/2	3/16	1/8
36040211	5/64	1-1/2	1/4	1/8
36040311	3/32	1-1/2	3/8	1/8
36040411	7/64	1-1/2	3/8	1/8
36040511	1/8	1-1/2	1/2	1/8
36040611	5/32	2	9/16	3/16
36040711	3/16	2	5/8	3/16
36040811	7/32	2-1/2	5/8	1/4
36040911	1/4	2-1/2	3/4	1/4
36041011	9/32	2-1/2	3/4	5/16
36041111	5/16	2-1/2	13/16	5/16
36041211	3/8	2-1/2	1	3/8
36041311	7/16	2-3/4	1	7/16
36041411	1/2	3	1	1/2
36041511	5/8	3-1/2	1-1/4	5/8
36041611	3/4	4	1-1/2	3/4

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3604	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

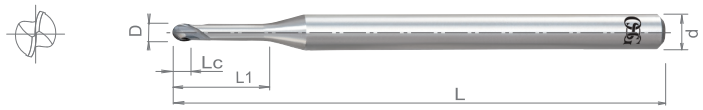
○ good ◎ best

List 3690

SPEED FEED P65-68 | CARBIDE | WXL | REG | 30° | SHANK h6

WXL-LN-EBD, 2 Flute, Regular Length, Long Neck, Ball End, Rib Processing

±5µm (±0.0002") Radius Tolerance



EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	L	Lc	L1	d2	d
36900111	1/64	2-1/2	1/64	3/64	0.013	1/8
36900211	1/64	2-1/2	1/64	3/32	0.013	1/8
36900311	1/32	2-1/2	1/32	5/32	0.029	1/4
36900411	1/32	2-1/2	1/32	5/16	0.029	1/4
36900511	1/32	2-1/2	1/32	13/32	0.029	1/4
36900611	1/16	2-1/2	1/16	5/16	0.061	1/4
36900711	1/16	2-1/2	1/16	5/8	0.061	1/4
36900811	1/16	3	1/16	13/16	0.061	1/4
36900911	3/32	2-1/2	3/32	15/32	0.092	1/4
36901011	3/32	2-7/8	3/32	15/16	0.092	1/4
36901111	3/32	3-1/8	3/32	1-13/32	0.092	1/4
36901211	1/8	3	1/8	5/8	0.123	1/4
36901311	1/8	3	1/8	1-1/4	0.123	1/4
36901411	1/8	3-3/4	1/8	1-7/8	0.123	1/4
36901511	3/16	3-1/2	3/16	15/16	0.185	1/4
36901611	3/16	4	3/16	1-7/8	0.185	1/4
36901711	1/4	4	1/4	1-1/4	0.248	1/4
36901811	1/4	4-1/2	1/4	2	0.248	1/4

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3690	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3790

WXL-LN-EBD, 2 Flute, Regular Length, Long Neck, Ball End, Rib Processing

SPEED FEED P65-68 | CARBIDE | WXL | REG | 30° | SHANK h6

±5µm Radius Tolerance

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Dia.	Shank Diameter
	D	L	Lc	L1	d2	d
3110103	0.1	45	0.1	0.3	0.085	4
3110105	0.1	45	0.1	0.5	0.085	4
3110203	0.2	45	0.2	0.3	0.18	4
3110205	0.2	45	0.2	0.5	0.18	4
3110207	0.2	45	0.16	0.75	0.18	4
3110210	0.2	45	0.2	1.0	0.18	4
3110212	0.2	45	0.16	1.25	0.18	4
3110215	0.2	45	0.2	1.5	0.18	4
3110217	0.2	45	0.16	1.75	0.18	4
3110220	0.2	45	0.16	2.0	0.18	4
3110225	0.2	45	0.16	2.5	0.18	4
3110230	0.2	45	0.16	3.0	0.18	4
3110305	0.3	45	0.24	0.5	0.28	4
3110306	0.3	45	0.24	0.6	0.28	4
3110307	0.3	45	0.24	0.75	0.28	4
3110310	0.3	45	0.2	1.0	0.28	4
3110312	0.3	45	0.24	1.25	0.28	4
3110315	0.3	45	0.2	1.5	0.28	4
3110317	0.3	45	0.24	1.75	0.28	4
3110320	0.3	45	0.2	2.0	0.28	4
3110322	0.3	45	0.24	2.25	0.28	4
3110325	0.3	45	0.24	2.5	0.28	4
3110327	0.3	45	0.24	2.75	0.28	4
3110330	0.3	45	0.24	3.0	0.28	4
3110335	0.3	45	0.24	3.5	0.28	4
3110340	0.3	45	0.24	4.0	0.28	4
3110345	0.3	45	0.24	4.5	0.28	4
3110350	0.3	45	0.24	5.0	0.28	4
3110405	0.4	45	0.3	0.5	0.37	4
3110407	0.4	45	0.3	0.75	0.37	4
3110410	0.4	45	0.3	1.0	0.37	4
3110415	0.4	45	0.3	1.5	0.37	4
3110420	0.4	45	0.3	2.0	0.37	4
3110425	0.4	45	0.3	2.5	0.37	4
3110430	0.4	45	0.3	3.0	0.37	4
3110435	0.4	45	0.3	3.5	0.37	4
3110440	0.4	45	0.3	4.0	0.37	4
3110445	0.4	45	0.3	4.5	0.37	4
3110450	0.4	45	0.3	5.0	0.37	4
3110455	0.4	45	0.3	5.5	0.37	4
3110460	0.4	45	0.3	6.0	0.37	4
3110510	0.5	45	0.4	1.0	0.45	4
3110515	0.5	45	0.4	1.5	0.45	4
3110520	0.5	45	0.4	2.0	0.45	4
3110525	0.5	45	0.4	2.5	0.45	4
3110530	0.5	45	0.4	3.0	0.45	4
3110535	0.5	45	0.4	3.5	0.45	4
3110540	0.5	45	0.4	4.0	0.45	4
3110545	0.5	45	0.4	4.5	0.45	4
3110550	0.5	45	0.4	5.0	0.45	4
3110555	0.5	45	0.4	5.5	0.45	4
3110560	0.5	45	0.4	6.0	0.45	4
3110570	0.5	45	0.4	7.0	0.45	4
3110580	0.5	45	0.4	8.0	0.45	4
3110590	0.5	45	0.4	9.0	0.45	4
3110600	0.5	45	0.4	10	0.45	4
3110610	0.6	45	0.5	1.0	0.55	4
3110615	0.6	45	0.5	1.5	0.55	4
3110620	0.6	45	0.5	2.0	0.55	4
3110625	0.6	45	0.5	2.5	0.55	4
3110630	0.6	45	0.5	3.0	0.55	4
3110635	0.6	45	0.5	3.5	0.55	4
3110640	0.6	45	0.5	4.0	0.55	4
3110645	0.6	45	0.5	4.5	0.55	4
3110650	0.6	45	0.5	5.0	0.55	4
3110655	0.6	45	0.5	5.5	0.55	4
3110660	0.6	45	0.5	6.0	0.55	4
3110665	0.6	45	0.5	6.5	0.55	4
3110670	0.6	45	0.5	7.0	0.55	4
3110675	0.6	45	0.5	7.5	0.55	4
3110680	0.6	45	0.5	8.0	0.55	4
3110685	0.6	45	0.5	8.5	0.55	4
3110690	0.6	45	0.5	9.0	0.55	4
3110695	0.6	45	0.5	9.5	0.55	4
3110700	0.6	45	0.5	10	0.55	4
3110711	0.6	45	0.5	11	0.55	4
3110712	0.6	45	0.5	12	0.55	4
3110820	0.8	45	0.6	2.0	0.75	4
3110830	0.8	45	0.5	3.0	0.75	4
3110840	0.8	45	0.6	4.0	0.75	4
3110850	0.8	45	0.6	5.0	0.75	4
3110860	0.8	45	0.6	6.0	0.75	4
3110870	0.8	45	0.6	7.0	0.75	4
3110880	0.8	45	0.6	8.0	0.75	4
3110890	0.8	45	0.6	9.0	0.75	4
3110900	0.8	45	0.6	10	0.75	4
3110912	0.8	45	0.5	12	0.75	4
3111025	1.0	45	0.8	2.5	0.95	4
3111030	1.0	45	0.8	3.0	0.95	4
3111040	1.0	45	0.8	4.0	0.95	4
3111050	1.0	45	0.8	5.0	0.95	4
3111060	1.0	45	0.8	6.0	0.95	4
3111070	1.0	45	0.8	7.0	0.95	4
3111080	1.0	45	0.8	8.0	0.95	4
3111090	1.0	45	0.8	9.0	0.95	4
3111100	1.0	45	0.8	10	0.95	4
3111112	1.0	45	0.8	12	0.95	4
3111114	1.0	50	0.8	14	0.95	4
3111116	1.0	50	0.8	16	0.95	4
3111118	1.0	55	0.8	18	0.95	4
3111120	1.0	55	0.8	20	0.95	4
3111240	1.2	45	1.0	4.0	1.15	4
3111260	1.2	45	1.0	6.0	1.15	4
3111280	1.2	45	1.0	8.0	1.15	4
3111300	1.2	45	1.0	10	1.15	4
3111312	1.2	45	1.0	12	1.15	4
3111314	1.2	50	1.0	14	1.15	4
3111316	1.2	50	1.0	16	1.15	4
3111318	1.2	55	1.0	18	1.15	4
3111320	1.2	60	1.0	20	1.15	4
3111324	1.2	60	1.0	24	1.15	4
3111480	1.4	45	1.1	8.0	1.35	4
3111512	1.4	45	1.1	12	1.35	4
3111516	1.4	50	1.1	16	1.35	4
3111530	1.5	45	1.2	3.0	1.45	4
3111540	1.5	45	1.2	4.0	1.45	4

Packed: 1 pc. Available WXL® coating only.

continued on next page

List 3790 (Continued)

SPEED FEED P65-68 | CARBIDE | WXL | REG | 30° | SHANK h6

WXL-LN-EBD, 2 Flute, Regular Length, Long Neck, Ball End, Rib Processing

±5µm Radius Tolerance

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Dia.	Shank Diameter
	D	L	Lc	L1	d2	d
3111560	1.5	45	1.2	6.0	1.45	4
3111580	1.5	45	1.2	8.0	1.45	4
3111600	1.5	45	1.2	10	1.45	4
3111612	1.5	45	1.2	12	1.45	4
3111614	1.5	50	1.2	14	1.45	4
3111616	1.5	55	1.2	16	1.45	4
3111618	1.5	55	1.2	18	1.45	4
3111620	1.5	55	1.2	20	1.45	4
3111622	1.5	55	1.2	22	1.45	4
3111630	1.5	65	1.2	30	1.45	4
3111640	1.6	45	1.3	4.0	1.55	4
3111680	1.6	45	1.3	8.0	1.55	4
3111712	1.6	45	1.3	12	1.55	4
3111716	1.6	50	1.3	16	1.55	4
3111720	1.6	55	1.3	20	1.55	4
3111880	1.8	45	1.4	8.0	1.75	4
3111912	1.8	45	1.4	12	1.75	4
3111916	1.8	50	1.4	16	1.75	4
3111920	1.8	55	1.4	20	1.75	4
3112030	2.0	45	1.6	3.0	1.95	4
3112040	2.0	45	1.6	4.0	1.95	4
3112060	2.0	45	1.6	6.0	1.95	4
3112080	2.0	45	1.6	8.0	1.95	4
3112100	2.0	45	1.6	10	1.95	4
3112112	2.0	45	1.6	12	1.95	4
3112114	2.0	50	1.6	14	1.95	4
3112116	2.0	50	1.6	16	1.95	4
3112118	2.0	55	1.6	18	1.95	4
3112120	2.0	55	1.6	20	1.95	4
3112122	2.0	60	1.6	22	1.95	4
3112125	2.0	65	1.6	25	1.95	4
3112130	2.0	70	1.6	30	1.95	4
3112135	2.0	75	1.6	35	1.95	4
3112140	2.0	80	1.6	40	1.95	4
3112560	2.5	45	2.0	6.0	2.45	4
3112600	2.5	50	2.0	10	2.45	4
3112615	2.5	55	2.0	15	2.45	4
3112620	2.5	60	2.0	20	2.45	4
3112625	2.5	65	2.0	25	2.45	4
3112630	2.5	70	2.0	30	2.45	4
3112635	2.5	70	2.0	35	2.45	4
3123060	3.0	50	2.4	6.0	2.85	6
3123080	3.0	50	2.4	8.0	2.85	6
3123100	3.0	50	2.4	10	2.85	6
3123112	3.0	55	2.4	12	2.85	6
3123114	3.0	55	2.4	14	2.85	6
3123115	3.0	55	2.4	15	2.85	6
3123116	3.0	55	2.4	16	2.85	6
3123120	3.0	60	2.4	20	2.85	6
3123125	3.0	65	2.4	25	2.85	6
3123130	3.0	70	2.4	30	2.85	6
3123135	3.0	80	2.4	35	2.85	6
3123140	3.0	85	2.4	40	2.85	6
3123600	3.5	60	2.8	10	3.35	6
3123615	3.5	60	2.8	15	3.35	6
3123620	3.5	65	2.8	20	3.35	6
3123625	3.5	65	2.8	25	3.35	6
3123630	3.5	70	2.8	30	3.35	6
3123635	3.5	80	2.8	35	3.35	6
3123640	3.5	90	2.8	40	3.35	6
3123645	3.5	90	2.8	45	3.35	6
3124080	4.0	60	3.2	8.0	3.85	6
3124100	4.0	60	3.2	10	3.85	6
3124112	4.0	60	3.2	12	3.85	6
3124114	4.0	60	3.2	14	3.85	6
3124115	4.0	60	3.2	15	3.85	6
3124116	4.0	60	3.2	16	3.85	6
3124120	4.0	65	3.2	20	3.85	6
3124125	4.0	70	3.2	25	3.85	6
3124130	4.0	80	3.2	30	3.85	6
3124135	4.0	80	3.2	35	3.85	6
3124140	4.0	90	3.2	40	3.85	6
3124145	4.0	90	3.2	45	3.85	6
3124150	4.0	100	3.2	50	3.85	6
3125100	5.0	65	5.0	10	4.85	6
3125115	5.0	70	5.0	15	4.85	6
3125120	5.0	70	4.0	20	4.85	6
3125125	5.0	70	4.0	25	4.85	6
3125130	5.0	80	4.0	30	4.85	6
3125135	5.0	80	4.0	35	4.85	6
3125140	5.0	90	5.0	40	4.85	6
3125145	5.0	100	5.0	45	4.85	6
3125150	5.0	100	5.0	50	4.85	6
3126100	6.0	60	6.0	10	5.85	6
3126120	6.0	70	6.0	20	5.85	6
3126125	6.0	70	6.0	25	5.85	6
3126130	6.0	80	4.8	30	5.85	6
3126135	6.0	80	6.0	35	5.85	6
3126140	6.0	90	4.8	40	5.85	6
3126145	6.0	100	6.0	45	5.85	6
3126150	6.0	120	4.8	50	5.85	6

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3790	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

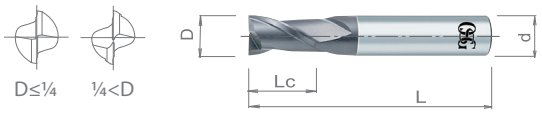
○ good ◎ best

List 3620

WXL-2D-DE, 2 Flute, Stub Length

SPEED FEED P69 | CARBIDE | WXL | STUB | 30° | SHANK h6

Milling Diameter Tolerance	
1/16≤D≤7/16	+0 / -0.0008"
1/2≤D≤3/4	+0 / -0.0012"



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
36200001	1/16	2	1/8	1/8
36200002	5/64	2	5/32	1/8
36200003	3/32	2	3/16	1/8
36200004	7/64	2	7/32	1/8
36200005	1/8	2	1/4	1/8
36200006	5/32	2	5/16	3/16
36200007	3/16	2	3/8	3/16
36200008	7/32	2	7/16	1/4
36200009	1/4	2-1/2	1/2	1/4
36200010	9/32	2-1/2	9/16	5/16
36200011	5/16	2-1/2	5/8	5/16
36200012	3/8	2-3/4	3/4	3/8
36200013	7/16	3	7/8	7/16
36200014	1/2	3	1	1/2
36200015	5/8	3-1/2	1-1/4	5/8
36200016	3/4	4	1-1/2	3/4

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3620	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

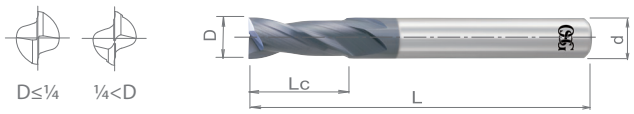
○ good ◎ best

List 3621

WXL-3D-DE, 2 Flute, Regular Length

SPEED FEED P69 | CARBIDE | WXL | REG | 35° | SHANK h6

Milling Diameter Tolerance	
1/16≤D≤7/16	+0 / -0.0008"
1/2≤D≤3/4	+0 / -0.0012"



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
36210001	1/16	2	3/16	1/8
36210002	5/64	2	15/64	1/8
36210003	3/32	2	9/32	1/8
36210004	7/64	2	21/64	1/8
36210005	1/8	2	3/8	1/8
36210006	5/32	2	15/32	3/16
36210007	3/16	2-1/4	9/16	3/16
36210008	7/32	2-1/2	21/32	1/4

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
36210009	1/4	2-1/2	3/4	1/4
36210010	9/32	2-3/4	27/32	5/16
36210011	5/16	2-3/4	15/16	5/16
36210012	3/8	3	1-1/8	3/8
36210013	7/16	3-1/4	1-5/16	7/16
36210014	1/2	3-1/2	1-1/2	1/2
36210015	5/8	4-1/4	1-7/8	5/8
36210016	3/4	5	2-1/4	3/4

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3621	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

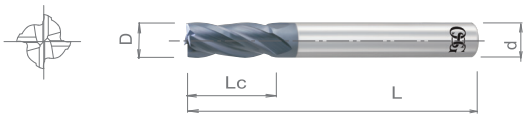
○ good ◎ best

List 3704

WXL-EMS, 4 Flute, Regular Length

SPEED FEED	CARBIDE	WXL		REG	30°	SHANK
P70						h6

Milling Diameter Tolerance	
1≤D≤12	+0 / -0.02mm



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3130510	1.0	40	2.5	4
3130515	1.5	40	4	4
3130520	2.0	40	6	4
3130525	2.5	40	8	4
3130530	3.0	45	8	6
3130535	3.5	45	10	6
3130540	4.0	45	11	6
3130545	4.5	45	11	6

Packed: 1 pc. Available WXL® coating only.

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3130550	5.0	50	13	6
3130560	6.0	50	13	6
3130570	7.0	60	16	8
3130580	8.0	60	19	8
3130590	9.0	70	19	10
3130600	10.0	70	22	10
3130620	12.0	75	26	12

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3704	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

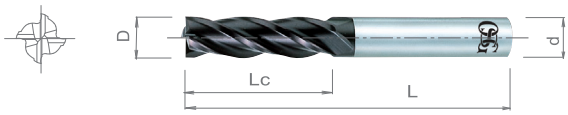
○ good ◎ best

List 3742

SPEED FEED P71 | CARBIDE | WXL | LONG | 30° | SHANK h6

WXL-EML, 4 Flute, Long Length

Milling Diameter Tolerance	
3≤D≤26	+0 / -0.03mm



EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
37420000	3.0	50	12	6
37420001	3.5	50	14	6
37420002	4.0	50	17	6
37420003	4.5	50	17	6
37420004	5.0	60	20	6
37420005	5.5	60	20	6
37420006	6.0	60	20	6
37420007	6.5	70	24	8
37420008	7.0	70	24	8
37420009	7.5	70	24	8
37420010	8.0	70	28	8
37420011	8.5	80	28	10
37420012	9.0	80	28	10
37420013	9.5	80	28	10
37420014	10.0	80	34	10

Packed: 1 pc. Available WXL® coating only.

EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Diameter d
37420015	10.5	90	34	12
37420016	11.0	90	34	12
37420017	11.5	90	34	12
37420018	12.0	90	40	12
37420019	13.0	100	40	12
37420020	14.0	100	40	12
37420021	15.0	105	40	16
37420022	16.0	115	48	16
37420023	18.0	115	48	16
37420024	20.0	125	56	20
37420025	23.0	140	67	25
37420026	24.0	140	67	25
37420027	25.0	140	67	25
37420028	26.0	140	67	25

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low 1010 1018	Med. 1035 1045	High 1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3742	◎	◎	◎	◎	◎	○	○	○	◎	◎	◎			◎	◎	◎	○

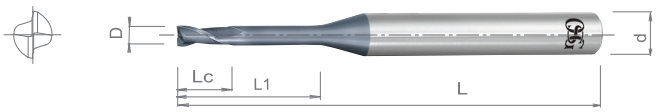
○ good ◎ best

List 3791

WXL-LN-EDS, 2 Flute, Stub Length, Long Neck, Rib Processing

SPEED FEED P73-76 | CARBIDE | WXL | STUB | 30° | SHANK h6

Milling Diameter Tolerance	
0.2≤D≤5	+0 / -0.015mm



EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter
	D	L	Lc	L1	d
3131201	0.2	45	0.30	0.5	4
3131202	0.2	45	0.30	1.0	4
3131203	0.2	45	0.30	1.5	4
3131204	0.2	45	0.30	2.0	4
3131205	0.2	45	0.30	2.5	4
3131206	0.2	45	0.30	3.0	4
3131207	0.2	45	0.30	3.5	4
3131208	0.2	45	0.30	4.0	4
3131302	0.3	45	0.45	1.0	4
3131303	0.3	45	0.45	1.5	4
3131304	0.3	45	0.45	2.0	4
3131305	0.3	45	0.45	2.5	4
3131306	0.3	45	0.45	3.0	4
3131308	0.3	45	0.45	4.0	4
3131310	0.3	45	0.45	5.0	4
3131312	0.3	45	0.45	6.0	4
3131318	0.3	45	0.45	9.0	4
3131403	0.4	45	0.60	1.5	4
3131404	0.4	45	0.60	2.0	4
3131406	0.4	45	0.60	3.0	4
3131408	0.4	45	0.60	4.0	4
3131410	0.4	45	0.60	5.0	4
3131412	0.4	45	0.60	6.0	4
3131414	0.4	45	0.60	7.0	4
3131416	0.4	45	0.60	8.0	4
3131418	0.4	45	0.60	9.0	4
3131420	0.4	45	0.60	10.0	4
3131424	0.4	45	0.60	12.0	4
3131501	0.5	45	0.70	1.5	4
3131502	0.5	45	0.70	2.0	4
3131503	0.5	45	0.70	3.0	4
3131504	0.5	45	0.70	4.0	4
3131505	0.5	45	0.70	5.0	4
3131506	0.5	45	0.70	6.0	4
3131507	0.5	45	0.70	7.0	4
3131508	0.5	45	0.70	8.0	4
3131509	0.5	45	0.70	9.0	4
3131510	0.5	45	0.70	10.0	4
3131512	0.5	45	0.70	12.0	4
3131515	0.5	50	0.70	15.0	4
3131602	0.6	45	0.90	2.0	4
3131603	0.6	45	0.90	3.0	4
3131604	0.6	45	0.90	4.0	4
3131605	0.6	45	0.90	5.0	4
3131606	0.6	45	0.90	6.0	4
3131607	0.6	45	0.90	7.0	4
3131608	0.6	45	0.90	8.0	4
3131610	0.6	45	0.90	10.0	4
3131612	0.6	45	0.90	12.0	4
3131615	0.6	50	0.90	15.0	4
3131618	0.6	50	0.90	18.0	4
3131702	0.7	45	1.00	2.0	4
3131704	0.7	45	1.00	4.0	4
3131706	0.7	45	1.00	6.0	4
3131708	0.7	45	1.00	8.0	4
3131710	0.7	45	1.00	10.0	4
3131804	0.8	45	1.20	4.0	4
3131806	0.8	45	1.20	6.0	4
3131808	0.8	45	1.20	8.0	4
3131810	0.8	45	1.20	10.0	4
3131812	0.8	45	1.20	12.0	4
3131814	0.8	50	1.20	14.0	4
3131816	0.8	50	1.20	16.0	4
3131820	0.8	55	1.20	20.0	4
3131824	0.8	60	1.20	24.0	4
3131904	0.9	45	1.35	4.0	4
3131906	0.9	45	1.35	6.0	4
3131908	0.9	45	1.35	8.0	4
3131910	0.9	45	1.35	10.0	4
3131915	0.9	50	1.35	15.0	4
3132003	1.0	45	1.50	3.0	4
3132004	1.0	45	1.50	4.0	4
3132005	1.0	45	1.50	5.0	4
3132006	1.0	45	1.50	6.0	4
3132007	1.0	45	1.50	7.0	4
3132008	1.0	45	1.50	8.0	4
3132009	1.0	45	1.50	9.0	4
3132010	1.0	45	1.50	10.0	4
3132012	1.0	45	1.50	12.0	4
3132014	1.0	50	1.50	14.0	4
3132016	1.0	50	1.50	16.0	4
3132018	1.0	55	1.50	18.0	4
3132020	1.0	55	1.50	20.0	4
3132022	1.0	60	1.50	22.0	4
3132025	1.0	60	1.50	25.0	4
3132030	1.0	70	1.50	30.0	4
3132204	1.2	45	1.80	4.0	4
3132206	1.2	45	1.80	6.0	4
3132208	1.2	45	1.80	8.0	4
3132210	1.2	45	1.80	10.0	4
3132212	1.2	45	1.80	12.0	4
3132214	1.2	50	1.80	14.0	4
3132216	1.2	50	1.80	16.0	4
3132220	1.2	55	1.80	20.0	4
3132406	1.4	45	2.10	6.0	4
3132408	1.4	45	2.10	8.0	4
3132410	1.4	45	2.10	10.0	4
3132412	1.4	45	2.10	12.0	4
3132414	1.4	50	2.10	14.0	4
3132416	1.4	50	2.10	16.0	4
3132422	1.4	60	2.10	22.0	4
3132504	1.5	45	2.30	4.0	4
3132506	1.5	45	2.30	6.0	4
3132508	1.5	45	2.30	8.0	4
3132510	1.5	45	2.30	10.0	4
3132512	1.5	45	2.30	12.0	4

Packed: 1 pc. Available WXL® coating only.

continued on next page

HTE

List 3791 (Continued)

WXL-LN-EDS, 2 Flute, Stub Length, Long Neck, Rib Processing

SPEED FEED P73-76 | CARBIDE | WXL | STUB | 30° | SHANK h6

Milling Diameter Tolerance	
0.2≤D≤5	+0 / -0.015mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter
	D	L	Lc	L1	d
3132514	1.5	50	2.30	14.0	4
3132516	1.5	50	2.30	16.0	4
3132518	1.5	55	2.30	18.0	4
3132520	1.5	55	2.30	20.0	4
3132525	1.5	60	2.30	25.0	4
3132530	1.5	70	2.30	30.0	4
3132538	1.5	80	2.30	38.0	4
3132540	1.5	80	2.30	40.0	4
3132545	1.5	80	2.30	45.0	4
3132606	1.6	45	2.40	6.0	4
3132608	1.6	45	2.40	8.0	4
3132610	1.6	45	2.40	10.0	4
3132612	1.6	45	2.40	12.0	4
3132614	1.6	50	2.40	14.0	4
3132616	1.6	50	2.40	16.0	4
3132618	1.6	55	2.40	18.0	4
3132620	1.6	55	2.40	20.0	4
3132806	1.8	45	2.70	6.0	4
3132808	1.8	45	2.70	8.0	4
3132810	1.8	45	2.70	10.0	4
3132812	1.8	45	2.70	12.0	4
3132814	1.8	50	2.70	14.0	4
3132816	1.8	50	2.70	16.0	4
3132818	1.8	55	2.70	18.0	4
3132820	1.8	55	2.70	20.0	4
3132825	1.8	60	2.70	25.0	4
3133006	2.0	45	3.00	6.0	4
3133008	2.0	45	3.00	8.0	4
3133010	2.0	45	3.00	10.0	4
3133012	2.0	45	3.00	12.0	4
3133014	2.0	50	3.00	14.0	4
3133016	2.0	50	3.00	16.0	4
3133018	2.0	55	3.00	18.0	4
3133020	2.0	55	3.00	20.0	4
3133025	2.0	60	3.00	25.0	4
3133030	2.0	70	3.00	30.0	4
3133035	2.0	80	3.00	35.0	4
3133040	2.0	90	3.00	40.0	4
3133050	2.0	100	3.00	50.0	4
3133060	2.0	110	3.00	60.0	4
3133508	2.5	45	3.70	8.0	4

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Shank Diameter
	D	L	Lc	L1	d
3133510	2.5	45	3.70	10.0	4
3133512	2.5	45	3.70	12.0	4
3133514	2.5	50	3.70	14.0	4
3133516	2.5	55	3.70	16.0	4
3133518	2.5	55	3.70	18.0	4
3133520	2.5	60	3.70	20.0	4
3133525	2.5	70	3.70	25.0	4
3133530	2.5	80	3.70	30.0	4
3133540	2.5	90	3.70	40.0	4
3133550	2.5	100	3.70	50.0	4
3134008	3.0	45	4.50	8.0	6
3134010	3.0	45	4.50	10.0	6
3134012	3.0	45	4.50	12.0	6
3134014	3.0	50	4.50	14.0	6
3134016	3.0	55	4.50	16.0	6
3134018	3.0	55	4.50	18.0	6
3134020	3.0	60	4.50	20.0	6
3134025	3.0	65	4.50	25.0	6
3134030	3.0	80	4.50	30.0	6
3134035	3.0	90	4.50	35.0	6
3134040	3.0	90	4.50	40.0	6
3134050	3.0	100	4.50	50.0	6
3135012	4.0	50	6.00	12.0	6
3135016	4.0	60	6.00	16.0	6
3135020	4.0	60	6.00	20.0	6
3135025	4.0	70	6.00	25.0	6
3135030	4.0	80	6.00	30.0	6
3135035	4.0	90	6.00	35.0	6
3135040	4.0	90	6.00	40.0	6
3135045	4.0	100	6.00	45.0	6
3135050	4.0	100	6.00	50.0	6
3135060	4.0	110	6.00	60.0	6
3136016	5.0	60	7.50	16.0	6
3136020	5.0	70	7.50	20.0	6
3136025	5.0	70	7.50	25.0	6
3136030	5.0	90	7.50	30.0	6
3136035	5.0	90	7.50	35.0	6
3136040	5.0	100	7.50	40.0	6
3136050	5.0	110	7.50	50.0	6
3136060	5.0	120	7.50	60.0	6

HTE

Packed: 1 pc. Available WXL® coating only.

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3791	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3711

WXL-LS-EBD, 2 Flute, Regular Length, Long Shank, Ball End

SPEED FEED P72 | CARBIDE | WXL | REG | 30° | SHANK h6

Radius Tolerance	
1≤D<4	+0.005mm / -0.005mm
5≤D≤18	+0.01mm / -0.01mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
37110000	1	70	2.5	3
37110001	2	70	5.0	3
37110002	3	80	8.0	3
37110003	4	100	8.0	4
37110004	5	100	10.0	4
37110005	6	140	12.0	6
37110006	7	140	14.0	6

Packed: 1 pc. Available WXL® coating only.

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
37110007	8	160	14.0	8
37110008	10	180	18.0	10
37110009	12	200	22.0	12
37110010	14	200	26.0	12
37110011	16	220	30.0	16
37110012	18	220	34.0	16

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3711	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○			◎	◎	◎	○

○ good ◎ best

List 3720

SPEED FEED P77-78 | CARBIDE | WXL | STUB | 30° | SHANK h6

WXL-1.5D-DE, 2 Flute, Stub Length

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3181801	0.1	45	0.15	4
3181802	0.2	45	0.30	4
3181803	0.3	45	0.45	4
3181804	0.4	45	0.60	4
3181805	0.5	45	0.75	4
3181806	0.6	45	0.90	4
3181807	0.7	45	1.10	4
3181808	0.8	45	1.20	4
3181809	0.9	45	1.40	4
3181810	1.0	45	1.50	4
3181811	1.1	45	1.70	4
3181812	1.2	45	1.80	4
3181813	1.3	45	2.00	4
3181814	1.4	45	2.10	4
3181815	1.5	45	2.30	4
3181816	1.6	45	2.40	4
3181817	1.7	45	2.60	4
3181818	1.8	45	2.70	4
3181819	1.9	45	2.90	4
3181820	2.0	45	3.00	4
3181821	2.1	45	3.20	4
3181822	2.2	45	3.30	4
3181823	2.3	45	3.50	4
3181824	2.4	45	3.60	4
3181825	2.5	45	3.80	4
3181826	2.6	45	3.90	4
3181827	2.7	45	4.10	4
3181828	2.8	45	4.20	4
3181829	2.9	45	4.40	4
3181830	3.0	45	4.50	6

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3181831	3.1	45	4.70	6
3181832	3.2	45	4.80	6
3181833	3.3	45	5.00	6
3181834	3.4	45	5.10	6
3181835	3.5	45	5.30	6
3181836	3.6	45	5.40	6
3181837	3.7	45	5.60	6
3181838	3.8	45	5.70	6
3181839	3.9	45	5.90	6
3181840	4.0	45	6.00	6
3181841	4.1	50	6.20	6
3181842	4.2	50	6.30	6
3181843	4.3	50	6.50	6
3181844	4.4	50	6.60	6
3181845	4.5	50	6.80	6
3181846	4.6	50	6.90	6
3181847	4.7	50	7.10	6
3181848	4.8	50	7.20	6
3181849	4.9	50	7.40	6
3181850	5.0	50	7.50	6
3181851	5.1	50	7.70	6
3181852	5.2	50	7.80	6
3181853	5.3	50	8.00	6
3181854	5.4	50	8.10	6
3181855	5.5	50	8.30	6
3181856	5.6	50	8.40	6
3181857	5.7	50	8.60	6
3181858	5.8	50	8.70	6
3181859	5.9	50	8.90	6
3181860	6.0	50	9.00	6

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

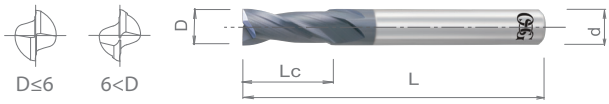
List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low 1010 1018	Med. 1035 1045	High 1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3720	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3721

WXL-2D-DE, 2 Flute, Stub Length

SPEED FEED P79-80 | CARBIDE | WXL | STUB | 30° | SHANK h6



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3182001	0.1	45	0.2	4
3182002	0.2	45	0.4	4
3182003	0.3	45	0.6	4
3182004	0.4	45	0.8	4
3182005	0.5	45	1.0	4
3182006	0.6	45	1.2	4
3182007	0.7	45	1.4	4
3182008	0.8	45	1.6	4
3182009	0.9	45	1.8	4
3182010	1.0	45	2.0	4
3182011	1.1	45	2.2	4
3182012	1.2	45	2.4	4
3182013	1.3	45	2.6	4
3182014	1.4	45	2.8	4
3182015	1.5	45	3.0	4
3182016	1.6	45	3.2	4
3182017	1.7	45	3.4	4
3182018	1.8	45	3.6	4
3182019	1.9	45	3.8	4
3182020	2.0	45	4.0	4
3182021	2.1	45	4.2	4
3182022	2.2	45	4.4	4
3182023	2.3	45	4.6	4
3182024	2.4	45	4.8	4
3182025	2.5	45	5.0	4
3182026	2.6	45	5.2	4
3182027	2.7	45	5.4	4
3182028	2.8	45	5.6	4
3182029	2.9	45	5.8	4
3182030	3.0	45	6.0	6
3182031	3.1	45	6.2	6
3182032	3.2	45	6.4	6
3182033	3.3	45	6.6	6
3182034	3.4	45	6.8	6
3182035	3.5	45	7.0	6
3182036	3.6	45	7.2	6
3182037	3.7	45	7.4	6

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3182038	3.8	45	7.6	6
3182039	3.9	45	7.8	6
3182040	4.0	45	8.0	6
3182041	4.1	50	8.2	6
3182042	4.2	50	8.4	6
3182043	4.3	50	8.6	6
3182044	4.4	50	8.8	6
3182045	4.5	50	9.0	6
3182046	4.6	50	9.2	6
3182047	4.7	50	9.4	6
3182048	4.8	50	9.6	6
3182049	4.9	50	9.8	6
3182050	5.0	50	10.0	6
3182051	5.1	50	10.2	6
3182052	5.2	50	10.4	6
3182053	5.3	50	10.6	6
3182054	5.4	50	10.8	6
3182055	5.5	50	11.0	6
3182056	5.6	50	11.2	6
3182057	5.7	50	11.4	6
3182058	5.8	50	11.6	6
3182059	5.9	50	11.8	6
3182060	6.0	50	12.0	6
3182065	6.5	60	13.0	8
3182070	7.0	60	14.0	8
3182075	7.5	60	15.0	8
3182080	8.0	60	16.0	8
3182085	8.5	70	17.0	10
3182090	9.0	70	18.0	10
3182095	9.5	70	19.0	10
3182100	10.0	70	20.0	10
3182110	11.0	75	22.0	12
3182120	12.0	75	24.0	12
3182160	16.0	90	32.0	16
3182180	18.0	90	36.0	16
3182200	20.0	100	40.0	20

HTE

Packed: 1 pc. Available WXL® coating only.

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3721	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3712

WXL-PC-EBD, 2 Flute, Stub Length, Pencil Neck, Ball End

SPEED FEED P81-88 | CARBIDE | WXL | STUB | 30° | SHANK h6

Radius Tolerance	
0.2≤D≤6	+/-0.005mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Minimum Neck Diameter	Effective Neck Length	Neck Taper	Shank Diameter	Type
	D	L	Lc	d1	L1	θn	d	
3170011	0.20	45	0.16	0.19	1.0	0.5°	4	1
3170012	0.20	45	0.16	0.19	1.5	0.5°	4	1
3170013	0.20	45	0.16	0.19	2.0	0.5°	4	1
3170014	0.20	45	0.16	0.19	2.5	0.5°	4	1
3170015	0.20	45	0.16	0.19	3.0	0.5°	4	1
3170021	0.20	45	0.16	0.19	2.0	1.0°	4	1
3170022	0.20	45	0.16	0.19	2.5	1.0°	4	1
3170023	0.20	45	0.16	0.19	3.0	1.0°	4	1
3170031	0.30	45	0.24	0.29	2.0	0.5°	4	1
3170032	0.30	45	0.24	0.29	3.0	0.5°	4	1
3170041	0.30	45	0.24	0.29	3.0	1.0°	4	1
3170042	0.30	45	0.24	0.29	4.0	1.0°	4	1
3170051	0.40	45	0.30	0.38	2.0	0.5°	4	1
3170052	0.40	45	0.30	0.38	3.0	0.5°	4	1
3170053	0.40	45	0.30	0.38	4.0	0.5°	4	1
3170054	0.40	45	0.30	0.38	5.0	0.5°	4	1
3170055	0.40	45	0.30	0.38	6.0	0.5°	4	1
3170061	0.40	45	0.30	0.38	4.0	1.0°	4	1
3170062	0.40	45	0.30	0.38	5.0	1.0°	4	1
3170063	0.40	45	0.30	0.38	6.0	1.0°	4	1
3170071	0.50	45	0.40	0.48	4.0	0.5°	4	1
3170072	0.50	45	0.40	0.48	6.0	0.5°	4	1
3170073	0.50	45	0.40	0.48	8.0	0.5°	4	1
3170074	0.50	45	0.40	0.48	10.0	0.5°	4	1
3170081	0.50	45	0.40	0.48	4.0	1.0°	4	1
3170082	0.50	45	0.40	0.48	6.0	1.0°	4	1
3170083	0.50	45	0.40	0.48	8.0	1.0°	4	1
3170084	0.50	45	0.40	0.48	10.0	1.0°	4	1
3170085	0.50	50	0.40	0.48	12.0	1.0°	4	1
3170091	0.60	45	0.50	0.58	2.0	0.5°	4	1
3170092	0.60	45	0.50	0.58	4.0	0.5°	4	1
3170093	0.60	45	0.50	0.58	6.0	0.5°	4	1
3170094	0.60	45	0.50	0.58	8.0	0.5°	4	1
3170095	0.60	45	0.50	0.58	10.0	0.5°	4	1
3170096	0.60	45	0.50	0.58	12.0	0.5°	4	1
3170097	0.60	50	0.50	0.58	16.0	0.5°	4	1

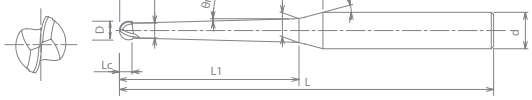
Packed: 1 pc. Available WXL® coating only.

continued on next page

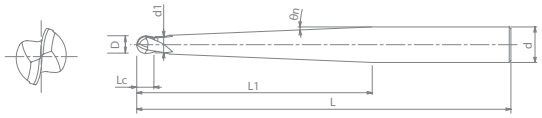
HTE

Type 1

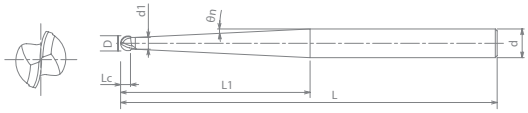
Type 2



Type 3



Type 4



Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3712	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3712 (Continued)

WXL-PC-EBD, 2 Flute, Stub Length, Pencil Neck, Ball End

SPEED FEED P81-88 | CARBIDE | WXL | STUB | 30° | SHANK h6

Radius Tolerance	
0.2≤D≤6	+/-0.005mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Minimum Neck Diameter	Effective Neck Length	Neck Taper	Shank Diameter	Type
	D	L	Lc	d1	L1	θn	d	
3170101	0.60	45	0.50	0.58	4.0	1.0°	4	1
3170102	0.60	45	0.50	0.58	6.0	1.0°	4	1
3170103	0.60	45	0.50	0.58	8.0	1.0°	4	1
3170104	0.60	45	0.50	0.58	10.0	1.0°	4	1
3170105	0.60	45	0.50	0.58	12.0	1.0°	4	1
3170106	0.60	50	0.50	0.58	16.0	1.0°	4	1
3170111	0.80	45	0.60	0.78	4.0	0.5°	4	1
3170112	0.80	45	0.60	0.78	6.0	0.5°	4	1
3170113	0.80	45	0.60	0.78	8.0	0.5°	4	1
3170114	0.80	45	0.60	0.78	12.0	0.5°	4	1
3170121	0.80	45	0.60	0.78	8.0	1.0°	4	1
3170122	0.80	45	0.60	0.78	12.0	1.0°	4	1
3170123	0.80	50	0.60	0.78	16.0	1.0°	4	1
3170131	1.00	45	0.63	0.95	6.0	0.5°	4	3
3170132	1.00	45	0.63	0.95	8.0	0.5°	4	3
3170133	1.00	45	0.63	0.95	10.0	0.5°	4	3
3170134	1.00	45	0.63	0.95	12.0	0.5°	4	3
3170135	1.00	50	0.63	0.95	16.0	0.5°	4	3
3170136	1.00	55	0.63	0.95	18.0	0.5°	4	3
3170137	1.00	55	0.63	0.95	20.0	0.5°	4	3
3170138	1.00	60	0.63	0.95	25.0	0.5°	4	3
3170139	1.00	65	0.63	0.95	30.0	0.5°	4	3
3170140	1.00	70	0.63	0.95	35.0	0.5°	4	3
3170141	1.00	45	0.63	0.95	10.0	1.0°	4	3
3170142	1.00	50	0.63	0.95	16.0	1.0°	4	3
3170143	1.00	55	0.63	0.95	20.0	1.0°	4	3
3170144	1.00	60	0.63	0.95	25.0	1.0°	4	3
3170145	1.00	65	0.63	0.95	30.0	1.0°	4	3
3170146	1.00	70	0.63	0.95	35.0	1.0°	4	3
3170147	1.00	80	0.63	0.95	40.0	1.0°	4	3
3170148	1.00	90	0.63	0.95	50.0	1.0°	4	3
3170149	1.00	100	0.63	0.95	60.0	1.0°	4	3
3170150	1.00	110	0.63	0.95	70.0	1.0°	4	3
3170151	1.00	45	0.63	0.95	8.0	1.5°	4	3
3170152	1.00	45	0.63	0.95	10.0	1.5°	4	3
3170153	1.00	45	0.63	0.95	12.0	1.5°	4	3
3170154	1.00	50	0.63	0.95	16.0	1.5°	4	3
3170155	1.00	55	0.63	0.95	20.0	1.5°	4	3
3170156	1.00	60	0.63	0.95	25.0	1.5°	4	3
3170157	1.00	65	0.63	0.95	30.0	1.5°	4	3
3170158	1.00	70	0.63	0.95	35.0	1.5°	4	3
3170161	1.00	80	0.63	0.95	45.0	2.0°	4	4
3170171	1.20	45	0.76	1.15	12.0	0.5°	4	3
3170172	1.20	60	0.76	1.15	25.0	0.5°	4	3
3170181	1.20	45	0.76	1.15	12.0	1.0°	4	3
3170182	1.20	60	0.76	1.15	25.0	1.0°	4	3
3170191	1.20	45	0.76	1.15	12.0	1.5°	4	3
3170192	1.20	60	0.76	1.15	25.0	1.5°	4	3
3170211	1.50	45	0.95	1.42	8.0	0.5°	4	3
3170212	1.50	45	0.95	1.42	10.0	0.5°	4	3
3170213	1.50	45	0.95	1.42	12.0	0.5°	4	3
3170214	1.50	55	0.95	1.42	16.0	0.5°	4	3
3170215	1.50	55	0.95	1.42	20.0	0.5°	4	3
3170216	1.50	60	0.95	1.42	25.0	0.5°	4	3
3170217	1.50	65	0.95	1.42	30.0	0.5°	4	3
3170218	1.50	70	0.95	1.42	35.0	0.5°	4	3
3170221	1.50	45	0.95	1.42	10.0	1.0°	4	3
3170222	1.50	45	0.95	1.42	12.0	1.0°	4	3
3170223	1.50	55	0.95	1.42	16.0	1.0°	4	3
3170224	1.50	55	0.95	1.42	20.0	1.0°	4	3
3170225	1.50	60	0.95	1.42	25.0	1.0°	4	3
3170226	1.50	65	0.95	1.42	30.0	1.0°	4	3
3170227	1.50	70	0.95	1.42	35.0	1.0°	4	3
3170230	1.50	45	0.95	1.42	10.0	1.5°	4	3
3170231	1.50	45	0.95	1.42	12.0	1.5°	4	3
3170232	1.50	55	0.95	1.42	16.0	1.5°	4	3

Packed: 1 pc. Available WXL® coating only.

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List 3712 (Continued)

WXL-PC-EBD, 2 Flute, Stub Length, Pencil Neck, Ball End

SPEED FEED P81-88 | CARBIDE | WXL | STUB | 30° | SHANK h6

Radius Tolerance	
0.2≤D≤6	+/-0.005mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Minimum Neck Diameter	Effective Neck Length	Neck Taper	Shank Diameter	Type
	D	L	Lc	d1	L1	θn	d	
3170233	1.50	55	0.95	1.42	20.0	1.5°	4	3
3170234	1.50	60	0.95	1.42	25.0	1.5°	4	3
3170235	1.50	65	0.95	1.42	30.0	1.5°	4	3
3170236	1.50	70	0.95	1.42	35.0	1.5°	4	3
3170241	1.50	70	0.95	1.42	38.6	2.0°	4	4
3170271	2.00	45	1.26	1.93	8.0	0.5°	4	3
3170272	2.00	45	1.26	1.93	10.0	0.5°	4	3
3170273	2.00	45	1.26	1.93	12.0	0.5°	4	3
3170274	2.00	50	1.26	1.93	16.0	0.5°	4	3
3170275	2.00	55	1.26	1.93	20.0	0.5°	4	3
3170276	2.00	65	1.26	1.93	26.0	0.5°	4	3
3170277	2.00	70	1.26	1.93	30.0	0.5°	4	3
3170278	2.00	75	1.26	1.93	35.0	0.5°	4	3
3170279	2.00	80	1.26	1.93	40.0	0.5°	4	3
3170281	2.00	50	1.26	1.93	16.0	1.0°	4	3
3170282	2.00	55	1.26	1.93	20.0	1.0°	4	3
3170283	2.00	65	1.26	1.93	25.0	1.0°	4	3
3170284	2.00	70	1.26	1.93	30.0	1.0°	4	3
3170285	2.00	75	1.26	1.93	35.0	1.0°	4	3
3170286	2.00	80	1.26	1.93	40.0	1.0°	4	3
3170287	2.00	90	1.26	1.93	50.0	1.0°	6	3
3170288	2.00	100	1.26	1.93	60.0	1.0°	6	3
3170289	2.00	110	1.26	1.93	70.0	1.0°	6	3
3170291	2.00	50	1.26	1.93	16.0	1.5°	4	3
3170292	2.00	55	1.26	1.93	20.0	1.5°	4	3
3170293	2.00	65	1.26	1.93	25.0	1.5°	4	3
3170294	2.00	70	1.26	1.93	30.0	1.5°	4	3
3170295	2.00	75	1.26	1.93	35.0	1.5°	4	3
3170296	2.00	80	1.26	1.93	41.4	1.5°	4	4
3170301	2.00	70	1.26	1.93	31.5	2.0°	4	4
3170321	3.00	50	2.40	2.95	8.0	0.5°	6	1
3170322	3.00	50	2.40	2.95	10.0	0.5°	6	1
3170323	3.00	55	2.40	2.95	12.0	0.5°	6	1
3170324	3.00	55	2.40	2.95	16.0	0.5°	6	1
3170325	3.00	60	2.40	2.95	20.0	0.5°	6	1
3170326	3.00	65	2.40	2.95	25.0	0.5°	6	1
3170327	3.00	70	2.40	2.95	30.0	0.5°	6	1
3170328	3.00	80	2.40	2.95	35.0	0.5°	6	1

Packed: 1 pc. Available WXL® coating only.

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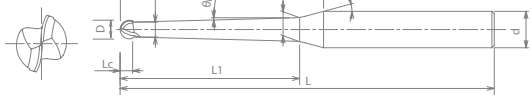
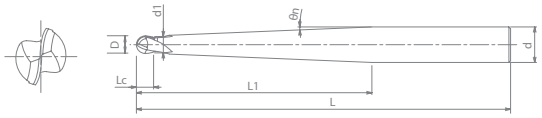
HTE

Type 1

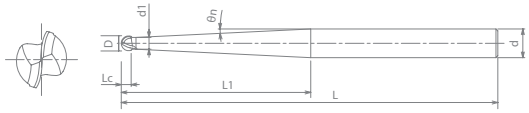
Type 2



Type 3



Type 4



Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3712	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3712 (Continued)

WXL-PC-EBD, 2 Flute, Stub Length, Pencil Neck, Ball End

SPEED FEED P81-88 | CARBIDE | WXL | STUB | 30° | SHANK h6

Radius Tolerance	
0.2≤D≤6	+/-0.005mm

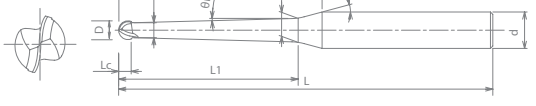
EDP Number	Mill Diameter	Overall Length	Length of Cut	Minimum Neck Diameter	Effective Neck Length	Neck Taper	Shank Diameter	Type
	D	L	Lc	d1	L1	θn	d	
3170329	3.00	85	2.40	2.95	40.0	0.5°	6	1
3170330	3.00	90	2.40	2.95	50.0	0.5°	6	1
3170331	3.00	60	2.40	2.95	20.0	1.0°	6	1
3170332	3.00	65	2.40	2.95	25.0	1.0°	6	1
3170333	3.00	70	2.40	2.95	30.0	1.0°	6	1
3170334	3.00	80	2.40	2.95	35.0	1.0°	6	1
3170335	3.00	85	2.40	2.95	40.0	1.0°	6	1
3170336	3.00	90	2.40	2.95	50.0	1.0°	6	1
3170337	3.00	100	2.40	2.95	60.0	1.0°	6	1
3170338	3.00	110	2.40	2.95	70.0	1.0°	6	1
3170341	3.00	60	2.40	2.95	20.0	1.5°	6	1
3170342	3.00	65	2.40	2.95	25.0	1.5°	6	1
3170343	3.00	70	2.40	2.95	30.0	1.5°	6	1
3170344	3.00	80	2.40	2.95	35.0	1.5°	6	1
3170345	3.00	85	2.40	2.95	40.0	1.5°	6	1
3170346	3.00	90	2.40	2.95	50.0	1.5°	6	1
3170347	3.00	100	2.40	2.95	62.5	1.5°	6	2
3170351	3.00	100	2.40	2.95	47.5	2.0°	6	2
3170371	4.00	65	3.20	3.93	20.0	1.0°	6	1
3170372	4.00	80	3.20	3.93	30.0	1.0°	6	1
3170373	4.00	90	3.20	3.93	40.0	1.0°	6	1
3170374	4.00	100	3.20	3.93	50.0	1.0°	8	1
3170375	4.00	110	3.20	3.93	60.0	1.0°	8	1
3170381	4.00	80	3.20	3.93	44.2	1.5°	6	2
3170391	4.00	80	3.20	3.93	34.0	2.0°	6	2
3170401	5.00	100	5.00	4.95	30.0	1.0°	8	1
3170402	5.00	100	5.00	4.95	40.0	1.0°	8	1
3170403	5.00	130	5.00	4.95	60.0	1.0°	8	1
3170411	5.00	100	5.00	4.95	26.9	1.5°	6	2
3170412	5.00	130	5.00	4.95	65.1	1.5°	8	2
3170421	5.00	130	5.00	4.95	50.1	2.0°	8	2
3170431	6.00	100	6.00	5.95	30.0	1.0°	8	1
3170432	6.00	100	6.00	5.95	40.0	1.0°	8	1
3170433	6.00	100	6.00	5.95	50.0	1.0°	8	1
3170434	6.00	110	6.00	5.95	60.0	1.0°	10	1
3170435	6.00	120	6.00	5.95	70.0	1.0°	10	1
3170436	6.00	130	6.00	5.95	80.0	1.0°	12	1
3170441	6.00	100	6.00	5.95	49.0	1.5°	8	2
3170451	6.00	100	6.00	5.95	36.0	2.0°	8	2

Packed: 1 pc. Available WXL® coating only.

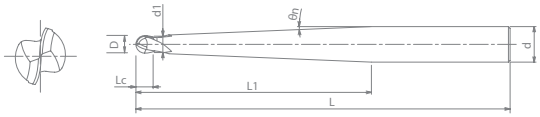
HTE

Type 1

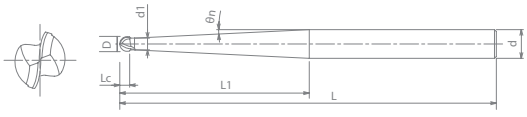
Type 2



Type 3



Type 4



Work Material

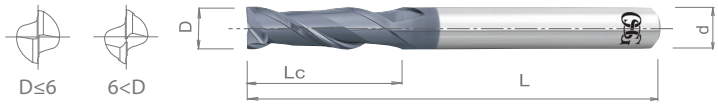
List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3712	◎	◎	◎	◎	◎	◎	◎	◎	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3722

WXL-3D-DE, 2 Flute, Regular Length

SPEED FEED P89-90 | CARBIDE | WXL | REG | 35° | SHANK h6



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3182401	0.1	45	0.3	4
3182402	0.2	45	0.6	4
3182403	0.3	45	0.9	4
3182404	0.4	45	1.2	4
3182405	0.5	45	1.5	4
3182406	0.6	45	1.8	4
3182407	0.7	45	2.1	4
3182408	0.8	45	2.4	4
3182409	0.9	45	2.7	4
3182410	1.0	45	3.0	4
3182411	1.1	45	3.3	4
3182412	1.2	45	3.6	4
3182413	1.3	45	3.9	4
3182414	1.4	45	4.2	4
3182415	1.5	45	4.5	4
3182416	1.6	45	4.8	4
3182417	1.7	45	5.1	4
3182418	1.8	45	5.4	4
3182419	1.9	45	5.7	4
3182420	2.0	45	6.0	4
3182421	2.1	45	6.3	4
3182422	2.2	45	6.6	4
3182423	2.3	45	6.9	4
3182424	2.4	45	7.2	4
3182425	2.5	45	7.5	4
3182426	2.6	45	7.8	4
3182427	2.7	45	8.1	4
3182428	2.8	45	8.4	4
3182429	2.9	45	8.7	4
3182430	3.0	45	9.0	6
3182431	3.1	45	9.3	6
3182432	3.2	45	9.6	6
3182433	3.3	45	9.9	6
3182434	3.4	45	10.2	6
3182435	3.5	45	10.5	6
3182436	3.6	45	10.8	6
3182437	3.7	45	11.1	6

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3182438	3.8	45	11.4	6
3182439	3.9	45	11.7	6
3182440	4.0	50	12.0	6
3182441	4.1	50	12.3	6
3182442	4.2	50	12.6	6
3182443	4.3	50	12.9	6
3182444	4.4	50	13.2	6
3182445	4.5	50	13.5	6
3182446	4.6	55	13.8	6
3182447	4.7	55	14.1	6
3182448	4.8	55	14.4	6
3182449	4.9	55	14.7	6
3182450	5.0	55	15.0	6
3182451	5.1	55	15.3	6
3182452	5.2	55	15.6	6
3182453	5.3	55	15.9	6
3182454	5.4	55	16.2	6
3182455	5.5	60	16.5	6
3182456	5.6	60	16.8	6
3182457	5.7	60	17.1	6
3182458	5.8	60	17.4	6
3182459	5.9	60	17.7	6
3182460	6.0	60	18.0	6
3182465	6.5	65	19.5	8
3182470	7.0	65	21.0	8
3182475	7.5	70	22.5	8
3182480	8.0	70	24.0	8
3182485	8.5	70	22.5	10
3182490	9.0	75	27.0	10
3182495	9.5	75	28.5	10
3182500	10.0	80	30.0	10
3182510	11.0	80	33.0	12
3182520	12.0	90	36.0	12
3182560	16.0	110	48.0	16
3182580	18.0	130	54.0	16
3182600	20.0	130	60.0	20

HTE

Packed: 1 pc. Available WXL® coating only.

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3722	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3723

SPEED FEED P91-92 | CARBIDE | WXL | LONG | 40° | SHANK h6

WXL-4D-DE, 2 Flute, Long Length

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3182602	0.2	45	0.8	4
3182603	0.3	45	1.2	4
3182604	0.4	45	1.6	4
3182605	0.5	45	2.0	4
3182606	0.6	45	2.4	4
3182607	0.7	45	2.8	4
3182608	0.8	45	3.2	4
3182609	0.9	45	3.6	4
3182610	1.0	45	4.0	4
3182611	1.1	45	4.4	4
3182612	1.2	45	4.8	4
3182613	1.3	45	5.2	4
3182614	1.4	45	5.6	4
3182615	1.5	45	6.0	4
3182616	1.6	45	6.4	4
3182617	1.7	45	6.8	4
3182618	1.8	45	7.2	4
3182619	1.9	45	7.6	4
3182620	2.0	45	8.0	4
3182621	2.1	45	8.4	4
3182622	2.2	45	8.8	4
3182623	2.3	45	9.2	4
3182624	2.4	45	9.6	4
3182625	2.5	45	10.0	4
3182626	2.6	50	10.4	4
3182627	2.7	50	10.8	4
3182628	2.8	50	11.2	4
3182629	2.9	50	11.6	4
3182630	3.0	50	12.0	6
3182631	3.1	50	12.4	6
3182632	3.2	50	12.8	6

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
3182633	3.3	50	13.2	6
3182634	3.4	50	13.6	6
3182635	3.5	50	14.0	6
3182636	3.6	50	14.4	6
3182637	3.7	50	14.8	6
3182638	3.8	50	15.2	6
3182639	3.9	50	15.6	6
3182640	4.0	55	16.0	6
3182641	4.1	55	16.4	6
3182642	4.2	55	16.8	6
3182643	4.3	55	17.2	6
3182644	4.4	55	17.6	6
3182645	4.5	55	18.0	6
3182646	4.6	55	18.4	6
3182647	4.7	55	18.8	6
3182648	4.8	55	19.2	6
3182649	4.9	55	19.6	6
3182650	5.0	60	20.0	6
3182651	5.1	60	20.4	6
3182652	5.2	60	20.8	6
3182653	5.3	60	21.2	6
3182654	5.4	60	21.6	6
3182655	5.5	65	22.0	6
3182656	5.6	65	22.4	6
3182657	5.7	65	22.8	6
3182658	5.8	65	23.2	6
3182659	5.9	65	23.6	6
3182660	6.0	65	24.0	6
3182680	8.0	80	32.0	8
3182700	10.0	90	40.0	10
3182720	12.0	100	48.0	12

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3723	◎	◎	◎	◎	◎	○	○	○	◎	○	○			◎	◎	○	

○ good ◎ best

List 3770

SPEED FEED P93 | CARBIDE | WXL | REG | 30° | SHANK h6

WXL-CR-EDS, 2 Flute, Regular Length, Corner Radius

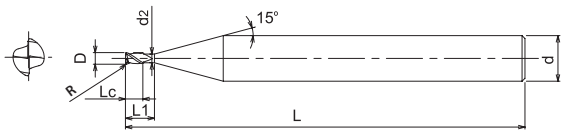
EDP Number	Mill Dia.	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Dia.	Shank Dia.	Type
	D	R	L	Lc	L1	d2	d	
37700000	0.6	0.1	50	0.9	2.0	0.55	6	1
37700001	0.8	0.1	50	1.2	2.6	0.75	6	1
37700002	1.0	0.1	50	1.5	2.7	0.95	6	1
37700003	1.2	0.1	50	1.8	3.2	1.15	6	1
37700004	1.4	0.1	50	2.1	3.7	1.35	6	1
37700005	1.5	0.1	50	2.3	4.0	1.45	6	1
37700006	1.6	0.1	50	2.4	4.2	1.55	6	1
37700007	1.8	0.1	50	2.7	4.7	1.75	6	1
37700008	2.0	0.1	50	3.0	5.2	1.95	6	1
37700009	2.5	0.1	50	3.7	5.2	2.40	6	1
37700010	3.0	0.2	60	8.0	-	-	6	2
37700011	3.0	0.5	60	8.0	-	-	6	2
37700012	4.0	0.2	70	11.0	-	-	6	2
37700013	4.0	0.5	70	11.0	-	-	6	2
37700014	4.0	1.0	70	11.0	-	-	6	2
37700015	5.0	0.2	80	13.0	-	-	6	2
37700016	5.0	0.5	80	13.0	-	-	6	2
37700017	5.0	1.0	80	13.0	-	-	6	2
37700018	6.0	0.2	90	13.0	-	-	6	2

EDP Number	Mill Dia.	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Dia.	Shank Dia.	Type
	D	R	L	Lc	L1	d2	d	
37700019	6.0	0.5	90	13.0	-	-	6	2
37700020	6.0	1.0	90	13.0	-	-	6	2
37700021	6.0	1.5	90	13.0	-	-	6	2
37700022	6.0	2.0	90	13.0	-	-	6	2
37700023	8.0	0.5	100	19.0	-	-	8	2
37700024	8.0	1.0	100	19.0	-	-	8	2
37700025	8.0	1.5	100	19.0	-	-	8	2
37700026	8.0	2.0	100	19.0	-	-	8	2
37700027	10.0	0.5	100	22.0	-	-	10	2
37700028	10.0	1.0	100	22.0	-	-	10	2
37700029	10.0	1.5	100	22.0	-	-	10	2
37700030	10.0	2.0	100	22.0	-	-	10	2
37700031	10.0	3.0	100	22.0	-	-	10	2
37700032	12.0	0.5	110	26.0	-	-	12	2
37700033	12.0	1.0	110	26.0	-	-	12	2
37700034	12.0	1.5	110	26.0	-	-	12	2
37700035	12.0	2.0	110	26.0	-	-	12	2
37700036	12.0	3.0	110	26.0	-	-	12	2

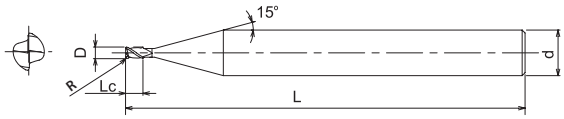
HTE

Packed: 1 pc. Available WXL® coating only.

Type 1



Type 2



Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3770	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3771

SPEED FEED P94 | CARBIDE | WXL | REG | 30° | SHANK h6

WXL-CR-PHS, 4 Flute, Regular Length, Corner Radius

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Shank Diameter
	D	R	L	Lc	d
37710000	3	0.2	60	8	6
37710001	3	0.5	60	8	6
37710002	4	0.2	70	11	6
37710003	4	0.5	70	11	6
37710004	4	1.0	70	11	6
37710005	5	0.2	80	13	6
37710006	5	0.5	80	13	6
37710007	5	1.0	80	13	6
37710008	6	0.2	90	13	6
37710009	6	0.5	90	13	6
37710010	6	1.0	90	13	6
37710011	6	1.5	90	13	6
37710012	6	2.0	90	13	6
37710013	8	0.5	100	19	8

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Shank Diameter
	D	R	L	Lc	d
37710014	8	1.0	100	19	8
37710015	8	1.5	100	19	8
37710016	8	2.0	100	19	8
37710017	10	0.5	100	22	10
37710018	10	1.0	100	22	10
37710019	10	1.5	100	22	10
37710020	10	2.0	100	22	10
37710021	10	3.0	100	22	10
37710022	12	0.5	110	26	12
37710023	12	1.0	110	26	12
37710024	12	1.5	110	26	12
37710025	12	2.0	110	26	12
37710026	12	3.0	110	26	12

Packed: 1 pc. Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3771	◎	◎	◎	◎	◎	○	○	○	◎	○	○	○	○	◎	◎	◎	○

○ good ◎ best

List 3794

WXL-LN-EMS, 4 Flute, Stub Length, Long Neck, Rib Processing

SPEED FEED P95-96 | CARBIDE | WXL | STUB | 35° | SHANK h6

Milling Diameter Tolerance	
1≤D≤3	+0 / -0.015mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	L	Lc	L1	d2	d
3172004	1.0	45	1.5	4	0.95	4
3172006	1.0	45	1.5	6	0.95	4
3172008	1.0	45	1.5	8	0.95	4
3172010	1.0	45	1.5	10	0.95	4
3172012	1.0	45	1.5	12	0.95	4
3172016	1.0	50	1.5	16	0.95	4
3172206	1.2	45	1.8	6	1.15	4
3172208	1.2	45	1.8	8	1.15	4
3172210	1.2	45	1.8	10	1.15	4
3172212	1.2	45	1.8	12	1.15	4
3172216	1.2	50	1.8	16	1.15	4
3172406	1.4	45	2.1	6	1.35	4
3172408	1.4	45	2.1	8	1.35	4
3172410	1.4	45	2.1	10	1.35	4
3172412	1.4	45	2.1	12	1.35	4
3172414	1.4	50	2.1	14	1.35	4
3172416	1.4	50	2.1	16	1.35	4
3172422	1.4	60	2.1	22	1.35	4
3172506	1.5	45	2.3	6	1.45	4
3172508	1.5	45	2.3	8	1.45	4
3172510	1.5	45	2.3	10	1.45	4
3172512	1.5	45	2.3	12	1.45	4
3172514	1.5	50	2.3	14	1.45	4
3172516	1.5	50	2.3	16	1.45	4
3172518	1.5	55	2.3	18	1.45	4
3172520	1.5	55	2.3	20	1.45	4
3172606	1.6	45	2.4	6	1.55	4
3172608	1.6	45	2.4	8	1.55	4
3172610	1.6	45	2.4	10	1.55	4
3172612	1.6	45	2.4	12	1.55	4
3172614	1.6	50	2.4	14	1.55	4
3172616	1.6	50	2.4	16	1.55	4
3172618	1.6	55	2.4	18	1.55	4
3172620	1.6	55	2.4	20	1.55	4
3172625	1.6	60	2.4	25	1.55	4
3172806	1.8	45	2.7	6	1.75	4
3172808	1.8	45	2.7	8	1.75	4
3172810	1.8	45	2.7	10	1.75	4
3172812	1.8	45	2.7	12	1.75	4
3172814	1.8	50	2.7	14	1.75	4
3172816	1.8	50	2.7	16	1.75	4

Packed: 1 pc.
Available WXL® coating only.

continued on next page

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3794	◎	◎	◎	◎	◎	○	○	○	◎	○	○			◎	◎	○	

○ good ◎ best

List 3794 (Continued)

WXL-LN-EMS, 4 Flute, Stub Length, Long Neck, Rib Processing

SPEED FEED P95-96 | CARBIDE | WXL | STUB | 35° | SHANK h6

Milling Diameter Tolerance	
1≤D≤3	+0 / -0.015mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	L	Lc	L1	d2	d
3172818	1.8	55	2.7	18	1.75	4
3172820	1.8	55	2.7	20	1.75	4
3172825	1.8	60	2.7	25	1.75	4
3173006	2.0	45	3.0	6	1.95	4
3173008	2.0	45	3.0	8	1.95	4
3173010	2.0	45	3.0	10	1.95	4
3173012	2.0	45	3.0	12	1.95	4
3173014	2.0	50	3.0	14	1.95	4
3173016	2.0	50	3.0	16	1.95	4
3173018	2.0	55	3.0	18	1.95	4
3173020	2.0	55	3.0	20	1.95	4
3173025	2.0	60	3.0	25	1.95	4
3173030	2.0	70	3.0	30	1.95	4
3173508	2.5	45	3.7	8	2.40	4
3173512	2.5	45	3.7	12	2.40	4
3173516	2.5	55	3.7	16	2.40	4
3173520	2.5	60	3.7	20	2.40	4
3173525	2.5	70	3.7	25	2.40	4
3174008	3.0	45	4.5	8	2.85	6
3174012	3.0	45	4.5	12	2.85	6
3174016	3.0	55	4.5	16	2.85	6
3174020	3.0	60	4.5	20	2.85	6
3174025	3.0	65	4.5	25	2.85	6
3174030	3.0	80	4.5	30	2.85	6

Packed: 1 pc.
Available WXL® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
3794	◎	◎	◎	◎	◎	○	○	○	◎	○	○			◎	◎	○	

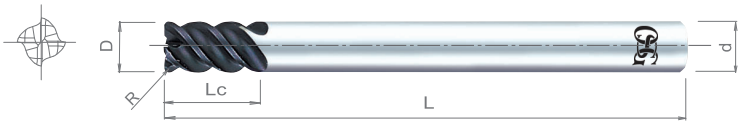
○ good ◎ best

List 4445

WXL-CR-EHS, 4 Flute, Regular Length, High Helix, Corner Radius

SPEED FEED P97 | CARBIDE | WXL | REG | 50° | SHANK h6

Radius Tolerance	
1/8≤D≤1/2	± 0.0008"



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Shank Diameter
	D	R	L	Lc	d
44450001	1/8	0.01	2-1/2	3/8	1/4
44450002	3/16	0.01	2-1/2	1/2	1/4
44450003	1/4	0.01	2-1/2	5/8	1/4

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Shank Diameter
	D	R	L	Lc	d
44450004	5/16	0.02	2-3/4	3/4	5/16
44450005	3/8	0.02	3	1	3/8
44450006	1/2	0.02	4	1-1/8	1/2

Packed: 1 pc.
Available WXL® coating only.

HTE

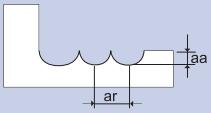
Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4445	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

○ good ◎ best

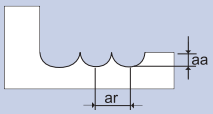
List 3610 - EXOCARB® WXL®: Ball End, Regular Length, 2 Flute

Standard Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Aluminum Copper Alloy		Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels		Hardened Steels Pre-hardened Steels, P20, H13, S7, A2			
Cutting Speed	388 SFM		324 SFM		263 SFM		233 SFM	
Depth of Cut	Dia / aa / ar D<1/16 / 0.05D / 0.2D 1/16≤D≤1/2 / 0.1D / 0.2D 				a_a=0.1D a_r=0.2D		a_a=0.05D a_r=0.1D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/32	47,429	66.4	39,606	55.4	32,149	45.0	28,482	34.2
1/16	23,715	61.7	19,803	51.5	16,075	41.8	14,241	34.2
3/32	15,810	60.1	13,202	50.2	10,716	40.7	9,494	34.2
1/8	11,857	56.9	9,901	47.5	8,037	38.6	7,120	31.3
3/16	7,905	58.5	6,601	48.8	5,358	39.7	4,747	33.2
1/4	5,929	54.5	4,951	45.5	4,019	37.0	3,560	32.0
5/16	4,743	56.9	3,961	47.5	3,215	38.6	2,848	32.5
3/8	3,952	55.3	3,300	46.2	2,679	37.5	2,373	28.5
1/2	2,964	51.6	2,475	43.1	2,009	35.0	1,780	30.6

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

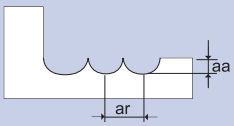
High Speed Light Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy		Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels		Hardened Steels Pre-hardened Steels, P20, H13, S7, A2			
Cutting Speed	659 SFM		713 SFM		651 SFM		561 SFM	
Depth of Cut	a_a=0.02D a_r=0.05D		Dia / aa / ar D≤3/16 / 0.02D / 0.05D 1/4≤D≤3/8 / 0.05D / 0.1D D=1/2 / 0.4D / 0.2D 				a_a=0.02D a_r=0.05D	
Mill Diameter	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/32	50,000	70.0	50,000	70.0	50,000	70.0	50,000	60.0
1/16	40,278	104.7	43,579	113.3	39,789	103.5	34,288	82.3
3/32	26,852	102.0	29,052	110.4	26,526	100.8	22,859	82.3
1/8	20,139	96.7	21,789	104.6	19,895	95.5	17,144	75.4
3/16	13,426	99.4	14,526	107.5	13,263	98.1	11,429	80.0
1/4	10,070	92.6	10,895	100.2	9,947	91.5	8,572	77.1
5/16	8,056	96.7	8,716	104.6	7,958	95.5	6,858	78.2
3/8	6,713	94.0	7,263	101.7	6,632	92.8	5,715	68.6
1/2	5,035	87.6	5,447	94.8	4,974	86.5	4,286	73.7

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

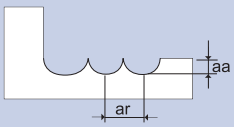
List 3710 - EXOCARB® WXL®: Ball End, Regular Length, 2 Flute

Standard Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy		Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels		Hardened Steels Pre-hardened Steels, P20, H13, S7, A2			
Cutting Speed	388 SFM		324 SFM		263 SFM		233 SFM	
Depth of Cut	a_a=0.05D a_r=0.1D				a_a=0.03D a_r=0.1D		a_a=0.02D a_r=0.05D	
Mill Diameter	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.1	50,000	10.0	50,000	10.0	50,000	10.0	50,000	10.0
0.2	50,000	20.0	50,000	20.0	50,000	20.0	50,000	20.0
0.4	50,000	40.0	50,000	40.0	50,000	40.0	50,000	30.0
0.6	50,000	60.0	50,000	60.0	42,531	51.0	37,679	31.7
0.8	47,059	75.3	39,296	62.9	31,898	51.0	28,259	31.1
1.0	37,647	67.8	31,437	56.6	25,518	45.9	22,608	31.7
2.0	18,823	60.2	15,719	50.3	12,759	40.8	11,304	29.4
3.0	12,549	67.8	10,479	56.6	8,506	45.9	7,536	33.2
4.0	9,412	73.4	7,859	61.3	6,380	49.8	5,652	40.7
6.0	6,274	67.8	5,240	56.6	4,253	45.9	3,768	33.2
8.0	4,706	63.1	3,930	52.7	3,190	42.7	2,826	31.7
10.0	3,765	57.2	3,144	47.8	2,552	38.8	2,261	28.0
12.0	3,137	56.5	2,620	47.2	2,127	38.3	1,884	29.4
16.0	2,353	42.4	1,965	35.4	1,595	28.7	1,413	22.0
20.0	1,882	33.9	1,572	28.3	1,276	23.0	1,130	17.6

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

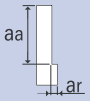
High Speed Light Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy		Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels		Hardened Steels Pre-hardened Steels, P20, H13, S7, A2			
Cutting Speed	659 SFM		713 SFM		651 SFM		561 SFM	
Depth of Cut	a_a=0.02D a_r=0.05D				a_a=0.02D a_r=0.05D		a_a=0.01D a_r=0.05D	
Mill Diameter	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1.0	50,000	90.0	50,000	90.0	50,000	90.0	50,000	70.0
2.0	31,971	102.3	34,590	110.7	31,583	101.1	27,216	70.8
3.0	21,314	115.1	23,060	124.5	21,055	113.7	18,144	79.8
4.0	15,985	124.7	17,295	134.9	15,791	123.2	13,608	98.0
6.0	10,657	115.1	11,530	124.5	10,528	113.7	9,072	79.8
8.0	7,993	107.1	8,648	115.9	7,896	105.8	6,804	76.2
10.0	6,394	97.2	6,918	105.2	6,317	96.0	5,443	67.5
12.0	5,328	95.9	5,765	103.8	5,264	94.7	4,536	70.8
16.0	3,996	71.9	4,324	77.8	3,948	71.1	3,402	53.1
20.0	3,197	57.5	3,459	62.3	3,158	56.8	2,722	42.5

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

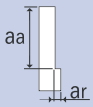
List 3670 - EXOCARB® WXL®: 4 Flute, Regular Length, Corner Radius

Side Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Alloy Steels Tool Steels		Hardened Steels Pre-hardened Steels		Stainless Steels Pre-hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	396 SFM		294 SFM		258 SFM		192 SFM		156 SFM		96 SFM	
Depth of Cut	a_a=1.2xD a_r=0.2xD 						a_a=1D a_r=0.1D		a_a=1D a_r=0.05D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	24,000	38.4	18,000	28.8	15,600	25.0	12,000	19.2	9,600	11.5	6,000	4.8
5/64	19,200	38.4	14,400	28.8	12,480	25.0	9,600	19.2	7,680	12.3	4,800	5.8
3/32	16,080	38.6	12,000	28.8	10,380	24.9	7,980	19.2	6,420	12.8	4,020	4.8
7/64	13,740	38.5	10,320	28.9	8,940	25.0	6,900	19.3	5,520	13.2	3,480	5.6
1/8	12,000	43.2	9,000	28.8	7,800	25.0	6,000	19.2	4,800	13.4	3,000	6.0
5/32	9,600	46.1	7,200	31.7	6,240	27.5	4,800	21.1	3,840	15.4	2,400	7.7
3/16	8,040	51.5	6,000	36.0	5,220	31.3	4,020	22.5	3,180	17.8	1,980	9.5
7/32	6,900	55.2	5,160	37.2	4,440	30.2	3,420	23.3	2,760	16.6	1,740	9.0
1/4	6,000	55.2	4,500	39.6	3,900	31.2	3,000	24.0	2,400	16.3	1,500	9.0
5/16	4,800	57.6	3,600	38.9	3,120	32.4	2,400	24.0	1,920	16.9	1,200	9.6
3/8	4,020	56.3	3,000	38.4	2,640	30.6	1,980	22.2	1,620	16.2	1,020	9.4
7/16	3,480	55.7	2,580	38.2	2,280	31.0	1,740	22.3	1,380	16.0	840	8.4
1/2	3,000	54.0	2,280	35.6	1,980	27.7	1,500	19.2	1,200	13.9	750	8.1

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

High Speed Light Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC	
Work Material	Carbon Steels 1045, 1055		Alloy Steels 4140, 4340		Hardened Steels Pre-hardened Steels D2, H13, 17-4PH		Tool Steels, Hardened Steels Pre-hardened Steels, D2, H13		Hardened Steels Heat Resistant Steels	
Cutting Speed	1,560 SFM		1,380 SFM		960 SFM		600 SFM		130 SFM	
Depth of Cut										

Dia	aa	ar
D<1/8	1.5D	0.01D
1/8≤D	1.5D	0.02D
5/8<D	1.5D	0.05D

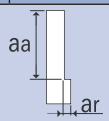
Dia	aa	ar
D≤5/16	1.0D	0.01D
5/16<D	1.0D	0.02D

Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/4	24,000	220.8	21,000	184.8	14,760	118.1	9,000	72.0	4,800	32.6
9/32	20,400	212.2	18,000	172.8	13,200	121.4	7,920	69.7	4,200	33.6
5/16	18,840	226.1	16,320	176.3	12,000	124.8	7,200	72.0	3,840	33.8
3/8	15,600	218.4	13,800	176.6	9,960	115.5	6,000	67.2	3,120	31.2
7/16	13,200	211.2	12,000	177.6	8,640	117.5	5,160	66.0	2,760	32.0
1/2	11,880	213.8	10,440	162.9	7,440	104.2	4,440	56.8	2,400	27.8

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

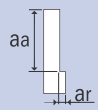
List 3604 - EXOCARB® WXL®: Regular Length, 4 Flute

Standard Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Aluminum Copper Alloy		Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels		Hardened Steels Pre-hardened Steels, P20, H13, S7, A2			
Cutting Speed	974 SFM		250 SFM		172 SFM		153 SFM	
Depth of Cut	Dia / aa / ar D<7/64 / 1.5D / 0.05D 7/64≤D / 1.5D / 0.1D 						aa=1.0D ar=0.02D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	50,000	80.0	14,000	22.4	8,200	13.1	7,400	11.8
5/64	47,500	95.0	12,000	24.0	7,000	14.0	6,350	12.7
3/32	42,750	102.6	10,800	25.9	6,600	15.8	5,950	14.3
7/64	35,000	98.0	8,900	24.9	5,750	16.1	5,150	14.4
1/8	28,000	100.8	7,000	25.2	4,800	15.4	4,200	13.4
5/32	25,000	130.0	6,050	31.5	4,250	20.4	3,700	16.3
3/16	21,500	137.6	5,500	35.2	3,900	23.4	3,425	19.2
7/32	17,500	140.0	4,100	32.8	2,950	20.1	2,650	18.0
1/4	14,000	128.8	3,800	35.0	2,600	20.8	2,300	18.4
9/32	12,500	130.0	3,400	35.4	2,400	23.0	2,100	18.5
5/16	12,000	144.0	3,050	36.6	2,200	25.5	1,950	19.5
3/8	10,100	141.4	2,750	38.5	1,975	22.9	1,750	19.6
7/16	8,700	139.2	2,250	36.0	1,600	21.8	1,425	18.2
1/2	7,400	133.2	1,900	34.2	1,350	18.9	1,200	15.8
5/8	6,000	110.4	1,500	27.6	1,100	16.3	995	13.9
3/4	5,000	94.0	1,275	24.0	950	16.3	850	13.9

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

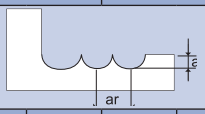
High Speed Light Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Aluminum Copper Alloy		Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels		Hardened Steels Pre-hardened Steels, P20, H13, S7, A2			
Cutting Speed	1,627 SFM		1,231 SFM		803 SFM		482 SFM	
Depth of Cut	Dia / aa / ar D<5/16 / 1.5D / 0.01D 5/16≤D / 1.5D / 0.02D 						Dia / aa / ar D<5/16 / 1.0D / 0.01D 5/16≤D / 1.0D / 0.02D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
7/32	26,000	208.0	20,000	160.0	13,000	88.4	7,950	54.1
1/4	22,500	207.0	19,000	174.8	11,500	92.0	7,000	56.0
9/32	24,000	249.6	17,500	182.0	10,500	100.8	6,250	55.0
5/16	19,500	234.0	14,500	174.0	9,900	114.8	5,950	59.5
3/8	17,500	245.0	13,250	185.5	8,900	103.2	5,350	59.9
7/16	14,250	228.0	10,950	175.2	7,275	98.9	4,350	55.7
1/2	12,000	216.0	9,200	165.6	6,125	85.8	3,675	48.5
5/8	9,700	178.5	7,450	137.1	4,950	73.3	2,950	41.3
3/4	9,150	172.0	6,275	118.0	4,175	71.8	2,500	41.0

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

List 3690 : Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing
List 3790 : Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing

Standard Milling

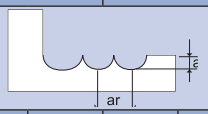
Hardness	–				Up to 32 HRC				33 to 41 HRC				42 to 50 HRC			
Work Material	Aluminum Copper Alloy				Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels				Hardened Steels Pre-hardened Steels, P20, H13, S7, A2							
Cutting Speed	388 SFM				324 SFM				263 SFM				233 SFM			
Depth of Cut																
Mill Dia.	L1	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)
0.1	0.30	32,000	5.9	0.0002	0.0002	32,000	3.0	0.0002	0.0002	32,000	2.0	0.00020	0.00020	32,000	1.4	0.0002	0.0002
	0.50	32,000	4.7	0.0002	0.0002	32,000	2.4	0.0002	0.0002	32,000	1.6	0.00020	0.00020	32,000	1.0	0.0002	0.0002
0.2	0.30	32,000	11.8	0.0008	0.0008	32,000	7.9	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	7.9	0.0002	0.0002
	0.50	32,000	11.8	0.0008	0.0008	32,000	7.9	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	7.9	0.0002	0.0002
	0.75	32,000	11.8	0.0008	0.0008	32,000	7.9	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	3.9	0.0002	0.0002
	1.00	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.00039	0.00039	32,000	3.1	0.0002	0.0002
	1.25	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.00039	0.00039	32,000	3.1	0.0002	0.0002
	1.50	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.00039	0.00039	32,000	3.1	0.0002	0.0002
	1.75	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.00039	0.00039	32,000	3.1	0.0002	0.0002
	2.00	32,000	5.9	0.0004	0.0004	32,000	3.9	0.0000	0.0000	32,000	3.9	0.00002	0.00002	32,000	3.1	0.0002	0.0002
	2.50	32,000	3.0	0.0004	0.0004	32,000	2.0	0.0000	0.0000	32,000	2.0	0.00002	0.00002	32,000	1.6	0.0001	0.0002
	3.00	32,000	3.0	0.0004	0.0004	32,000	2.0	0.0000	0.0000	32,000	2.0	0.00002	0.00002	32,000	1.6	0.0001	0.0002
0.3	0.50	32,000	23.6	0.0008	0.0012	32,000	15.7	0.0004	0.0006	32,000	11.8	0.00039	0.00059	32,000	11.8	0.0002	0.0002
	0.60	32,000	23.6	0.0008	0.0012	32,000	15.7	0.0004	0.0006	32,000	11.8	0.00039	0.00059	32,000	11.8	0.0002	0.0002
	0.75	32,000	23.6	0.0008	0.0012	32,000	15.7	0.0004	0.0006	32,000	11.8	0.00039	0.00059	32,000	11.8	0.0002	0.0002
	1.00	32,000	17.7	0.0008	0.0012	32,000	11.8	0.0004	0.0006	32,000	7.9	0.00039	0.00059	32,000	7.9	0.0002	0.0002
	1.25	32,000	17.7	0.0008	0.0012	32,000	11.8	0.0004	0.0006	32,000	7.9	0.00039	0.00059	32,000	7.9	0.0002	0.0002
	1.50	32,000	17.7	0.0008	0.0012	32,000	11.8	0.0004	0.0006	32,000	7.9	0.00039	0.00059	32,000	7.9	0.0002	0.0002
	1.75	32,000	17.7	0.0008	0.0012	32,000	11.8	0.0004	0.0006	32,000	7.9	0.00039	0.00059	32,000	7.9	0.0002	0.0002
	2.00	32,000	17.7	0.0008	0.0012	32,000	11.8	0.0004	0.0006	32,000	7.9	0.00039	0.00059	32,000	7.9	0.0002	0.0002
	2.25	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	7.9	0.0004	0.0004
	2.50	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	7.9	0.0004	0.0004
	2.75	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	7.9	0.0004	0.0004
	3.00	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0004	32,000	7.9	0.00039	0.00039	32,000	7.9	0.0002	0.0004
	3.50	32,000	10.6	0.0008	0.0008	32,000	7.1	0.0004	0.0004	32,000	4.7	0.00039	0.00039	32,000	4.7	0.0002	0.0004
	4.00	32,000	10.6	0.0008	0.0008	32,000	7.1	0.0004	0.0004	32,000	4.7	0.00039	0.00039	32,000	4.7	0.0002	0.0002
	4.50	32,000	10.6	0.0008	0.0008	32,000	7.1	0.0004	0.0004	32,000	4.7	0.00039	0.00039	32,000	4.7	0.0001	0.0002
	5.00	32,000	5.9	0.0004	0.0008	32,000	3.9	0.0000	0.0004	32,000	2.8	0.00002	0.00039	32,000	2.8	0.0001	0.0002
0.4	0.50	32,000	29.5	0.0010	0.0020	32,000	19.7	0.0006	0.0010	32,000	15.7	0.00059	0.00079	32,000	15.7	0.0004	0.0004
	0.75	32,000	29.5	0.0010	0.0020	32,000	19.7	0.0006	0.0010	32,000	15.7	0.00059	0.00079	32,000	15.7	0.0004	0.0004
	1.00	32,000	23.6	0.0010	0.0020	32,000	15.7	0.0006	0.0010	32,000	11.8	0.00059	0.00079	32,000	11.8	0.0004	0.0004
	1.50	32,000	23.6	0.0010	0.0020	32,000	15.7	0.0006	0.0010	32,000	11.8	0.00059	0.00079	32,000	11.8	0.0004	0.0004
	2.00	27,000	17.7	0.0010	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.00059	0.00079	27,000	7.9	0.0004	0.0004
	2.50	27,000	17.7	0.0010	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.00059	0.00079	27,000	7.9	0.0004	0.0004
	3.00	27,000	17.7	0.0010	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.00059	0.00079	27,000	7.9	0.0004	0.0004
	3.50	27,000	17.7	0.0010	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.00059	0.00079	27,000	7.9	0.0004	0.0004
	4.00	27,000	17.7	0.0004	0.0012	27,000	11.8	0.0000	0.0006	27,000	7.9	0.00002	0.00047	27,000	7.9	0.0002	0.0004
	4.50	24,000	11.8	0.0004	0.0012	27,000	7.9	0.0000	0.0006	27,000	3.9	0.00002	0.00047	27,000	3.9	0.0002	0.0004
	5.00	24,000	11.8	0.0004	0.0012	27,000	7.9	0.0000	0.0006	27,000	3.9	0.00002	0.00047	27,000	3.9	0.0002	0.0004
	5.50	21,000	11.8	0.0004	0.0008	27,000	7.9	0.0000	0.0004	27,000	3.9	0.00002	0.00031	27,000	3.9	0.0002	0.0002
	6.00	21,000	5.9	0.0004	0.0006	27,000	3.9	0.0000	0.0003	27,000	3.1	0.00002	0.00024	27,000	3.1	0.0001	0.0002
0.5	1.00	32,000	29.5	0.0016	0.0020	32,000	19.7	0.0008	0.0010	32,000	15.7	0.00079	0.00079	32,000	15.7	0.0004	0.0004
	1.50	32,000	29.5	0.0016	0.0020	32,000	19.7	0.0008	0.0010	32,000	15.7	0.00079	0.00079	32,000	15.7	0.0004	0.0004
	2.00	32,000	23.6	0.0016	0.0020	32,000	15.7	0.0008	0.0010	32,000	11.8	0.00079	0.00079	32,000	11.8	0.0004	0.0004
	2.50	27,000	17.7	0.0016	0.0020	27,000	11.8	0.0008	0.0010	27,000	7.9	0.00079	0.00079	27,000	7.9	0.0004	0.0004
	3.00	27,000	17.7	0.0016	0.0020	27,000	11.8	0.0008	0.0010	27,000	7.9	0.00079	0.00079	27,000	7.9	0.0004	0.0004
	3.50	27,000	17.7	0.0016	0.0020	27,000	11.8	0.0008	0.0010	27,000	7.9	0.00079	0.00079	27,000	7.9	0.0004	0.0004
	4.00	27,000	17.7	0.0016	0.0020	27,000	11.8	0.0008	0.0010	27,000	7.9	0.00079	0.00079	27,000	7.9	0.0004	0.0004
	4.50	21,000	11.8	0.0016	0.0020	20,000	7.9	0.0008	0.0010	20,000	7.9	0.00079	0.00079	20,000	7.9	0.0004	0.0004
	5.00	21,000	11.8	0.0016	0.0020	20,000	7.9	0.0008	0.0010	20,000	5.9	0.00079	0.00079	20,000	5.9	0.0004	0.0004
	5.50	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0004	0.0006	20,000	5.9	0.00039	0.00039	20,000	5.9	0.0004	0.0004
	6.00	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0004	0.0006	20,000	5.9	0.00039	0.00039	20,000	5.9	0.0004	0.0004
	7.00	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0004	0.0006	20,000	5.9	0.00039	0.00039	20,000	5.9	0.0004	0.0004
0.5	8.00	21,000	11.8	0.0008	0.0012	15,000	7.9	0.0004	0.0006	15,000	5.9	0.00039	0.00039	15,000	5.9	0.0002	0.0004
	9.00	18,000	5.9	0.0008	0.0008	15,000	3.9	0.0004	0.0004	15,000	3.1	0.00002	0.00039	15,000	3.1	0.0002	0.0002
	10.00	18,000	5.9	0.0004	0.0004	15,000	3.9	0.0000	0.0000	15,000	3.1	0.00002	0.00002	15,000	3.1	0.0001	0.0002

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3690: Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing (Continued)
List 3790: Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing (Continued)

Standard Milling

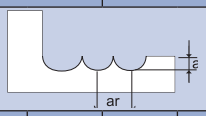
Hardness	–				Up to 32 HRC				33 to 41 HRC				42 to 50 HRC			
Work Material	Aluminum Copper Alloy				Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels				Hardened Steels Pre-hardened Steels, P20, H13, S7, A2							
Cutting Speed	388 SFM				324 SFM				263 SFM				233 SFM			
Depth of Cut																
Mill Dia.	L1	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)
0.6	1.00	32,000	35.4	0.0018	0.0047	32,000	23.6	0.0012	0.0024	32,000	19.7	0.00120	0.00200	32,000	19.7	0.0012	0.0012
	1.50	32,000	35.4	0.0018	0.0047	32,000	23.6	0.0012	0.0024	32,000	19.7	0.00120	0.00200	32,000	19.7	0.0012	0.0012
	2.00	32,000	26.6	0.0018	0.0047	32,000	17.7	0.0012	0.0024	32,000	11.8	0.00120	0.00200	32,000	11.8	0.0012	0.0012
	2.50	30,000	26.6	0.0018	0.0047	32,000	17.7	0.0012	0.0024	32,000	11.8	0.00120	0.00200	32,000	11.8	0.0012	0.0012
	3.00	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.00120	0.00200	24,000	7.9	0.0012	0.0012
	3.50	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.00120	0.00160	24,000	7.9	0.0012	0.0012
	4.00	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.00120	0.00160	24,000	7.9	0.0012	0.0012
	4.50	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.00120	0.00160	24,000	7.9	0.0012	0.0012
	5.00	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.00120	0.00160	24,000	7.9	0.0008	0.0008
	5.50	25,000	11.8	0.0018	0.0047	20,000	7.9	0.0012	0.0024	20,000	7.9	0.00120	0.00160	20,000	7.9	0.0008	0.0008
	6.00	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.00120	0.00160	20,000	5.9	0.0008	0.0008
	6.50	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.00120	0.00160	20,000	5.9	0.0008	0.0008
	7.00	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.00120	0.00160	20,000	5.9	0.0008	0.0008
	7.50	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.00120	0.00160	20,000	5.9	0.0008	0.0008
	8.00	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.00120	0.00160	20,000	5.9	0.0008	0.0008
	8.50	22,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.00079	0.00160	20,000	5.9	0.0004	0.0004
	9.00	22,000	8.9	0.0012	0.0039	20,000	5.9	0.0008	0.0020	20,000	5.9	0.00079	0.00160	20,000	5.9	0.0004	0.0004
	9.50	22,000	8.9	0.0012	0.0039	17,000	5.9	0.0008	0.0020	17,000	5.9	0.00079	0.00160	17,000	5.9	0.0004	0.0004
	10.00	20,000	5.9	0.0010	0.0020	17,000	3.9	0.0006	0.0010	17,000	3.9	0.00059	0.00079	17,000	3.9	0.0002	0.0002
	11.00	20,000	5.9	0.0010	0.0020	17,000	3.9	0.0006	0.0010	17,000	3.9	0.00039	0.00079	17,000	3.9	0.0002	0.0002
	12.00	20,000	4.7	0.0010	0.0020	17,000	3.1	0.0006	0.0010	17,000	3.1	0.00039	0.00047	17,000	3.1	0.0002	0.0002
0.8	2.00	27,000	26.6	0.0024	0.0063	23,000	17.7	0.0016	0.0031	21,000	11.8	0.00160	0.00240	21,000	11.8	0.0016	0.0016
	3.00	27,000	26.6	0.0024	0.0063	23,000	17.7	0.0016	0.0031	21,000	11.8	0.00160	0.00240	21,000	11.8	0.0016	0.0016
	4.00	27,000	26.6	0.0024	0.0063	23,000	17.7	0.0016	0.0031	21,000	11.8	0.00160	0.00240	21,000	11.8	0.0016	0.0016
	5.00	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.00160	0.00200	19,000	7.9	0.0008	0.0010
	6.00	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.00160	0.00200	19,000	7.9	0.0008	0.0010
	7.00	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.00160	0.00200	19,000	7.9	0.0008	0.0010
	8.00	22,000	8.9	0.0024	0.0047	19,000	5.9	0.0016	0.0024	17,000	5.9	0.00160	0.00200	17,000	5.9	0.0008	0.0010
	9.00	22,000	8.9	0.0024	0.0047	19,000	5.9	0.0016	0.0024	17,000	5.9	0.00160	0.00200	17,000	5.9	0.0008	0.0010
	10.00	22,000	8.9	0.0024	0.0047	19,000	5.9	0.0016	0.0024	17,000	5.9	0.00160	0.00200	17,000	5.9	0.0008	0.0010
	12.00	22,000	8.9	0.0024	0.0047	19,000	5.9	0.0016	0.0024	17,000	5.9	0.00160	0.00200	17,000	5.9	0.0008	0.0010
1.0	2.50	28,000	35.4	0.0030	0.0079	25,000	23.6	0.0020	0.0039	21,000	15.7	0.00200	0.00310	21,000	15.7	0.0020	0.0020
	3.00	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.00200	0.00310	21,000	11.8	0.0020	0.0020
	4.00	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.00200	0.00310	21,000	11.8	0.0020	0.0020
	5.00	21,000	17.7	0.0030	0.0079	19,000	11.8	0.0020	0.0039	16,000	7.9	0.00200	0.00310	16,000	7.9	0.0020	0.0020
	6.00	21,000	17.7	0.0030	0.0079	19,000	11.8	0.0020	0.0039	16,000	7.9	0.00200	0.00310	16,000	7.9	0.0020	0.0020
	7.00	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0030	16,000	7.9	0.00200	0.00300	16,000	7.9	0.0012	0.0012
	8.00	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0030	16,000	7.9	0.00200	0.00300	16,000	7.9	0.0012	0.0012
	9.00	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0030	16,000	7.9	0.00200	0.00300	16,000	7.9	0.0012	0.0012
	10.00	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.00120	0.00180	14,000	5.9	0.0004	0.0006
	12.00	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.00120	0.00180	14,000	5.9	0.0004	0.0006
	14.00	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.00120	0.00180	14,000	5.9	0.0004	0.0006
	16.00	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.00120	0.00180	10,000	5.9	0.0004	0.0006
	18.00	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.00120	0.00180	10,000	5.9	0.0004	0.0006
	20.00	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.00120	0.00180	10,000	5.9	0.0004	0.0006
	22.00	16,000	8.9	0.0020	0.0020	13,000	5.9	0.0008	0.0010	10,000	3.9	0.00079	0.00079	10,000	3.9	0.0002	0.0002
1.2	4.00	20,000	29.5	0.0035	0.0093	17,000	19.7	0.0024	0.0047	14,000	11.8	0.00240	0.00390	14,000	11.8	0.0024	0.0024
	6.00	20,000	17.7	0.0035	0.0093	17,000	11.8	0.0024	0.0047	14,000	7.9	0.00240	0.00390	14,000	7.9	0.0024	0.0024
	8.00	20,000	17.7	0.0035	0.0093	17,000	11.8	0.0024	0.0047	14,000	7.9	0.00240	0.00390	14,000	7.9	0.0024	0.0024
	10.00	20,000	17.7	0.0035	0.0071	17,000	11.8	0.0024	0.0035	14,000	7.9	0.00240	0.00280	14,000	7.9	0.0012	0.0012
1.2	12.00	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.00240	0.00280	11,000	5.9	0.0012	0.0012
	14.00	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.00240	0.00280	11,000	5.9	0.0004	0.0012
	16.00	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.00240	0.00280	11,000	5.9	0.0004	0.0012
	18.00	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.00240	0.00280	11,000	5.9	0.0004	0.0012
	20.00	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.00240	0.00280	11,000	5.9	0.0004	0.0012
	24.00	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.00240	0.00280	11,000	5.9	0.0004	0.0012

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3690: Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing (Continued)
List 3790: Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing (Continued)

Standard Milling

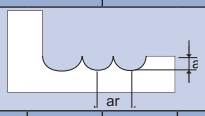
Hardness		–				Up to 32 HRC				33 to 41 HRC				42 to 50 HRC			
Work Material		Aluminum Copper Alloy				Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels				Hardened Steels Pre-hardened Steels, P20, H13, S7, A2							
Cutting Speed		388 SFM				324 SFM				263 SFM				233 SFM			
Depth of Cut																	
Mill Dia.	L1	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)
1.4	8.00	18,000	17.7	0.0039	0.0110	15,500	11.8	0.0028	0.0055	12,000	9.8	0.00280	0.00390	12,000	9.8	0.0028	0.0028
	12.00	18,000	17.7	0.0039	0.0079	15,500	11.8	0.0028	0.0039	12,000	9.8	0.00280	0.00310	12,000	9.8	0.0028	0.0028
	16.00	13,000	11.8	0.0035	0.0071	12,000	7.9	0.0024	0.0035	9,000	5.9	0.00180	0.00280	9,000	5.9	0.0004	0.0012
1.5	3.00	20,000	35.4	0.0047	0.0120	15,000	23.6	0.0031	0.0059	12,000	19.7	0.00310	0.00470	12,000	11.8	0.0031	0.0039
	4.00	20,000	35.4	0.0047	0.0120	15,000	23.6	0.0031	0.0059	12,000	19.7	0.00310	0.00470	12,000	11.8	0.0031	0.0039
	6.00	18,000	29.5	0.0047	0.0120	15,000	19.7	0.0031	0.0059	12,000	13.8	0.00310	0.00470	12,000	11.8	0.0031	0.0039
	8.00	17,000	17.7	0.0047	0.0120	15,000	11.8	0.0031	0.0059	12,000	9.8	0.00310	0.00470	12,000	9.8	0.0031	0.0039
	10.00	17,000	17.7	0.0047	0.0120	15,000	11.8	0.0031	0.0059	12,000	9.8	0.00310	0.00470	12,000	9.8	0.0031	0.0039
	12.00	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.00310	0.00350	12,000	9.8	0.0020	0.0024
	14.00	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.00310	0.00350	12,000	9.8	0.0020	0.0024
	16.00	13,000	11.8	0.0035	0.0071	12,000	7.9	0.0024	0.0039	9,500	5.9	0.00240	0.00280	9,500	5.9	0.0004	0.0012
	18.00	13,000	11.8	0.0035	0.0071	12,000	7.9	0.0024	0.0039	9,500	5.9	0.00240	0.00280	9,500	5.9	0.0004	0.0012
	20.00	13,000	11.8	0.0035	0.0071	12,000	7.9	0.0024	0.0039	9,500	5.9	0.00240	0.00280	9,500	5.9	0.0004	0.0012
	22.00	13,000	11.8	0.0035	0.0071	12,000	7.9	0.0024	0.0039	9,500	5.9	0.00240	0.00280	9,500	5.9	0.0004	0.0012
	30.00	13,000	11.8	0.0035	0.0071	12,000	7.9	0.0024	0.0039	9,500	5.9	0.00240	0.00280	9,500	5.9	0.0004	0.0012
1.6	4.00	20,000	35.4	0.0047	0.0130	14,000	23.6	0.0031	0.0063	11,000	19.7	0.00310	0.00510	11,000	13.8	0.0031	0.0004
	8.00	16,500	17.7	0.0047	0.0130	14,000	11.8	0.0031	0.0063	11,000	9.8	0.00310	0.00510	11,000	9.8	0.0031	0.0004
	12.00	16,500	17.7	0.0047	0.0094	14,000	11.8	0.0031	0.0047	11,000	9.8	0.00310	0.00310	11,000	9.8	0.0020	0.0020
	16.00	11,500	11.8	0.0047	0.0094	11,000	7.9	0.0031	0.0047	9,000	5.9	0.00310	0.00310	9,000	5.9	0.0020	0.0020
	20.00	11,500	11.8	0.0035	0.0079	11,000	7.9	0.0024	0.0047	9,000	5.9	0.00240	0.00300	9,000	5.9	0.0006	0.0012
1.8	8.00	16,500	23.6	0.0051	0.0140	14,000	15.7	0.0035	0.0071	11,000	11.8	0.00350	0.00630	11,000	11.8	0.0035	0.0047
	12.00	16,500	23.6	0.0051	0.0140	14,000	15.7	0.0035	0.0071	11,000	11.8	0.00350	0.00630	11,000	11.8	0.0035	0.0047
	16.00	16,500	23.6	0.0051	0.0055	14,000	15.7	0.0035	0.0055	11,000	11.8	0.00350	0.00470	11,000	11.8	0.0020	0.0024
	20.00	11,000	11.8	0.0039	0.0087	11,000	7.9	0.0024	0.0051	8,000	7.9	0.00240	0.00310	8,000	7.9	0.0008	0.0012
2.0	3.00	16,500	53.1	0.0059	0.0220	16,500	35.4	0.0039	0.0110	13,500	31.5	0.00390	0.01100	13,500	27.6	0.0039	0.0079
	4.00	16,500	41.3	0.0059	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.00390	0.01100	13,500	19.7	0.0039	0.0079
	6.00	16,500	41.3	0.0059	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.00390	0.01100	13,500	19.7	0.0039	0.0079
	8.00	16,500	41.3	0.0059	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.00390	0.01100	13,500	19.7	0.0039	0.0079
	10.00	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.00390	0.01100	10,000	11.8	0.0039	0.0079
	12.00	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.00390	0.01100	10,000	11.8	0.0039	0.0079
	14.00	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.00390	0.01100	10,000	11.8	0.0039	0.0079
	16.00	14,000	29.5	0.0059	0.0170	13,000	19.7	0.0039	0.0083	10,000	11.8	0.00390	0.00830	10,000	11.8	0.0024	0.0039
	18.00	14,000	29.5	0.0059	0.0170	13,000	19.7	0.0039	0.0083	10,000	11.8	0.00390	0.00830	10,000	11.8	0.0024	0.0039
	20.00	11,000	14.8	0.0059	0.0170	10,000	9.8	0.0039	0.0083	8,000	7.9	0.00390	0.00830	8,000	7.9	0.0024	0.0039
	22.00	11,000	14.8	0.0059	0.0170	10,000	9.8	0.0039	0.0083	8,000	7.9	0.00390	0.00830	8,000	7.9	0.0024	0.0039
	25.00	11,000	14.8	0.0059	0.0170	10,000	9.8	0.0039	0.0083	8,000	7.9	0.00390	0.00830	8,000	7.9	0.0024	0.0039
	30.00	11,000	14.8	0.0059	0.0170	10,000	9.8	0.0039	0.0083	8,000	7.9	0.00390	0.00830	8,000	7.9	0.0024	0.0039
	35.00	10,000	14.8	0.0059	0.0170	10,000	9.8	0.0039	0.0083	8,000	7.9	0.00390	0.00830	8,000	7.9	0.0024	0.0039
	40.00	10,000	11.8	0.0059	0.0170	10,000	7.9	0.0039	0.0083	8,000	6.3	0.00390	0.00830	8,000	6.3	0.0024	0.0039
2.5	6.00	16,000	41.3	0.0071	0.0280	12,000	27.6	0.0047	0.0140	10,000	23.6	0.00470	0.01200	10,000	23.6	0.0039	0.0098
	10.00	14,000	41.3	0.0071	0.0280	12,000	27.6	0.0047	0.0140	10,000	23.6	0.00470	0.01200	10,000	23.6	0.0039	0.0098
	15.00	14,000	23.6	0.0071	0.0280	13,000	15.7	0.0047	0.0140	8,500	11.8	0.00470	0.01200	8,500	11.8	0.0039	0.0098
	20.00	12,000	23.6	0.0071	0.0220	13,000	15.7	0.0047	0.0110	8,500	11.8	0.00470	0.00790	8,500	11.8	0.0031	0.0059
	25.00	12,000	17.7	0.0071	0.0220	8,000	11.8	0.0047	0.0110	6,500	9.8	0.00470	0.00790	6,500	9.8	0.0031	0.0059
2.5	30.00	12,000	14.8	0.0071	0.0220	8,000	9.8	0.0047	0.0110	6,500	7.9	0.00470	0.00790	6,500	7.9	0.0031	0.0059
	35.00	12,000	14.8	0.0071	0.0220	8,000	9.8	0.0047	0.0110	6,500	7.9	0.00470	0.00790	6,500	7.9	0.0031	0.0059

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3690: Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing (Continued)
List 3790: Ball End, Regular Length, 2 Flute, Long Neck, Rib Processing (Continued)

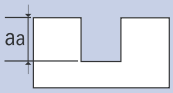
Standard Milling

Hardness		–				Up to 32 HRC				33 to 41 HRC				42 to 50 HRC			
Work Material		Aluminum Copper Alloy				Cast Iron, Carbon Steel, Alloy Steels, Stainless, Die Steels				Hardened Steels Pre-hardened Steels, P20, H13, S7, A2							
Cutting Speed		388 SFM				324 SFM				263 SFM				233 SFM			
Depth of Cut																	
Mill Dia.	L1	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)
3.0	6.00	15,000	47.2	0.0079	0.0330	9,500	31.5	0.0059	0.0170	7,500	23.6	0.00590	0.01700	7,500	23.6	0.0059	0.0120
	8.00	12,000	35.4	0.0079	0.0330	9,500	23.6	0.0059	0.0170	7,500	15.7	0.00590	0.01400	7,500	15.7	0.0059	0.0120
	10.00	12,000	35.4	0.0079	0.0330	9,500	23.6	0.0059	0.0170	7,500	15.7	0.00590	0.01400	7,500	15.7	0.0059	0.0120
	12.00	10,000	35.4	0.0079	0.0330	9,500	23.6	0.0059	0.0170	7,500	15.7	0.00590	0.01400	7,500	15.7	0.0059	0.0120
	14.00	10,000	35.4	0.0079	0.0330	9,500	23.6	0.0059	0.0170	7,500	15.7	0.00590	0.01400	7,500	15.7	0.0059	0.0120
	15.00	10,000	23.6	0.0079	0.0330	8,500	15.7	0.0059	0.0170	6,500	9.8	0.00590	0.01400	6,500	9.8	0.0059	0.0120
	16.00	10,000	17.7	0.0079	0.0330	8,500	11.8	0.0059	0.0170	6,500	9.8	0.00590	0.01400	6,500	9.8	0.0059	0.0120
	20.00	10,000	17.7	0.0079	0.0330	8,500	11.8	0.0059	0.0170	6,500	9.8	0.00590	0.01400	6,500	9.8	0.0059	0.0120
	25.00	10,000	17.7	0.0079	0.0330	8,500	11.8	0.0059	0.0170	6,500	9.8	0.00590	0.01200	6,500	9.8	0.0035	0.0059
	30.00	9,000	14.8	0.0079	0.0330	7,500	9.8	0.0059	0.0170	6,000	7.9	0.00590	0.01200	6,000	7.9	0.0035	0.0059
	35.00	9,000	14.8	0.0079	0.0330	7,500	9.8	0.0059	0.0170	6,000	7.9	0.00590	0.01200	6,000	7.9	0.0035	0.0059
	40.00	9,000	14.8	0.0079	0.0330	7,500	9.8	0.0059	0.0170	6,000	7.9	0.00590	0.01200	6,000	7.9	0.0035	0.0059
3.5	10.00	10,000	41.3	0.0160	0.0390	8,500	27.6	0.0059	0.0190	6,500	19.7	0.00590	0.01700	6,500	19.7	0.0059	0.0140
	15.00	10,000	35.4	0.0160	0.0390	8,500	23.6	0.0059	0.0190	6,500	15.7	0.00590	0.01700	6,500	15.7	0.0059	0.0140
	20.00	8,000	29.5	0.0160	0.0390	7,500	19.7	0.0059	0.0190	5,500	11.8	0.00590	0.01700	5,500	11.8	0.0059	0.0140
	25.00	8,000	23.6	0.0160	0.0390	7,500	15.7	0.0059	0.0190	5,500	10.8	0.00590	0.01700	5,500	10.8	0.0059	0.0140
	30.00	8,000	17.7	0.0160	0.0390	7,500	11.8	0.0059	0.0190	5,500	9.8	0.00590	0.01400	5,500	9.8	0.0039	0.0079
	35.00	8,000	14.8	0.0160	0.0390	6,000	9.8	0.0059	0.0190	5,000	7.9	0.00590	0.01400	5,000	7.9	0.0039	0.0079
	40.00	6,000	14.8	0.0120	0.0390	6,000	9.8	0.0059	0.0190	5,000	7.9	0.00590	0.01400	5,000	7.9	0.0039	0.0079
	45.00	6,000	14.8	0.0120	0.0390	6,000	9.8	0.0059	0.0190	5,000	7.9	0.00590	0.01400	5,000	7.9	0.0039	0.0079
4.0	8.00	11,000	47.2	0.0200	0.0500	7,500	31.5	0.0079	0.0250	6,000	27.6	0.00790	0.02400	6,000	27.6	0.0079	0.0180
	10.00	9,000	35.4	0.0200	0.0500	7,500	23.6	0.0079	0.0250	6,000	15.7	0.00790	0.02400	6,000	15.7	0.0079	0.0180
	12.00	9,000	35.4	0.0200	0.0500	7,500	23.6	0.0079	0.0250	6,000	15.7	0.00790	0.02400	6,000	15.7	0.0079	0.0180
	14.00	9,000	35.4	0.0200	0.0500	7,500	23.6	0.0079	0.0250	6,000	15.7	0.00790	0.02400	6,000	15.7	0.0079	0.0180
	15.00	9,000	35.4	0.0200	0.0500	7,500	23.6	0.0079	0.0250	6,000	15.7	0.00790	0.02400	6,000	15.7	0.0079	0.0180
	16.00	9,000	35.4	0.0200	0.0500	7,500	23.6	0.0079	0.0250	6,000	15.7	0.00790	0.02400	6,000	15.7	0.0079	0.0180
	20.00	7,000	23.6	0.0200	0.0500	6,000	15.7	0.0079	0.0250	5,000	9.8	0.00790	0.02400	5,000	9.8	0.0079	0.0180
	25.00	7,000	23.6	0.0200	0.0500	6,000	15.7	0.0079	0.0250	5,000	9.8	0.00790	0.02400	5,000	9.8	0.0079	0.0180
	30.00	7,000	23.6	0.0160	0.0500	6,000	15.7	0.0079	0.0250	5,000	9.8	0.00790	0.02200	5,000	9.8	0.0047	0.0079
	35.00	7,000	23.6	0.0160	0.0500	6,000	15.7	0.0079	0.0250	5,000	9.8	0.00790	0.02200	5,000	9.8	0.0047	0.0079
	40.00	5,000	14.8	0.0140	0.0500	5,000	9.8	0.0079	0.0250	4,000	7.9	0.00790	0.02200	4,000	7.9	0.0047	0.0079
	45.00	5,000	14.8	0.0140	0.0500	5,000	9.8	0.0079	0.0250	4,000	7.9	0.00790	0.02200	4,000	7.9	0.0047	0.0079
	50.00	5,000	14.8	0.0140	0.0500	5,000	9.8	0.0079	0.0250	4,000	7.9	0.00790	0.02200	4,000	7.9	0.0047	0.0079
5.0	10.00	9,000	53.1	0.0240	0.0710	6,500	35.4	0.0098	0.0350	5,000	29.5	0.00980	0.02800	5,000	29.5	0.0098	0.0200
	15.00	9,000	53.1	0.0240	0.0710	6,500	35.4	0.0098	0.0350	5,000	29.5	0.00980	0.02800	5,000	29.5	0.0098	0.0200
	20.00	7,000	29.5	0.0240	0.0710	6,500	19.7	0.0098	0.0350	5,000	15.7	0.00980	0.02800	5,000	15.7	0.0098	0.0200
	25.00	6,000	29.5	0.0240	0.0710	5,000	19.7	0.0098	0.0350	4,000	9.8	0.00980	0.02800	4,000	9.8	0.0098	0.0200
	30.00	6,000	29.5	0.0240	0.0710	5,000	19.7	0.0098	0.0350	4,000	9.8	0.00980	0.02800	4,000	9.8	0.0098	0.0200
	35.00	6,000	29.5	0.0240	0.0710	5,000	19.7	0.0098	0.0350	4,000	9.8	0.00980	0.02800	4,000	9.8	0.0098	0.0200
	40.00	5,000	23.6	0.0160	0.0710	4,000	15.7	0.0098	0.0350	4,000	7.9	0.00980	0.02400	4,000	7.9	0.0079	0.0098
	45.00	5,000	23.6	0.0160	0.0710	4,000	15.7	0.0098	0.0350	4,000	7.9	0.00980	0.02400	4,000	7.9	0.0079	0.0098
	50.00	5,000	17.7	0.0160	0.0710	4,000	11.8	0.0098	0.0350	4,000	7.9	0.00980	0.02400	4,000	7.9	0.0079	0.0098
6.0	10.00	7,000	59.1	0.0300	0.0940	5,500	39.4	0.0120	0.0470	4,500	31.5	0.01200	0.03800	4,500	31.5	0.0120	0.0240
	20.00	7,000	47.2	0.0300	0.0940	5,500	31.5	0.0120	0.0470	4,500	23.6	0.01200	0.03800	4,500	23.6	0.0120	0.0240
	25.00	6,000	35.4	0.0300	0.0940	5,500	23.6	0.0120	0.0470	4,500	15.7	0.01200	0.03800	4,500	15.7	0.0120	0.0240
	30.00	5,000	23.6	0.0300	0.0940	4,000	15.7	0.0120	0.0470	4,000	11.8	0.01200	0.03800	4,000	11.8	0.0120	0.0240
	35.00	5,000	23.6	0.0300	0.0940	4,000	15.7	0.0120	0.0470	4,000	11.8	0.01200	0.03800	4,000	11.8	0.0120	0.0240
	40.00	5,000	23.6	0.0240	0.0940	4,000	15.7	0.0120	0.0470	4,000	11.8	0.01200	0.03800	4,000	11.8	0.0120	0.0240
	45.00	5,000	23.6	0.0240	0.0940	4,000	15.7	0.0120	0.0470	4,000	11.8	0.01200	0.03800	4,000	11.8	0.0120	0.0240
	50.00	5,000	23.6	0.0240	0.0940	4,000	15.7	0.0120	0.0470	4,000	11.8	0.01200	0.03800	4,000	11.8	0.0120	0.0120

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

List 3620 - EXOCARB® WXL®: Stub Length, 2 Flute
List 3621 - EXOCARB® WXL®: Regular Length, 2 Flute

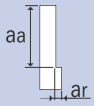
Slotting

Hardness	–	Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels		Hardened Steels Pre-hardened Steels, Stainless Steels			
Cutting Speed	52~522 SFM	33~251 SFM		33~186 SFM		33~159 SFM	
Depth of Cut		Dia. / aa D<1/8 / 0.3D 1/8≤D / 0.5D					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	31,000	12.6	12,000	4.7	8,500	3.5	7,500	2.6
5/64	24,000	12.2	9,700	5.1	7,000	3.5	6,300	2.8
3/32	20,500	13.8	8,600	5.9	6,300	3.5	5,500	2.8
7/64	17,500	15.0	7,300	6.7	5,500	3.9	4,700	3.0
1/8	15,000	16.5	6,500	7.1	5,000	4.3	4,200	3.1
5/32	12,000	17.7	5,400	8.3	4,200	4.9	3,500	3.5
3/16	10,500	20.9	4,900	10.2	3,700	5.1	3,100	3.7
7/32	8,700	21.3	4,300	10.6	3,100	5.1	2,600	3.9
1/4	7,500	20.9	3,700	10.6	2,700	5.1	2,300	3.9
9/32	6,900	20.9	3,400	10.6	2,500	5.1	2,100	3.9
5/16	5,900	20.5	3,000	10.2	2,200	4.9	1,900	3.9
3/8	5,100	20.1	2,500	10.2	1,800	4.9	1,400	3.7
7/16	4,400	19.7	2,200	9.8	1,600	4.9	1,100	3.7
1/2	4,000	20.1	2,000	9.8	1,400	4.9	1,200	3.7
5/8	3,000	15.7	1,500	7.9	1,100	4.5	800	3.1
3/4	2,700	14.2	1,300	7.1	900	3.9	700	2.8

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

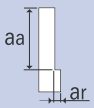
List 3704 - EXOCARB® WXL®: Regular Length, 4 Flute

Side Milling

Hardness	–		Up to 32 HRC		33~41 HRC		42~50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels Prehardended Steels Stainless Steels			
Cutting Speed	516~990 SFM		248~254 SFM		143~184 SFM		129~164 SFM	
Depth of Cut			Dia. / aa / ar D<3 / 1.5D / 0.05D 3≤D / 1.5D / 0.10D				aa = 1.0D ar = 0.02D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1	50,000	17.3	24,000	8.3	14,000	3.1	12,500	2.8
1.5	50,000	38.4	16,000	12.2	9,250	4.5	8,400	4.1
2	47,500	43.3	12,000	11.6	7,000	4.3	6,350	3.9
2.5	38,000	74.8	9,600	18.9	6,200	5.5	5,550	4.9
3	32,000	63.0	8,150	16.9	5,300	4.9	4,750	4.3
4	24,000	66.9	6,050	17.7	4,250	5.3	3,700	4.5
5	19,000	78.7	4,900	20.5	3,550	5.5	3,150	4.9
6	16,000	78.7	4,100	20.5	2,950	5.7	2,650	5.1
8	12,000	74.8	3,050	19.9	2,200	5.7	1,950	5.1
10	9,500	74.8	2,450	19.9	1,750	5.7	1,550	5.1
12	7,900	74.8	2,050	19.9	1,450	5.7	1,300	5.1
14	6,800	74.8	1,750	19.5	1,250	5.7	1,100	4.9
15	6,300	74.8	1,600	19.3	1,150	5.3	1,050	4.7
16	5,900	70.9	1,500	18.9	1,100	5.1	995	4.5
18	5,300	70.9	1,350	18.5	990	4.5	880	4.1
20	4,700	66.9	1,200	17.5	890	4.1	795	3.7
25	3,800	55.1	970	14.2	710	3.3	635	3.0
30	3,100	43.3	815	11.8	590	2.8	530	2.4

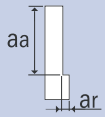
1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

High Speed Milling

Hardness	–		Up to 32 HRC		33~41 HRC		42~50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels Pre-hardened Steels			
Cutting Speed	1597~1625 SFM		1197~1238 SFM		805~820 SFM		480~492 SFM	
Depth of Cut			Dia. / aa / ar D<3 / 1.5D / 0.01D 3≤D / 1.5D / 0.02D				aa = 1.0D ar = 0.02D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
6	26,000	114.2	20,000	90.6	13,000	59.1	7,950	31.3
8	19,500	118.1	14,500	90.6	9,900	57.1	5,950	31.3
10	15,500	114.2	12,000	90.6	7,950	57.1	4,750	31.3
12	13,000	118.1	9,900	90.6	6,600	57.1	3,950	31.1
14	11,100	110.2	8,500	86.6	5,650	53.1	3,400	29.1
15	10,500	110.2	7,950	84.6	5,250	53.1	3,150	28.7
16	9,700	106.3	7,450	82.7	4,950	53.1	2,950	28.1
18	8,600	106.3	6,600	82.7	4,400	51.2	2,650	27.8
20	7,800	102.4	5,950	78.7	3,950	51.2	2,350	26.2
25	6,200	78.7	4,750	63.0	3,150	41.3	1,900	22.0
30	5,200	66.9	3,950	53.1	2,650	35.0	1,550	17.9

List 3742 - EXOCARB® WXL®: 4 Flute, Square End, Long Length

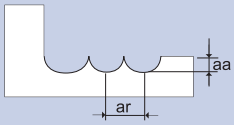
Side Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC	
Work Material	Mild Steel Carbon Steels Cast Iron		Alloy Steels Tool Steels		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels	
Cutting Speed	200 SFM		160 SFM		130 SFM		110 SFM		80 SFM	
Depth of Cut	Dia. / aa / ar D≤20 / 2.5D / 0.05D 20<D / 2.5D / 0.1mm 						Dia. / aa / ar D≤8 / 1D / 0.01D 8<D / 1D / 0.5mm		aa = 2.5D ar = 0.02D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
3	6,350	8.9	5,300	7.5	4,200	5.9	3,700	5.2	2,100	2.9
4	4,750	8.9	3,950	7.5	3,150	5.9	2,750	5.2	1,550	2.9
5	3,800	8.9	3,150	7.5	2,500	5.9	2,200	5.2	1,250	2.9
6	3,150	8.9	2,650	7.5	2,100	5.9	1,850	5.2	1,050	3.0
8	2,350	8.9	1,950	7.5	1,550	5.9	1,350	5.1	995	3.8
10	1,900	8.9	1,550	7.5	1,250	5.9	1,100	5.2	795	3.7
12	1,550	8.9	1,300	7.5	1,050	6.0	925	5.3	660	3.8
14	1,350	8.9	1,100	7.5	905	6.0	795	5.2	565	3.7
16	1,150	8.9	995	7.5	795	6.2	695	5.4	495	3.8
18	1,050	8.9	880	7.5	705	6.0	615	5.2	440	3.7
20	955	8.9	795	7.5	635	5.9	555	5.2	395	3.7
22	865	8.9	720	7.5	575	5.9	505	5.2	360	3.7
24	795	8.7	660	7.1	530	5.8	460	5.0	330	3.6
25	760	8.3	635	6.7	505	5.5	445	4.9	315	3.4

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously,
3. Use a suitable cutting fluid with high smoke retardant.

List 3711 - EXOCARB® WXL®: 2 Flute, Ball End, Regular Length, Long Shank

Side Milling

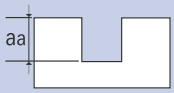
Hardness	–	Up to 20 HRC	20 to 30 HRC	30 to 38 HRC	38 to 45 HRC	45 to 55 HRC	55 to 60 HRC
Work Material	Cast Iron	Mild Steels Carbon Steels	Alloy Steels Tool Steels	Hardened Steels Pre-hardened Steels	Stainless Steel Hardened Steels	Hardened Steels	Hardened Steels
Cutting Speed	330-490 SFM	330-390 SFM	300-330 SFM	230-260 SFM	200-230 SFM	170-200 SFM	120-150 SFM
Depth of Cut				aa=0.1D ar=0.2D		aa=0.05D ar=0.1D	

Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1	32,000	64.0	32,000	64.0	31,500	63.0	25,000	50.0	22,000	35.2	19,000	26.6	14,000	19.6
2	23,500	79.9	19,000	64.6	15,500	52.7	12,500	42.5	11,000	35.2	9,500	26.6	7,150	20.0
3	15,500	74.4	12,500	60.0	10,500	50.4	8,450	40.6	7,400	32.6	6,350	25.4	4,750	19.0
4	11,500	69.0	9,500	57.0	7,950	47.7	6,350	38.1	5,550	31.1	4,750	24.7	3,550	18.5
5	9,500	72.2	7,600	57.8	6,350	48.3	5,050	38.4	4,450	32.0	3,800	25.8	2,850	19.4
6	7,950	70.0	6,350	55.9	5,300	46.6	4,200	37.0	3,700	31.1	3,150	25.2	2,350	18.8
8	5,950	71.4	4,750	57.0	3,950	47.4	3,150	37.8	2,750	31.9	2,350	26.3	1,750	19.6
10	4,750	67.5	3,800	54.0	3,150	44.7	2,500	35.5	2,200	30.4	1,900	25.5	1,400	18.8
12	3,950	67.2	3,150	53.6	2,650	45.1	2,100	35.7	1,850	30.7	1,550	24.8	1,150	18.4
14	3,400	57.8	2,700	45.9	2,250	38.3	1,800	30.6	1,550	25.7	1,350	21.6	1,000	16.0
16	2,950	50.2	2,350	40.0	1,950	33.2	1,550	26.4	1,350	22.4	1,150	18.4	895	14.3
18	2,650	45.1	2,100	35.7	1,750	29.8	1,400	23.8	1,200	19.9	1,050	16.8	795	12.7
20	2,350	40.0	1,900	32.3	1,550	26.4	1,250	21.3	1,100	18.3	955	15.3	715	11.4
25	1,900	32.3	1,500	25.5	1,250	21.3	1,000	17.0	890	14.8	760	12.2	570	9.1
30	1,550	26.4	1,250	21.3	1,050	17.9	845	14.4	740	12.3	635	10.2	475	7.6

1. Use a rigid and precise machine and holder.
2. Use a suitable cutting fluid with high smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

List 3791 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length

Slotting

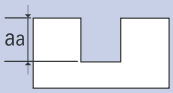
Hardness	–			Up to 32 HRC			33~41 HRC			42~50 HRC		
Work Material	Copper Copper Alloy			Mild Steels Carbon Steels			Hardened Steels Pre-hardened Steels Stainless Steels					
Cutting Speed	45~376 SFM*			41~309 SFM*			41~309 SFM*			40~258 SFM*		
Depth of Cut												
D (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)
0.2	0.5	35,200	19.3	0.0009	32,000	17.7	0.0007	32,000	17.7	0.0006	29,000	9.8	0.0005
0.2	1	35,200	15.0	0.0006	32,000	13.8	0.0005	32,000	13.8	0.0004	29,000	7.9	0.0004
0.2	1.5	31,000	10.6	0.0004	28,000	9.8	0.0003	28,000	9.8	0.0003	25,000	5.9	0.0002
0.2	2	24,000	8.7	0.0002	22,000	7.9	0.0002	22,000	7.9	0.0002	20,000	4.7	0.0001
0.2	2.5	22,000	7.5	0.0002	20,000	7.1	0.0002	20,000	6.7	0.0002	20,000	3.9	0.0001
0.2	3	22,000	7.1	0.0002	20,000	6.7	0.0001	20,000	6.3	0.0001	20,000	3.5	0.0001
0.2	3.5	22,000	5.9	0.0002	20,000	5.5	0.0001	20,000	5.1	0.0001	20,000	3.1	0.0001
0.2	4	22,000	1.6	0.0001	20,000	1.6	0.0001	20,000	1.4	0.0001	20,000	1.2	0.0001
0.3	1	38,500	18.9	0.0013	32,000	15.7	0.0011	32,000	13.8	0.0009	29,000	11.8	0.0007
0.3	1.5	38,500	16.9	0.0011	32,000	14.2	0.0009	32,000	11.8	0.0008	29,000	9.8	0.0006
0.3	2	33,500	14.2	0.0009	28,000	11.8	0.0008	28,000	9.8	0.0007	25,000	7.9	0.0005
0.3	2.5	33,500	13.0	0.0007	28,000	11.0	0.0006	28,000	9.1	0.0005	25,000	7.5	0.0003
0.3	3	26,500	11.8	0.0004	22,000	9.8	0.0004	22,000	6.3	0.0003	20,000	5.9	0.0002
0.3	4	24,000	8.7	0.0003	20,000	7.5	0.0003	20,000	5.9	0.0002	20,000	5.1	0.0001
0.3	5	24,000	7.5	0.0002	20,000	6.3	0.0002	20,000	5.5	0.0001	18,000	4.7	0.0001
0.3	6	24,000	3.9	0.0001	20,000	3.5	0.0001	20,000	3.1	0.0001	16,000	2.4	0.0001
0.3	9	19,000	1.2	0.0001	16,000	1.2	0.0001	16,000	1.2	0.0001	13,000	0.8	0.0001
0.4	1.5	38,500	20.5	0.0013	32,000	17.3	0.0011	32,000	15.0	0.0009	29,000	13.0	0.0007
0.4	2	38,500	18.9	0.0012	32,000	15.7	0.0010	32,000	13.8	0.0009	29,000	11.8	0.0007
0.4	3	33,500	14.2	0.0008	28,000	11.8	0.0007	28,000	9.8	0.0006	25,000	7.9	0.0004
0.4	4	26,500	11.8	0.0006	22,000	9.8	0.0005	22,000	7.9	0.0004	20,000	5.9	0.0003
0.4	5	24,000	9.4	0.0003	20,000	7.9	0.0002	20,000	6.3	0.0002	20,000	5.1	0.0001
0.4	6	24,000	8.3	0.0002	20,000	7.1	0.0002	20,000	5.5	0.0002	20,000	4.7	0.0001
0.4	7	24,000	6.3	0.0002	20,000	5.5	0.0002	20,000	4.7	0.0001	20,000	4.3	0.0001
0.4	8	24,000	5.9	0.0001	20,000	5.1	0.0001	20,000	4.3	0.0001	20,000	3.9	0.0001
0.4	9	24,000	5.5	0.0001	20,000	4.7	0.0001	20,000	3.9	0.0001	20,000	3.1	0.0001
0.4	10	24,000	5.1	0.0001	20,000	4.3	0.0001	20,000	3.3	0.0001	18,000	2.8	0.0001
0.4	12	24,000	3.9	0.0001	20,000	3.5	0.0001	20,000	3.1	0.0001	16,000	2.4	0.0001
0.5	1.5	38,500	26.0	0.0021	32,000	21.7	0.0018	32,000	16.5	0.0015	29,000	13.0	0.0012
0.5	2	38,500	23.6	0.0021	32,000	19.7	0.0018	32,000	15.7	0.0015	29,000	11.8	0.0012
0.5	3	36,000	21.3	0.0014	30,000	17.7	0.0012	30,000	14.2	0.0011	27,000	11.0	0.0009
0.5	4	33,500	18.9	0.0010	28,000	15.7	0.0008	28,000	12.6	0.0007	25,000	9.8	0.0006
0.5	5	33,500	17.7	0.0007	28,000	15.0	0.0006	25,000	11.8	0.0004	22,000	9.1	0.0003
0.5	6	26,500	16.5	0.0003	22,000	13.8	0.0002	22,000	8.7	0.0002	20,000	7.1	0.0002
0.5	7	24,000	15.0	0.0002	20,000	12.6	0.0002	20,000	7.9	0.0002	20,000	6.7	0.0001
0.5	8	24,000	12.6	0.0002	20,000	10.6	0.0002	20,000	7.1	0.0001	20,000	5.9	0.0001
0.5	9	24,000	11.8	0.0001	20,000	9.8	0.0001	18,000	6.3	0.0001	18,000	5.5	0.0001
0.5	10	24,000	9.4	0.0001	20,000	7.9	0.0001	18,000	5.9	0.0001	18,000	5.1	0.0001
0.5	12	24,000	7.5	0.0001	20,000	6.3	0.0001	18,000	4.7	0.0001	18,000	3.9	0.0001
0.5	15	21,500	3.9	0.0001	18,000	3.5	0.0001	16,000	3.1	0.0001	16,000	2.8	0.0001
0.6	2	38,500	28.3	0.0026	32,000	23.6	0.0021	32,000	15.7	0.0018	27,000	11.8	0.0014
0.6	3	38,500	26.0	0.0024	32,000	21.7	0.0020	32,000	14.2	0.0016	27,000	11.0	0.0012
0.6	4	33,500	21.3	0.0019	28,000	17.7	0.0016	28,000	11.8	0.0013	25,000	7.9	0.0010
0.6	5	33,500	18.9	0.0014	28,000	15.7	0.0012	25,000	8.7	0.0008	22,000	7.1	0.0008
0.6	6	26,500	11.8	0.0009	22,000	9.8	0.0007	22,000	7.9	0.0006	20,000	5.9	0.0005
0.6	7	26,500	11.8	0.0005	22,000	9.8	0.0004	22,000	7.9	0.0003	20,000	5.9	0.0003
0.6	8	26,500	11.8	0.0003	22,000	9.8	0.0003	22,000	7.9	0.0002	20,000	5.9	0.0002
0.6	10	24,000	9.4	0.0002	20,000	7.9	0.0002	18,000	5.9	0.0002	18,000	5.1	0.0001
0.6	12	21,500	8.7	0.0001	18,000	7.5	0.0001	18,000	5.9	0.0001	18,000	4.7	0.0001

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.
* Maximum speed will vary by diameter.

continued on next page

List 3791 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length (Continued)

Slotting

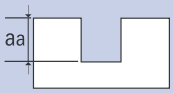
Hardness	–			Up to 32 HRC			33~41 HRC			42~50 HRC		
Work Material	Copper Copper Alloy			Mild Steels Carbon Steels			Hardened Steels Pre-hardened Steels Stainless Steels					
Cutting Speed	45~376 SFM*			41~309 SFM*			41~309 SFM*			40~258 SFM*		
Depth of Cut												
D (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)
0.6	15	21,500	5.9	0.0001	18,000	5.1	0.0001	16,000	4.3	0.0001	16,000	3.9	0.0001
0.6	18	18,000	3.5	0.0001	15,000	3.1	0.0001	14,000	2.8	0.0001	14,000	2.4	0.0001
0.7	2	38,500	28.3	0.0030	32,000	23.6	0.0025	32,000	19.7	0.0021	26,000	15.7	0.0017
0.7	4	33,500	21.3	0.0022	28,000	17.7	0.0018	28,000	11.8	0.0015	22,000	11.8	0.0012
0.7	6	33,500	21.3	0.0014	28,000	17.7	0.0011	28,000	7.9	0.0010	22,000	7.9	0.0008
0.7	8	26,500	11.8	0.0008	22,000	9.8	0.0007	22,000	7.9	0.0006	20,000	5.9	0.0004
0.7	10	26,500	11.8	0.0004	22,000	9.8	0.0003	22,000	7.9	0.0003	20,000	5.9	0.0002
0.8	4	38,500	28.3	0.0025	32,000	23.6	0.0021	32,000	23.6	0.0017	25,000	15.7	0.0014
0.8	6	31,000	21.3	0.0016	26,000	17.7	0.0013	26,000	15.7	0.0011	21,000	11.8	0.0009
0.8	8	26,500	16.5	0.0011	22,000	13.8	0.0009	22,000	11.8	0.0008	18,000	9.8	0.0006
0.8	10	26,500	16.5	0.0005	22,000	13.8	0.0004	22,000	11.8	0.0003	18,000	9.4	0.0002
0.8	12	20,500	14.2	0.0003	17,000	11.8	0.0003	17,000	11.8	0.0002	15,000	7.9	0.0002
0.8	14	20,500	12.6	0.0002	17,000	10.6	0.0001	17,000	9.8	0.0001	13,000	6.7	0.0001
0.8	16	19,000	10.6	0.0001	16,000	9.1	0.0001	16,000	8.7	0.0001	12,000	5.9	0.0001
0.8	20	17,000	7.9	0.0001	14,000	6.7	0.0001	14,000	6.3	0.0001	12,000	5.1	0.0001
0.8	24	14,500	3.9	0.0001	12,000	3.5	0.0001	12,000	3.1	0.0001	10,000	2.8	0.0001
0.9	4	38,500	57.1	0.0028	32,000	47.2	0.0024	30,000	33.9	0.0024	23,000	25.6	0.0016
0.9	6	36,000	47.2	0.0028	30,000	39.4	0.0023	28,000	30.7	0.0020	22,000	23.6	0.0016
0.9	8	31,000	37.8	0.0018	26,000	31.5	0.0015	25,000	23.6	0.0013	19,000	15.7	0.0010
0.9	10	24,000	28.3	0.0013	20,000	23.6	0.0011	20,000	19.7	0.0009	16,000	11.8	0.0007
0.9	15	20,500	14.2	0.0004	17,000	11.8	0.0003	17,000	11.8	0.0002	16,000	11.8	0.0002
1.0	3	36,000	57.1	0.0043	30,000	47.2	0.0035	30,000	43.3	0.0031	22,000	31.5	0.0024
1.0	4	36,000	55.1	0.0038	30,000	45.3	0.0031	30,000	43.3	0.0028	22,000	25.6	0.0020
1.0	5	36,000	51.2	0.0038	30,000	43.3	0.0031	28,000	37.4	0.0028	20,000	23.6	0.0018
1.0	6	32,500	47.2	0.0033	27,000	39.4	0.0028	26,000	35.4	0.0024	20,000	23.6	0.0016
1.0	7	30,000	47.2	0.0024	25,000	39.4	0.0020	24,000	31.5	0.0020	20,000	19.7	0.0012
1.0	8	27,500	37.8	0.0019	23,000	31.5	0.0016	22,000	27.6	0.0016	18,000	15.7	0.0012
1.0	9	24,000	33.1	0.0014	20,000	27.6	0.0012	19,000	23.6	0.0012	18,000	15.7	0.0010
1.0	10	23,000	28.3	0.0014	19,000	23.6	0.0012	18,000	19.7	0.0011	15,000	11.8	0.0008
1.0	12	23,000	28.3	0.0009	19,000	23.6	0.0008	18,000	19.7	0.0007	15,000	11.8	0.0004
1.0	14	18,000	18.9	0.0005	15,000	15.7	0.0004	15,000	15.7	0.0004	12,000	7.9	0.0003
1.0	16	18,000	14.2	0.0004	15,000	11.8	0.0003	15,000	11.8	0.0003	12,000	7.9	0.0002
1.0	18	15,500	10.6	0.0003	13,000	9.1	0.0002	13,000	8.7	0.0002	11,000	7.1	0.0002
1.0	20	14,500	8.7	0.0002	12,000	7.5	0.0002	11,000	7.1	0.0002	10,000	5.1	0.0001
1.0	22	13,000	7.5	0.0002	11,000	6.3	0.0001	10,000	5.9	0.0001	9,000	3.9	0.0001
1.0	25	11,000	3.9	0.0002	9,000	3.5	0.0001	9,000	3.3	0.0001	8,500	3.1	0.0001
1.0	30	9,600	1.6	0.0001	8,000	1.6	0.0001	8,000	1.4	0.0001	8,000	1.2	0.0001
1.2	4	29,000	51.2	0.0043	24,000	43.3	0.0035	23,000	39.4	0.0031	18,000	27.6	0.0024
1.2	6	27,500	47.2	0.0038	23,000	39.4	0.0031	22,000	35.4	0.0028	17,000	23.6	0.0020
1.2	8	24,000	33.1	0.0033	20,000	27.6	0.0028	19,000	27.6	0.0020	14,000	15.7	0.0016
1.2	10	24,000	33.1	0.0024	20,000	27.6	0.0020	19,000	27.6	0.0016	14,000	15.7	0.0012
1.2	12	20,500	28.3	0.0019	17,000	23.6	0.0016	16,000	19.7	0.0012	11,000	11.8	0.0008
1.2	14	18,000	21.3	0.0007	15,000	17.7	0.0006	13,000	15.0	0.0005	11,000	9.8	0.0004
1.2	16	14,500	14.2	0.0004	12,000	11.8	0.0003	11,000	9.8	0.0003	10,000	8.7	0.0002
1.2	20	12,000	9.4	0.0002	10,000	7.9	0.0002	10,000	7.5	0.0002	9,000	7.1	0.0002
1.4	6	24,000	47.2	0.0061	20,000	39.4	0.0051	19,000	35.4	0.0043	15,000	23.6	0.0035
1.4	8	21,500	37.8	0.0043	18,000	31.5	0.0035	17,000	27.6	0.0031	13,000	15.7	0.0024
1.4	10	21,500	37.8	0.0028	18,000	31.5	0.0024	17,000	27.6	0.0020	13,000	15.7	0.0016
1.4	12	21,500	37.8	0.0024	18,000	31.5	0.0020	17,000	27.6	0.0016	13,000	15.7	0.0012
1.4	14	18,000	28.3	0.0019	15,000	23.6	0.0016	14,000	19.7	0.0014	11,000	11.8	0.0012

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.
* Maximum speed will vary by diameter.

continued on next page

List 3791 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length (Continued)

Slotting

Hardness		–			Up to 32 HRC			33~41 HRC			42~50 HRC		
Work Material		Copper Copper Alloy			Mild Steels Carbon Steels			Hardened Steels Pre-hardened Steels Stainless Steels					
Cutting Speed		45~376 SFM*			41~309 SFM*			41~309 SFM*			40~258 SFM*		
Depth of Cut													
D (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)
1.4	16	18,000	28.3	0.0014	15,000	23.6	0.0012	14,000	19.7	0.0008	11,000	11.8	0.0008
1.4	22	12,000	11.8	0.0002	10,000	9.8	0.0002	9,000	8.3	0.0002	8,000	7.1	0.0002
1.5	4	21,500	47.2	0.0066	18,000	39.4	0.0055	18,000	35.4	0.0043	14,000	23.6	0.0035
1.5	6	21,500	47.2	0.0066	18,000	39.4	0.0055	18,000	35.4	0.0043	14,000	23.6	0.0035
1.5	8	19,000	37.8	0.0047	16,000	31.5	0.0039	15,000	27.6	0.0031	12,000	15.7	0.0028
1.5	10	19,000	37.8	0.0038	16,000	31.5	0.0031	15,000	27.6	0.0028	12,000	15.7	0.0020
1.5	12	19,000	37.8	0.0028	16,000	31.5	0.0024	15,000	27.6	0.0020	12,000	15.7	0.0016
1.5	14	19,000	37.8	0.0024	16,000	31.5	0.0020	15,000	27.6	0.0018	12,000	15.7	0.0014
1.5	16	17,000	28.3	0.0024	14,000	23.6	0.0020	13,000	19.7	0.0016	10,000	11.8	0.0012
1.5	18	17,000	28.3	0.0014	14,000	23.6	0.0012	13,000	19.7	0.0008	10,000	11.8	0.0008
1.5	20	14,500	19.7	0.0009	12,000	16.5	0.0008	11,000	15.0	0.0006	10,000	11.8	0.0004
1.5	25	12,000	13.4	0.0004	10,000	11.4	0.0003	9,000	9.1	0.0003	8,000	8.3	0.0002
1.5	30	9,000	7.9	0.0002	7,500	6.7	0.0002	7,400	5.9	0.0002	7,000	5.1	0.0001
1.5	38	8,150	3.9	0.0002	6,800	3.5	0.0002	6,700	3.3	0.0001	6,000	3.0	0.0001
1.5	40	7,200	3.5	0.0002	6,000	3.0	0.0001	5,900	2.8	0.0001	5,600	2.4	0.0001
1.5	45	6,600	2.0	0.0002	5,500	1.8	0.0001	5,400	1.6	0.0001	5,400	1.6	0.0000
1.6	6	20,500	47.2	0.0071	17,000	39.4	0.0059	17,000	35.4	0.0051	13,000	23.6	0.0039
1.6	8	18,000	37.8	0.0066	15,000	31.5	0.0055	15,000	27.6	0.0047	11,000	15.7	0.0039
1.6	10	18,000	37.8	0.0052	15,000	31.5	0.0043	15,000	27.6	0.0035	11,000	15.7	0.0028
1.6	12	18,000	37.8	0.0033	15,000	31.5	0.0028	15,000	27.6	0.0024	11,000	15.7	0.0020
1.6	14	18,000	37.8	0.0028	15,000	31.5	0.0024	15,000	27.6	0.0020	11,000	15.7	0.0016
1.6	16	15,500	28.3	0.0024	13,000	23.6	0.0020	13,000	19.7	0.0016	9,000	11.8	0.0014
1.6	18	15,500	28.3	0.0019	13,000	23.6	0.0016	13,000	19.7	0.0012	9,000	11.8	0.0012
1.6	20	15,500	28.3	0.0009	13,000	23.6	0.0008	13,000	19.7	0.0008	9,000	11.8	0.0004
1.8	6	19,000	51.2	0.0104	16,000	43.3	0.0087	15,000	39.4	0.0071	12,000	27.6	0.0055
1.8	8	19,000	51.2	0.0099	16,000	43.3	0.0083	15,000	39.4	0.0067	12,000	27.6	0.0051
1.8	10	17,000	37.8	0.0057	14,000	31.5	0.0047	14,000	27.6	0.0039	10,000	19.7	0.0031
1.8	12	17,000	37.8	0.0047	14,000	31.5	0.0039	14,000	27.6	0.0031	10,000	19.7	0.0028
1.8	14	17,000	37.8	0.0038	14,000	31.5	0.0031	14,000	27.6	0.0024	10,000	19.7	0.0020
1.8	16	17,000	37.8	0.0033	14,000	31.5	0.0028	14,000	27.6	0.0020	10,000	19.7	0.0016
1.8	18	14,500	28.3	0.0024	12,000	23.6	0.0020	12,000	19.7	0.0018	8,000	15.7	0.0014
1.8	20	14,500	28.3	0.0019	12,000	23.6	0.0016	12,000	19.7	0.0016	8,000	15.7	0.0012
1.8	25	9,600	14.2	0.0004	8,000	11.8	0.0004	7,000	9.8	0.0003	6,000	7.9	0.0003
2.0	6	18,000	51.2	0.0146	15,000	43.3	0.0122	14,000	39.4	0.0102	11,000	27.6	0.0083
2.0	8	18,000	51.2	0.0123	15,000	43.3	0.0102	14,000	39.4	0.0087	11,000	27.6	0.0071
2.0	10	15,500	37.8	0.0113	13,000	31.5	0.0094	12,000	27.6	0.0079	9,000	19.7	0.0063
2.0	12	15,500	37.8	0.0061	13,000	31.5	0.0051	12,000	27.6	0.0043	9,000	19.7	0.0035
2.0	14	15,500	37.8	0.0052	13,000	31.5	0.0043	12,000	27.6	0.0035	9,000	19.7	0.0028
2.0	16	15,500	37.8	0.0038	13,000	31.5	0.0031	12,000	27.6	0.0028	9,000	19.7	0.0024
2.0	18	15,500	37.8	0.0033	13,000	31.5	0.0028	12,000	27.6	0.0024	9,000	19.7	0.0020
2.0	20	13,000	28.3	0.0024	11,000	23.6	0.0020	10,000	19.7	0.0020	7,000	15.7	0.0016
2.0	25	13,000	28.3	0.0014	11,000	23.6	0.0012	10,000	19.7	0.0008	7,000	15.7	0.0008
2.0	30	13,000	28.3	0.0009	11,000	23.6	0.0008	10,000	19.7	0.0004	7,000	15.7	0.0004
2.0	35	11,000	18.1	0.0004	9,000	15.4	0.0004	8,000	15.0	0.0003	6,000	10.6	0.0003
2.0	40	7,800	9.4	0.0002	6,500	7.9	0.0002	6,000	7.1	0.0002	6,000	5.5	0.0001
2.0	50	6,950	4.7	0.0001	5,800	3.9	0.0001	5,700	3.7	0.0001	5,000	3.1	0.0001
2.0	60	6,000	2.4	0.0000	5,000	2.0	0.0000	5,000	1.8	0.0000	5,000	1.6	0.0000
2.5	8	14,500	51.2	0.0184	12,000	43.3	0.0154	11,000	39.4	0.0130	9,000	27.6	0.0102
2.5	10	14,500	51.2	0.0156	12,000	43.3	0.0130	11,000	39.4	0.0110	9,000	27.6	0.0087
2.5	12	14,500	51.2	0.0109	12,000	43.3	0.0091	11,000	39.4	0.0075	9,000	27.6	0.0059

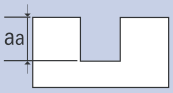
1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

* Maximum speed will vary by diameter.

continued on next page

List 3791 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length (Continued)

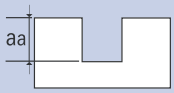
Slotting

Hardness	–			Up to 32 HRC			33~41 HRC			42~50 HRC		
Work Material	Copper Copper Alloy			Mild Steels Carbon Steels			Hardened Steels Pre-hardened Steels Stainless Steels					
Cutting Speed	45~376 SFM*			41~309 SFM*			41~309 SFM*			40~258 SFM*		
Depth of Cut												
D (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)
2.5	14	12,000	37.8	0.0080	10,000	31.5	0.0067	9,000	27.6	0.0055	7,000	19.7	0.0043
2.5	16	12,000	37.8	0.0057	10,000	31.5	0.0047	9,000	27.6	0.0039	7,000	19.7	0.0031
2.5	18	12,000	37.8	0.0052	10,000	31.5	0.0043	9,000	27.6	0.0035	7,000	19.7	0.0028
2.5	20	12,000	37.8	0.0043	10,000	31.5	0.0035	9,000	27.6	0.0031	7,000	19.7	0.0024
2.5	25	9,600	28.3	0.0038	8,000	23.6	0.0031	8,000	19.7	0.0024	6,000	15.7	0.0020
2.5	30	9,600	28.3	0.0014	8,000	23.6	0.0012	8,000	19.7	0.0012	6,000	15.7	0.0008
2.5	40	7,800	13.0	0.0003	6,500	11.0	0.0003	6,000	10.6	0.0002	6,000	9.4	0.0002
2.5	50	6,950	7.9	0.0001	5,800	6.7	0.0001	5,700	6.3	0.0001	5,000	5.1	0.0001
3.0	8	12,000	51.2	0.0170	10,000	43.3	0.0142	10,000	39.4	0.0118	8,000	27.6	0.0094
3.0	10	12,000	51.2	0.0137	10,000	43.3	0.0114	10,000	39.4	0.0094	8,000	27.6	0.0075
3.0	12	12,000	51.2	0.0128	10,000	43.3	0.0106	10,000	39.4	0.0091	8,000	27.6	0.0071
3.0	14	12,000	51.2	0.0118	10,000	43.3	0.0098	10,000	39.4	0.0083	8,000	27.6	0.0067
3.0	16	12,000	37.8	0.0094	10,000	31.5	0.0079	9,000	27.6	0.0067	6,000	19.7	0.0051
3.0	18	12,000	37.8	0.0066	10,000	31.5	0.0055	9,000	27.6	0.0047	6,000	19.7	0.0039
3.0	20	12,000	37.8	0.0061	10,000	31.5	0.0051	9,000	27.6	0.0043	6,000	19.7	0.0031
3.0	25	12,000	37.8	0.0052	10,000	31.5	0.0043	9,000	27.6	0.0035	6,000	19.7	0.0028
3.0	30	9,600	28.3	0.0043	8,000	23.6	0.0035	7,000	19.7	0.0031	5,000	15.7	0.0024
3.0	35	9,600	28.3	0.0033	8,000	23.6	0.0028	7,000	19.7	0.0024	5,000	15.7	0.0020
3.0	40	9,600	28.3	0.0019	8,000	23.6	0.0016	7,000	19.7	0.0012	5,000	15.7	0.0008
3.0	50	6,950	12.6	0.0004	5,800	10.6	0.0004	5,700	9.4	0.0002	5,000	7.9	0.0002
4.0	12	8,550	53.1	0.0180	7,000	43.3	0.0150	7,000	39.4	0.0126	6,000	27.6	0.0102
4.0	16	8,550	53.1	0.0170	7,000	43.3	0.0142	7,000	39.4	0.0118	6,000	27.6	0.0094
4.0	20	8,550	38.2	0.0161	7,000	31.5	0.0134	6,000	27.6	0.0110	5,000	19.7	0.0087
4.0	25	8,550	38.2	0.0123	7,000	31.5	0.0102	6,000	27.6	0.0087	5,000	19.7	0.0071
4.0	30	8,550	38.2	0.0090	7,000	31.5	0.0075	6,000	27.6	0.0063	5,000	19.7	0.0051
4.0	35	8,550	38.2	0.0080	7,000	31.5	0.0067	6,000	27.6	0.0055	5,000	19.7	0.0043
4.0	40	7,300	28.7	0.0066	6,000	23.6	0.0055	5,000	23.6	0.0047	4,000	15.7	0.0039
4.0	45	7,300	28.7	0.0057	6,000	23.6	0.0047	5,000	23.6	0.0039	4,000	15.7	0.0031
4.0	50	7,300	28.7	0.0024	6,000	23.6	0.0020	5,000	23.6	0.0016	4,000	15.7	0.0012
4.0	60	6,100	13.4	0.0009	5,000	11.0	0.0008	5,000	10.6	0.0008	4,000	9.8	0.0004
5.0	16	7,300	53.1	0.0213	6,000	43.3	0.0177	5,000	35.4	0.0150	5,000	23.6	0.0118
5.0	20	7,300	45.3	0.0203	6,000	37.4	0.0169	5,000	30.7	0.0142	5,000	23.6	0.0114
5.0	25	6,100	38.2	0.0198	5,000	31.5	0.0165	5,000	27.6	0.0138	5,000	23.6	0.0110
5.0	30	6,100	38.2	0.0180	5,000	31.5	0.0150	5,000	27.6	0.0118	5,000	23.6	0.0098
5.0	35	6,100	38.2	0.0156	5,000	31.5	0.0130	5,000	27.6	0.0110	5,000	23.6	0.0087
5.0	40	6,100	28.7	0.0134	5,000	23.6	0.0110	4,000	22.8	0.0079	4,000	19.7	0.0071
5.0	50	4,900	24.0	0.0071	4,000	19.7	0.0059	3,000	15.7	0.0051	3,000	15.7	0.0039
5.0	60	4,900	16.5	0.0028	4,000	13.8	0.0024	3,000	13.0	0.0024	3,000	11.8	0.0016

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.
* Maximum speed will vary by diameter.

List 3720 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length

Slotting

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloys	Mild Steels Carbon Steels	Hardened Steels, Pre-hardened Steels Stainless Steels	
Cutting Speed	52~682 SFM*	41~323 SFM*	41~241 SFM*	41~208 SFM*
Depth of Cut	Dia. / aa D<1 / 0.1D 1≤D<3 / 0.3D 3≤D / 0.5D			

Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.1	50,000	4.7	40,000	3.1	40,000	3.0	40,000	1.5
0.2	50,000	6.7	40,000	4.3	40,000	3.5	40,000	1.8
0.3	50,000	8.3	40,000	5.5	40,000	3.9	40,000	2.8
0.4	50,000	9.1	40,000	5.9	40,000	4.3	34,500	3.0
0.5	50,000	9.8	38,500	5.9	31,000	4.3	27,500	3.0
0.6	50,000	11.0	33,500	5.9	24,500	4.3	21,000	3.0
0.7	50,000	12.2	30,000	5.9	21,500	4.3	18,500	3.0
0.8	50,000	14.2	27,000	5.9	19,500	4.3	17,000	3.1
0.9	50,000	15.7	23,500	5.9	17,000	4.3	15,000	3.1
1.0	50,000	16.9	22,000	5.9	15,500	4.3	13,500	3.1
1.1	50,000	16.5	20,000	5.9	14,000	4.3	12,500	3.1
1.2	50,000	16.5	18,500	5.9	13,500	4.3	11,500	3.1
1.3	47,000	16.1	17,500	5.9	12,500	4.3	11,000	3.1
1.4	44,000	16.1	16,000	5.9	11,500	4.3	10,000	3.1
1.5	40,000	15.7	15,500	5.9	11,000	4.3	9,900	3.1
1.6	39,000	15.7	15,000	5.9	10,500	4.3	9,400	3.1
1.7	36,500	15.7	14,000	5.9	9,900	4.3	8,800	3.1
1.8	34,500	15.7	13,500	6.3	9,400	4.3	8,500	3.1
1.9	32,500	15.7	12,500	6.3	8,800	4.3	7,900	3.3
2.0	30,000	15.0	12,000	6.3	8,700	4.3	7,900	3.5
2.1	29,000	16.1	11,500	6.7	8,300	4.3	7,400	3.5
2.2	28,000	16.1	11,000	6.7	8,200	4.3	7,200	3.5
2.3	27,500	16.1	11,000	7.1	8,000	4.3	7,000	3.5
2.4	26,000	16.9	10,500	7.1	7,900	4.3	6,900	3.5
2.5	24,500	16.9	10,500	7.9	7,600	4.3	6,600	3.5
2.6	23,500	18.5	9,800	7.9	7,400	4.9	6,300	3.5
2.7	23,000	18.5	9,500	7.9	7,100	4.9	6,100	3.5
2.8	22,000	18.5	9,100	8.3	6,900	4.9	5,800	3.7
2.9	21,500	18.5	8,800	8.3	6,700	4.9	5,700	3.7
3.0	21,000	21.3	8,900	9.1	6,800	5.1	5,700	3.9
3.1	20,000	21.7	8,700	9.4	6,700	5.1	5,600	3.9
3.2	19,500	22.0	8,400	9.4	6,500	5.7	5,400	4.1
3.3	19,000	22.0	8,100	9.8	6,300	5.7	5,200	4.1
3.4	18,000	22.0	7,900	9.8	6,100	5.7	5,100	4.1
3.5	18,000	22.0	7,800	9.8	6,000	6.1	5,000	4.1
3.6	17,500	22.8	7,600	10.6	5,900	6.1	4,900	4.3
3.7	16,500	22.8	7,400	10.6	5,700	6.1	4,700	4.3
3.8	16,000	23.2	7,300	11.0	5,700	6.1	4,600	4.3
3.9	15,500	23.2	7,100	11.0	5,500	6.3	4,500	4.3
4.0	15,500	23.6	7,000	11.0	5,500	6.3	4,500	4.5
4.1	15,500	25.2	6,900	11.4	5,400	6.3	4,400	4.5
4.2	15,000	25.2	6,800	11.4	5,300	6.3	4,400	4.5
4.3	14,000	25.2	6,700	12.2	5,200	6.3	4,300	4.5
4.4	14,000	26.4	6,600	12.6	5,100	6.7	4,200	4.9
4.5	14,000	26.4	6,600	12.6	5,100	6.7	4,200	4.9
4.6	13,500	27.6	6,500	13.0	4,900	6.7	4,100	4.9
4.7	13,500	27.6	6,500	13.8	4,900	6.7	4,100	4.9
4.8	13,500	28.0	6,400	13.8	4,800	6.7	4,100	4.9

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

*Maximum speed will vary by diameter.

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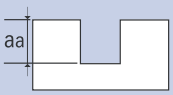
List 3720 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length (Continued)

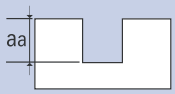
Slotting

Hardness	–		Up to 32 HRC		33~41 HRC		42~50 HRC	
Work Material	Copper Copper Alloys		Mild Steels Carbon Steels		Hardened Steels, Pre-hardened Steels Stainless Steels			
Cutting Speed	52~682 SFM*		41~323 SFM*		41~241 SFM*		41~208 SFM*	
Depth of Cut	Dia. / aa D<1 / 0.1D 1≤D<3 / 0.3D 3≤D / 0.5D							
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
4.9	13,500	28.0	6,300	14.2	4,700	6.7	4,000	4.9
5.0	12,500	28.3	6,200	14.6	4,600	6.7	3,900	5.1
5.1	12,500	28.3	6,100	14.6	4,500	6.7	3,900	5.1
5.2	12,000	28.3	6,000	14.6	4,400	6.7	3,800	5.1
5.3	12,000	28.3	5,900	14.6	4,400	6.7	3,800	5.1
5.4	11,500	28.3	5,800	14.6	4,300	6.7	3,600	5.1
5.5	11,500	28.3	5,700	14.6	4,200	6.7	3,500	5.1
5.6	11,500	28.3	5,600	14.6	4,100	6.7	3,500	5.1
5.7	11,000	28.3	5,500	14.6	4,000	6.7	3,400	5.1
5.8	11,000	28.0	5,400	14.6	3,900	6.7	3,300	5.1
5.9	10,500	28.0	5,300	14.6	3,800	6.7	3,300	5.1
6.0	10,000	28.0	5,200	14.6	3,800	6.7	3,200	5.1

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.
*Maximum speed will vary by diameter.

List 3721 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length

Slotting

Hardness	–		Up to 32 HRC		33~41 HRC		42~50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels, Pre-hardened Steels Stainless Steels			
Depth of Cut			Dia. | aa D<1 | 0.1D 1≤D<3 | 0.3D 3≤D | 0.5D					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.1	50,000	3.9	32,000	2.8	32,000	2.4	32,000	1.2
0.2	50,000	5.5	32,000	3.5	32,000	3.0	32,000	1.4
0.3	50,000	6.7	32,000	4.3	32,000	3.1	32,000	2.2
0.4	50,000	7.5	32,000	4.7	32,000	3.5	27,500	2.4
0.5	50,000	7.9	31,000	4.7	25,000	3.5	22,000	2.4
0.6	50,000	9.1	27,000	4.7	19,500	3.5	17,000	2.4
0.7	50,000	9.8	24,000	4.7	17,000	3.5	15,000	2.4
0.8	50,000	11.4	21,500	4.7	15,500	3.5	13,500	2.6
0.9	49,000	12.6	19,000	4.7	13,500	3.5	12,000	2.6
1.0	47,500	13.8	17,500	4.7	12,500	3.5	11,000	2.6
1.1	43,000	13.4	16,000	4.7	11,500	3.5	9,900	2.6
1.2	40,500	13.4	15,000	4.7	10,500	3.5	9,300	2.6
1.3	38,000	13.0	14,000	4.7	9,900	3.5	8,700	2.6
1.4	35,000	13.0	13,000	4.7	9,200	3.5	8,100	2.6
1.5	32,000	12.6	12,500	4.7	8,900	3.5	7,900	2.6
1.6	31,000	12.6	12,000	4.7	8,500	3.5	7,500	2.6
1.7	29,000	12.6	11,000	4.7	7,900	3.5	7,000	2.6
1.8	28,000	12.6	10,500	5.1	7,500	3.5	6,800	2.7
1.9	26,000	12.6	10,000	5.1	7,100	3.5	6,300	2.7
2.0	24,000	12.2	9,700	5.1	7,000	3.5	6,300	2.8
2.1	23,000	13.0	9,300	5.5	6,600	3.5	5,900	2.8
2.2	22,500	13.0	9,000	5.5	6,500	3.5	5,700	2.8
2.3	22,000	13.0	8,800	5.9	6,400	3.5	5,600	2.8
2.4	20,500	13.8	8,600	5.9	6,300	3.5	5,500	2.8
2.5	20,000	13.8	8,200	6.3	6,100	3.5	5,300	2.8
2.6	19,000	15.0	7,900	6.3	5,900	3.9	5,000	2.8
2.7	18,000	15.0	7,600	6.3	5,700	3.9	4,900	2.8
2.8	17,500	15.0	7,300	6.7	5,500	3.9	4,700	3.0
2.9	17,000	15.0	7,100	6.7	5,300	3.9	4,500	3.0
3.0	16,000	15.7	6,900	6.7	5,300	3.9	4,400	3.0
3.1	15,500	16.1	6,700	7.1	5,100	3.9	4,300	3.0
3.2	15,000	16.5	6,500	7.1	5,000	4.3	4,200	3.1
3.3	14,500	16.5	6,300	7.5	4,800	4.3	4,000	3.1
3.4	14,000	16.5	6,100	7.5	4,600	4.3	3,900	3.1
3.5	14,000	16.5	6,000	7.5	4,600	4.7	3,800	3.1
3.6	13,500	16.9	5,900	7.9	4,500	4.7	3,700	3.3
3.7	12,500	16.9	5,700	7.9	4,400	4.7	3,600	3.3
3.8	12,500	17.3	5,600	8.3	4,400	4.7	3,600	3.3
3.9	12,000	17.3	5,500	8.3	4,200	4.9	3,500	3.3
4.0	12,000	17.7	5,400	8.3	4,200	4.9	3,500	3.5
4.1	11,500	18.9	5,300	8.7	4,100	4.9	3,400	3.5
4.2	11,500	18.9	5,300	8.7	4,100	4.9	3,300	3.5
4.3	11,000	18.9	5,200	9.1	4,000	4.9	3,300	3.5
4.4	11,000	19.7	5,100	9.4	3,900	5.1	3,200	3.7
4.5	10,500	19.7	5,100	9.4	3,900	5.1	3,200	3.7
4.6	10,500	20.5	5,000	9.8	3,800	5.1	3,200	3.7
4.7	10,500	20.5	5,000	10.2	3,800	5.1	3,100	3.7
4.8	10,500	20.9	4,900	10.2	3,700	5.1	3,100	3.7
4.9	10,000	20.9	4,900	10.6	3,600	5.1	3,100	3.7
5.0	9,500	21.3	4,800	10.6	3,500	5.1	3,000	3.9
5.1	9,500	21.3	4,700	10.6	3,500	5.1	3,000	3.9

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

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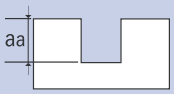
List 3721 - EXOCARB® WXL®: 2 Flute, Square End, Stub Length (Continued)

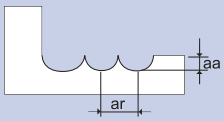
Slotting

Hardness	–		Up to 32 HRC		33~41 HRC		42~50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels, Pre-hardened Steels Stainless Steels			
Depth of Cut			Dia. / aa D<1 / 0.1D 1≤D<3 / 0.3D 3≤D / 0.5D					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
5.2	9,300	21.3	4,600	10.6	3,400	5.1	2,900	3.9
5.3	9,200	21.3	4,600	10.6	3,400	5.1	2,900	3.9
5.4	9,000	21.3	4,500	10.6	3,300	5.1	2,800	3.9
5.5	8,800	21.3	4,400	10.6	3,200	5.1	2,700	3.9
5.6	8,700	21.3	4,300	10.6	3,100	5.1	2,600	3.9
5.7	8,500	21.3	4,200	10.6	3,100	5.1	2,600	3.9
5.8	8,400	20.9	4,200	10.6	3,000	5.1	2,600	3.9
5.9	8,200	20.9	4,100	10.6	2,900	5.1	2,500	3.9
6.0	7,900	20.9	4,000	10.6	2,900	5.1	2,500	3.9
6.5	7,500	20.9	3,700	10.6	2,700	5.1	2,300	3.9
7.0	6,900	20.9	3,400	10.6	2,500	5.1	2,100	3.9
7.5	6,400	20.9	3,200	10.6	2,300	5.1	2,000	3.9
8.0	5,900	20.5	3,000	10.2	2,200	4.9	1,900	3.9
8.5	5,600	20.5	2,800	10.2	2,000	4.9	1,700	3.9
9.0	5,300	20.1	2,600	10.2	1,900	4.9	1,500	3.9
9.5	5,100	20.1	2,500	10.2	1,800	4.9	1,400	3.7
10.0	4,700	19.7	2,400	9.8	1,700	4.9	1,500	3.7
11.0	4,400	19.7	2,200	9.8	1,600	4.9	1,100	3.7
12.0	4,000	20.1	2,000	9.8	1,400	4.9	1,200	3.7
16.0	3,000	15.7	1,500	7.9	1,100	4.5	800	3.1
18.0	2,700	14.2	1,300	7.1	900	3.9	700	2.8
20.0	2,400	11.8	1,200	5.9	800	3.5	600	2.4

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck

Standard Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	66~464 SFM	66~340 SFM	66~279 SFM	
Depth of Cut				

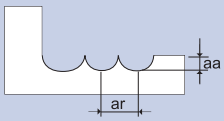
R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
0.10	0.5°	1	0.3°	32,000	7.9	0.0008	0.0008	32,000	5.9	0.0004	0.0004	32,000	5.9	0.0004	0.0004	32,000	3.9	0.0002	0.0002
0.10	0.5°	1.5	0.3°	32,000	7.9	0.0008	0.0008	32,000	5.9	0.0004	0.0004	32,000	5.9	0.0004	0.0004	32,000	3.9	0.0002	0.0002
0.10	0.5°	2	0.3°	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.0004	0.0004	32,000	3.1	0.0002	0.0002
0.10	0.5°	2.5	0.3°	32,000	5.9	0.0004	0.0004	32,000	3.9	0.0002	0.0002	32,000	3.9	0.0002	0.0002	32,000	3.1	0.0002	0.0002
0.10	0.5°	3	0.3°	32,000	3.9	0.0004	0.0004	32,000	3.1	0.0002	0.0002	32,000	3.1	0.0002	0.0002	32,000	2.4	0.0001	0.0002
0.10	1°	2	0.3°	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.0004	0.0004	32,000	3.1	0.0002	0.0002
0.10	1°	2.5	0.3°	32,000	5.9	0.0008	0.0008	32,000	3.9	0.0004	0.0004	32,000	3.9	0.0004	0.0004	32,000	3.1	0.0002	0.0002
0.10	1°	3	0.3°	32,000	5.9	0.0004	0.0004	32,000	3.9	0.0002	0.0002	32,000	3.9	0.0002	0.0002	32,000	3.1	0.0002	0.0002
0.15	0.5°	2	0.3°	32,000	23.6	0.0008	0.0012	32,000	11.8	0.0004	0.0006	32,000	7.9	0.0004	0.0006	32,000	7.9	0.0002	0.0002
0.15	0.5°	3	0.3°	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0004	32,000	7.9	0.0004	0.0004	32,000	7.9	0.0004	0.0004
0.15	1°	3	0.3°	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0006	32,000	7.9	0.0004	0.0006	32,000	7.9	0.0002	0.0002
0.15	1°	4	0.3°	32,000	17.7	0.0008	0.0008	32,000	11.8	0.0004	0.0004	32,000	7.9	0.0004	0.0004	32,000	7.9	0.0004	0.0004
0.20	0.5°	2	0.3°	27,000	17.7	0.0012	0.0020	32,000	15.7	0.0006	0.0010	32,000	11.8	0.0006	0.0008	32,000	11.8	0.0004	0.0004
0.20	0.5°	3	0.3°	27,000	17.7	0.0010	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.0006	0.0008	27,000	7.9	0.0004	0.0004
0.20	0.5°	4	0.3°	27,000	17.7	0.0008	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.0006	0.0008	27,000	7.9	0.0004	0.0004
0.20	0.5°	5	0.3°	27,000	15.7	0.0006	0.0020	27,000	11.8	0.0002	0.0006	27,000	7.9	0.0002	0.0005	27,000	7.9	0.0002	0.0004
0.20	0.5°	6	0.3°	27,000	11.8	0.0004	0.0012	27,000	11.8	0.0002	0.0006	27,000	7.9	0.0002	0.0005	27,000	7.9	0.0002	0.0004
0.20	1°	4	0.3°	27,000	17.7	0.0010	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.0006	0.0008	27,000	7.9	0.0004	0.0004
0.20	1°	5	0.3°	27,000	17.7	0.0008	0.0020	27,000	11.8	0.0006	0.0010	27,000	7.9	0.0006	0.0008	27,000	7.9	0.0004	0.0004
0.20	1°	6	0.3°	27,000	15.7	0.0006	0.0020	27,000	11.8	0.0002	0.0006	27,000	7.9	0.0002	0.0005	27,000	7.9	0.0002	0.0004
0.25	0.5°	4	0.3°	32,000	23.6	0.0016	0.0020	32,000	15.7	0.0008	0.0010	32,000	11.8	0.0008	0.0008	32,000	11.8	0.0004	0.0006
0.25	0.5°	6	0.3°	27,000	17.7	0.0016	0.0020	20,000	7.9	0.0008	0.0010	20,000	5.9	0.0008	0.0008	20,000	5.9	0.0004	0.0004
0.25	0.5°	8	0.3°	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0004	0.0006	20,000	5.9	0.0004	0.0004	20,000	5.9	0.0004	0.0004
0.25	0.5°	10	0.3°	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0004	0.0006	20,000	5.9	0.0004	0.0004	20,000	5.9	0.0002	0.0004
0.25	1°	4	0.3°	32,000	23.6	0.0016	0.0020	32,000	15.7	0.0008	0.0010	32,000	11.8	0.0008	0.0008	32,000	11.8	0.0004	0.0004
0.25	1°	6	0.3°	27,000	17.7	0.0016	0.0020	32,000	15.7	0.0008	0.0010	32,000	11.8	0.0008	0.0008	32,000	11.8	0.0004	0.0004
0.25	1°	8	0.3°	27,000	17.7	0.0016	0.0020	20,000	7.9	0.0008	0.0010	20,000	5.9	0.0008	0.0008	20,000	5.9	0.0004	0.0004
0.25	1°	10	0.3°	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0008	0.0010	20,000	5.9	0.0008	0.0008	20,000	5.9	0.0004	0.0004
0.25	1°	12	0.3°	21,000	11.8	0.0008	0.0012	20,000	7.9	0.0004	0.0006	20,000	5.9	0.0004	0.0004	20,000	5.9	0.0004	0.0004
0.30	0.5°	2	0.3°	32,000	26.6	0.0018	0.0047	32,000	17.7	0.0012	0.0024	32,000	11.8	0.0012	0.0020	32,000	11.8	0.0012	0.0012
0.30	0.5°	4	0.3°	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.0012	0.0020	24,000	7.9	0.0012	0.0012
0.30	0.5°	6	0.3°	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.0012	0.0016	24,000	7.9	0.0008	0.0008
0.30	0.5°	8	0.3°	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0012	0.0016	20,000	5.9	0.0008	0.0008
0.30	0.5°	10	0.3°	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0012	0.0016	20,000	5.9	0.0008	0.0008
0.30	0.5°	12	0.3°	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0008	0.0016	20,000	5.9	0.0004	0.0004
0.30	0.5°	16	0.3°	20,000	5.9	0.0010	0.0020	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0004	0.0016	20,000	5.9	0.0004	0.0004
0.30	1°	4	0.3°	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.0012	0.0020	24,000	7.9	0.0012	0.0012
0.30	1°	6	0.3°	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.0012	0.0016	24,000	7.9	0.0008	0.0008
0.30	1°	8	0.3°	30,000	14.8	0.0018	0.0047	25,000	9.8	0.0012	0.0024	24,000	7.9	0.0012	0.0016	24,000	7.9	0.0008	0.0008
0.30	1°	10	0.3°	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0012	0.0016	20,000	5.9	0.0008	0.0008
0.30	1°	12	0.3°	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0012	0.0016	20,000	5.9	0.0008	0.0008
0.30	1°	16	0.3°	25,000	8.9	0.0018	0.0047	20,000	5.9	0.0012	0.0024	20,000	5.9	0.0012	0.0016	20,000	5.9	0.0008	0.0008
0.40	0.5°	4	0.3°	27,000	26.6	0.0024	0.0063	23,000	17.7	0.0016	0.0031	21,000	11.8	0.0016	0.0024	21,000	11.8	0.0016	0.0031
0.40	0.5°	6	0.3°	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.0016	0.0020	19,000	7.9	0.0012	0.0020
0.40	0.5°	8	0.3°	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.0016	0.0020	19,000	7.9	0.0012	0.0020
0.40	0.5°	12	0.3°	22,000	8.9	0.0024	0.0047	19,000	5.9	0.0016	0.0024	17,000	5.9	0.0016	0.0020	17,000	5.9	0.0008	0.0020
0.40	1°	8	0.3°	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.0016	0.0020	19,000	7.9	0.0012	0.0020
0.40	1°	12	0.3°	24,000	14.8	0.0024	0.0047	21,000	9.8	0.0016	0.0024	19,000	7.9	0.0016	0.0020	19,000	7.9	0.0008	0.0020

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

Standard Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	66~464 SFM	66~340 SFM	66~279 SFM	
Depth of Cut				

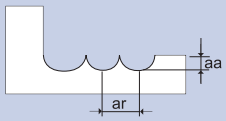
R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
0.40	1°	16	0.3°	22,000	8.9	0.0024	0.0047	19,000	5.9	0.0016	0.0024	17,000	5.9	0.0016	0.0020	17,000	5.9	0.0008	0.0008
0.50	0.5°	6	0.3°	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.0020	0.0031	21,000	11.8	0.0020	0.0020
0.50	0.5°	8	0.3°	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.0020	0.0031	21,000	11.8	0.0020	0.0020
0.50	0.5°	10	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	0.5°	12	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	0.5°	16	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0010
0.50	0.5°	18	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0010
0.50	0.5°	20	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0010
0.50	0.5°	25	0.3°	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.0012	0.0016	10,000	5.9	0.0004	0.0006
0.50	0.5°	30	0.3°	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.0012	0.0016	10,000	5.9	0.0004	0.0006
0.50	0.5°	35	0.3°	13,000	11.8	0.0016	0.0047	13,000	7.9	0.0004	0.0020	10,000	5.9	0.0004	0.0016	10,000	5.9	0.0002	0.0006
0.50	1°	10	0.3°	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.0020	0.0031	21,000	11.8	0.0020	0.0020
0.50	1°	16	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	1°	20	0.3°	21,000	17.7	0.0030	0.0059	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0008
0.50	1°	25	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0008
0.50	1°	30	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0006
0.50	1°	35	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0006
0.50	1°	40	0.3°	18,000	11.8	0.0024	0.0047	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0006
0.50	1°	50	0.3°	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.0012	0.0016	10,000	5.9	0.0004	0.0006
0.50	1°	60	0.3°	16,000	11.8	0.0024	0.0047	13,000	7.9	0.0012	0.0020	10,000	5.9	0.0012	0.0016	10,000	5.9	0.0004	0.0006
0.50	1°	70	0.3°	12,000	11.8	0.0024	0.0047	13,000	7.9	0.0008	0.0020	10,000	5.9	0.0008	0.0016	10,000	5.9	0.0004	0.0006
0.50	1.5°	8	0.3°	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.0020	0.0031	21,000	11.8	0.0020	0.0020
0.50	1.5°	10	0.3°	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.0020	0.0031	21,000	11.8	0.0020	0.0020
0.50	1.5°	12	0.3°	28,000	29.5	0.0030	0.0079	25,000	19.7	0.0020	0.0039	21,000	11.8	0.0020	0.0031	21,000	11.8	0.0020	0.0020
0.50	1.5°	16	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	1.5°	20	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	1.5°	25	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	1.5°	30	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.50	1.5°	35	0.3°	21,000	17.7	0.0030	0.0059	17,000	7.9	0.0012	0.0020	14,000	5.9	0.0012	0.0016	14,000	5.9	0.0004	0.0008
0.50	2°	45	0.3°	21,000	17.7	0.0030	0.0059	19,000	11.8	0.0020	0.0039	16,000	7.9	0.0020	0.0031	16,000	7.9	0.0020	0.0020
0.60	0.5°	12	0.3°	20,000	17.7	0.0035	0.0094	17,000	11.8	0.0024	0.0047	14,000	7.9	0.0024	0.0039	14,000	7.9	0.0024	0.0024
0.60	0.5°	25	0.3°	16,000	11.8	0.0035	0.0071	14,000	7.9	0.0024	0.0035	11,000	5.9	0.0024	0.0028	11,000	5.9	0.0008	0.0012
0.60	1°	12	0.3°	20,000	17.7	0.0035	0.0094	17,000	11.8	0.0024	0.0047	14,000	7.9	0.0024	0.0039	14,000	7.9	0.0024	0.0024
0.60	1°	25	0.3°	16,000	11.8	0.0035	0.0094	14,000	7.9	0.0024	0.0035	11,000	5.9	0.0024	0.0028	11,000	5.9	0.0008	0.0012
0.60	1.5°	12	0.3°	20,000	23.6	0.0035	0.0094	17,000	17.7	0.0024	0.0047	14,000	11.8	0.0024	0.0039	14,000	11.8	0.0024	0.0024
0.60	1.5°	25	0.3°	20,000	17.7	0.0035	0.0094	17,000	11.8	0.0024	0.0047	14,000	7.9	0.0024	0.0039	14,000	7.9	0.0024	0.0024
0.75	0.5°	8	0.3°	18,000	29.5	0.0055	0.0118	15,000	19.7	0.0031	0.0059	12,000	13.8	0.0031	0.0059	12,000	11.8	0.0031	0.0059
0.75	0.5°	10	0.3°	17,000	17.7	0.0055	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	0.5°	12	0.3°	17,000	17.7	0.0047	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	0.5°	16	0.3°	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.0031	0.0039	12,000	9.8	0.0030	0.0039
0.75	0.5°	20	0.3°	13,000	11.8	0.0047	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0020	0.0039
0.75	0.5°	25	0.3°	13,000	11.8	0.0047	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0020	0.0039
0.75	0.5°	30	0.3°	13,000	11.8	0.0047	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0014	0.0039
0.75	0.5°	35	0.3°	13,000	11.8	0.0035	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0012	0.0039
0.75	1°	10	0.3°	18,000	29.5	0.0055	0.0118	15,000	19.7	0.0031	0.0059	12,000	13.8	0.0031	0.0059	12,000	11.8	0.0031	0.0059
0.75	1°	12	0.3°	17,000	17.7	0.0055	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	1°	16	0.3°	17,000	17.7	0.0047	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	1°	20	0.3°	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.0031	0.0039	12,000	9.8	0.0030	0.0039

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

Standard Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	66~464 SFM	66~340 SFM	66~279 SFM	
Depth of Cut				

R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
0.75	1°	25	0.3°	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.0031	0.0039	12,000	9.8	0.0020	0.0039
0.75	1°	30	0.3°	13,000	11.8	0.0035	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0012	0.0039
0.75	1°	35	0.3°	13,000	11.8	0.0035	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0008	0.0039
0.75	1.5°	10	0.3°	18,000	29.5	0.0047	0.0118	15,000	19.7	0.0031	0.0059	12,000	13.8	0.0031	0.0059	12,000	11.8	0.0031	0.0059
0.75	1.5°	12	0.3°	17,000	17.7	0.0047	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	1.5°	16	0.3°	17,000	17.7	0.0047	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	1.5°	20	0.3°	17,000	17.7	0.0047	0.0118	15,000	11.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059	12,000	9.8	0.0031	0.0059
0.75	1.5°	25	0.3°	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.0031	0.0039	12,000	9.8	0.0030	0.0039
0.75	1.5°	30	0.3°	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.0031	0.0039	12,000	9.8	0.0030	0.0039
0.75	1.5°	35	0.3°	13,000	11.8	0.0030	0.0079	12,000	7.9	0.0024	0.0039	9,500	5.9	0.0024	0.0039	9,500	5.9	0.0020	0.0039
0.75	2°	38.6	0.3°	17,000	17.7	0.0047	0.0094	15,000	11.8	0.0031	0.0047	12,000	9.8	0.0031	0.0039	12,000	9.8	0.0030	0.0039
1.00	0.5°	8	0.3°	16,500	41.3	0.0079	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.0039	0.0110	13,500	19.7	0.0039	0.0079
1.00	0.5°	10	0.3°	16,500	41.3	0.0079	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.0039	0.0110	13,500	19.7	0.0039	0.0079
1.00	0.5°	12	0.3°	16,500	41.3	0.0079	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.0039	0.0110	13,500	19.7	0.0039	0.0079
1.00	0.5°	16	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	0.5°	20	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	0.5°	25	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	0.5°	30	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	0.5°	35	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	0.5°	40	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	1°	16	0.3°	16,500	41.3	0.0079	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.0039	0.0110	13,500	19.7	0.0039	0.0079
1.00	1°	20	0.3°	14,000	29.5	0.0079	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	1°	25	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	1°	30	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0031	0.0039
1.00	1°	35	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0031	0.0039
1.00	1°	40	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	1°	50	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	1°	60	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	1°	70	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	1.5°	16	0.3°	16,500	41.3	0.0079	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.0039	0.0110	13,500	19.7	0.0039	0.0079
1.00	1.5°	20	0.3°	16,500	41.3	0.0079	0.0220	16,500	27.6	0.0039	0.0110	13,500	19.7	0.0039	0.0110	13,500	19.7	0.0039	0.0079
1.00	1.5°	25	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	1.5°	30	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	1.5°	35	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.00	1.5°	41.5	0.3°	11,000	14.8	0.0059	0.0165	10,000	9.8	0.0039	0.0083	8,000	7.9	0.0039	0.0071	8,000	7.9	0.0024	0.0039
1.00	2°	31.5	0.3°	14,000	29.5	0.0059	0.0220	13,000	19.7	0.0039	0.0110	10,000	11.8	0.0039	0.0110	10,000	11.8	0.0039	0.0079
1.50	0.5°	8	0.3°	15,000	47.2	0.0079	0.0331	9,500	31.5	0.0059	0.0165	7,500	23.6	0.0059	0.0165	7,500	23.6	0.0059	0.0118
1.50	0.5°	10	0.3°	15,000	47.2	0.0079	0.0331	9,500	31.5	0.0059	0.0165	7,500	23.6	0.0059	0.0165	7,500	23.6	0.0059	0.0118
1.50	0.5°	12	0.3°	12,000	35.4	0.0079	0.0331	9,500	23.6	0.0059	0.0165	7,500	15.7	0.0059	0.0142	7,500	15.7	0.0059	0.0118
1.50	0.5°	16	0.3°	10,000	35.4	0.0079	0.0331	9,500	23.6	0.0059	0.0165	7,500	15.7	0.0059	0.0142	7,500	15.7	0.0059	0.0118
1.50	0.5°	20	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	0.5°	25	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	0.5°	30	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0118	6,500	9.8	0.0035	0.0059
1.50	0.5°	35	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0118	6,500	9.8	0.0035	0.0059
1.50	0.5°	40	0.3°	9,000	14.8	0.0079	0.0331	7,500	9.8	0.0059	0.0165	6,000	7.9	0.0059	0.0118	6,000	7.9	0.0035	0.0059
1.50	0.5°	50	0.3°	9,000	14.8	0.0079	0.0331	7,500	9.8	0.0059	0.0165	6,000	7.9	0.0059	0.0118	6,000	7.9	0.0035	0.0059
1.50	1°	20	0.3°	10,000	35.4	0.0079	0.0331	9,500	23.6	0.0059	0.0165	7,500	15.7	0.0059	0.0142	7,500	15.7	0.0059	0.0118
1.50	1°	25	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

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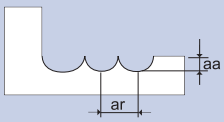
List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

Standard Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	66~464 SFM	66~340 SFM	66~279 SFM	
Depth of Cut				

R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
1.50	1°	30	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	1°	35	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0118	6,500	9.8	0.0035	0.0059
1.50	1°	40	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0118	6,500	9.8	0.0035	0.0059
1.50	1°	50	0.3°	9,000	14.8	0.0079	0.0331	7,500	9.8	0.0059	0.0165	6,000	7.9	0.0059	0.0118	6,000	7.9	0.0035	0.0059
1.50	1°	60	0.3°	9,000	14.8	0.0079	0.0331	7,500	9.8	0.0059	0.0165	6,000	7.9	0.0059	0.0118	6,000	7.9	0.0035	0.0059
1.50	1°	70	0.3°	9,000	14.8	0.0079	0.0331	7,500	9.8	0.0059	0.0165	6,000	7.9	0.0059	0.0118	6,000	7.9	0.0035	0.0059
1.50	1.5°	20	0.3°	10,000	35.4	0.0118	0.0331	9,500	23.6	0.0059	0.0165	7,500	15.7	0.0059	0.0142	7,500	15.7	0.0059	0.0118
1.50	1.5°	25	0.3°	10,000	17.7	0.0098	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	1.5°	30	0.3°	10,000	17.7	0.0098	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	1.5°	35	0.3°	10,000	17.7	0.0098	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	1.5°	40	0.3°	10,000	17.7	0.0098	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
1.50	1.5°	50	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0118	6,500	9.8	0.0035	0.0059
1.50	1.5°	62.5	0.3°	10,000	17.7	0.0079	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0118	6,500	9.8	0.0035	0.0059
1.50	1.5°	47.5	0.3°	10,000	17.7	0.0098	0.0331	8,500	11.8	0.0059	0.0165	6,500	9.8	0.0059	0.0142	6,500	9.8	0.0059	0.0118
2.00	1°	20	0.5°	9,000	35.4	0.0197	0.0504	7,500	23.6	0.0079	0.0252	6,000	15.7	0.0079	0.0236	6,000	15.7	0.0079	0.0157
2.00	1°	30	0.5°	7,000	23.6	0.0197	0.0504	6,000	15.7	0.0079	0.0252	5,000	9.8	0.0079	0.0236	5,000	9.8	0.0079	0.0157
2.00	1°	40	0.5°	7,000	23.6	0.0157	0.0504	6,000	15.7	0.0079	0.0252	5,000	9.8	0.0079	0.0220	5,000	9.8	0.0047	0.0118
2.00	1°	50	0.5°	7,000	23.6	0.0157	0.0504	6,000	15.7	0.0079	0.0252	5,000	9.8	0.0079	0.0220	5,000	9.8	0.0047	0.0079
2.00	1°	60	0.5°	5,000	14.8	0.0138	0.0504	5,000	9.8	0.0079	0.0252	4,000	7.9	0.0079	0.0220	4,000	7.9	0.0047	0.0079
2.00	1.5°	44.2	0.5°	7,000	23.6	0.0197	0.0504	6,000	15.7	0.0079	0.0252	5,000	9.8	0.0079	0.0236	5,000	9.8	0.0079	0.0157
2.00	2°	34	0.5°	7,000	23.6	0.0197	0.0504	6,000	15.7	0.0079	0.0252	5,000	9.8	0.0079	0.0236	5,000	9.8	0.0079	0.0197
2.50	1°	30	0.5°	7,000	29.5	0.0236	0.0709	6,500	19.7	0.0098	0.0354	5,000	15.7	0.0098	0.0276	5,000	15.7	0.0098	0.0197
2.50	1°	40	0.5°	6,000	29.5	0.0236	0.0709	5,000	19.7	0.0098	0.0354	4,000	9.8	0.0098	0.0276	4,000	9.8	0.0098	0.0197
2.50	1°	60	0.5°	5,000	23.6	0.0157	0.0709	4,000	15.7	0.0098	0.0354	4,000	7.9	0.0098	0.0236	4,000	7.9	0.0079	0.0098
2.50	1.5°	26.9	0.5°	9,000	53.1	0.0236	0.0709	6,500	35.4	0.0098	0.0354	5,000	29.5	0.0098	0.0276	5,000	29.5	0.0098	0.0197
2.50	1.5°	65.1	0.5°	6,000	29.5	0.0236	0.0709	5,000	19.7	0.0098	0.0354	4,000	9.8	0.0098	0.0276	4,000	9.8	0.0098	0.0197
2.50	2°	50.1	0.5°	6,000	29.5	0.0236	0.0709	5,000	19.7	0.0098	0.0354	4,000	9.8	0.0098	0.0276	4,000	9.8	0.0098	0.0197
3.00	1°	30	0.5°	7,000	47.2	0.0295	0.0945	5,500	31.5	0.0118	0.0472	4,500	23.6	0.0118	0.0378	4,500	23.6	0.0118	0.0236
3.00	1°	40	0.5°	5,000	23.6	0.0295	0.0945	4,000	15.7	0.0118	0.0472	4,000	11.8	0.0118	0.0378	4,000	11.8	0.0118	0.0236
3.00	1°	50	0.5°	5,000	23.6	0.0236	0.0945	4,000	15.7	0.0118	0.0472	4,000	11.8	0.0118	0.0378	4,000	11.8	0.0118	0.0236
3.00	1°	60	0.5°	5,000	23.6	0.0236	0.0945	4,000	15.7	0.0118	0.0472	4,000	11.8	0.0118	0.0378	4,000	11.8	0.0118	0.0236
3.00	1°	70	0.5°	5,000	23.6	0.0236	0.0945	4,000	15.7	0.0118	0.0472	4,000	11.8	0.0118	0.0378	4,000	11.8	0.0118	0.0118
3.00	1°	80	0.5°	5,000	23.6	0.0177	0.0945	4,000	15.7	0.0079	0.0472	4,000	11.8	0.0079	0.0378	4,000	11.8	0.0079	0.0118
3.00	1.5°	49	0.5°	5,000	23.6	0.0236	0.0945	4,000	15.7	0.0118	0.0472	4,000	11.8	0.0118	0.0378	4,000	11.8	0.0118	0.0236
3.00	2°	36	0.5°	7,000	47.2	0.0295	0.0945	5,500	31.5	0.0118	0.0472	4,500	23.6	0.0118	0.0378	4,500	23.6	0.0118	0.0236

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

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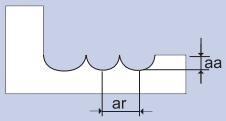
List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

High Speed Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	103~1031 SFM	78~928 SFM		76~774 SFM
Depth of Cut				

R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
0.10	0.5°	1	0.3°	50,000	17.3	0.0003	0.0004	50,000	14.2	0.0002	0.0002	50,000	13.4	0.0002	0.0002	50,000	13.4	0.0002	0.0002
0.10	0.5°	1.5	0.3°	50,000	17.3	0.0003	0.0004	50,000	14.2	0.0002	0.0002	50,000	13.4	0.0002	0.0002	50,000	13.4	0.0002	0.0002
0.10	0.5°	2	0.3°	50,000	14.2	0.0003	0.0004	45,000	11.8	0.0002	0.0002	45,000	11.0	0.0002	0.0002	45,000	11.0	0.0002	0.0002
0.10	0.5°	2.5	0.3°	50,000	12.6	0.0003	0.0004	38,000	9.1	0.0002	0.0002	38,000	8.3	0.0002	0.0002	37,000	7.9	0.0002	0.0002
0.10	0.5°	3	0.3°	50,000	9.8	0.0003	0.0004	38,000	7.9	0.0002	0.0002	38,000	7.1	0.0002	0.0002	37,000	5.9	0.0001	0.0002
0.10	1°	3.5	0.3°	50,000	17.3	0.0003	0.0004	50,000	14.2	0.0002	0.0002	50,000	13.4	0.0002	0.0002	50,000	13.4	0.0002	0.0002
0.10	1°	4	0.3°	50,000	14.2	0.0003	0.0004	45,000	11.8	0.0002	0.0002	45,000	11.0	0.0002	0.0002	45,000	11.0	0.0002	0.0002
0.10	1°	4.5	0.3°	50,000	12.6	0.0003	0.0004	38,000	9.1	0.0002	0.0002	38,000	8.3	0.0002	0.0002	37,000	7.9	0.0002	0.0002
0.15	0.5°	2	0.3°	50,000	28.7	0.0003	0.0008	50,000	23.6	0.0002	0.0004	50,000	22.4	0.0002	0.0004	50,000	22.4	0.0002	0.0002
0.15	0.5°	3	0.3°	50,000	22.8	0.0003	0.0004	45,000	18.9	0.0002	0.0002	45,000	17.7	0.0002	0.0002	45,000	17.7	0.0002	0.0002
0.15	1°	3	0.3°	50,000	24.0	0.0003	0.0008	47,000	20.1	0.0002	0.0004	47,000	18.9	0.0002	0.0004	47,000	18.9	0.0002	0.0002
0.15	1°	4	0.3°	50,000	22.8	0.0003	0.0004	45,000	18.9	0.0002	0.0002	45,000	17.7	0.0002	0.0002	45,000	17.7	0.0002	0.0002
0.20	0.5°	2	0.3°	50,000	38.2	0.0006	0.0016	50,000	31.5	0.0004	0.0008	50,000	29.9	0.0004	0.0008	50,000	29.9	0.0004	0.0004
0.20	0.5°	3	0.3°	50,000	26.4	0.0005	0.0012	45,000	21.7	0.0003	0.0006	45,000	20.5	0.0003	0.0006	45,000	20.5	0.0003	0.0004
0.20	0.5°	4	0.3°	48,000	21.3	0.0003	0.0008	43,000	19.7	0.0002	0.0004	43,000	18.5	0.0002	0.0004	43,000	18.5	0.0002	0.0004
0.20	0.5°	5	0.3°	45,000	18.9	0.0003	0.0008	40,000	16.5	0.0002	0.0004	40,000	15.7	0.0002	0.0004	40,000	15.7	0.0002	0.0004
0.20	0.5°	6	0.3°	40,000	15.7	0.0003	0.0004	36,000	14.6	0.0002	0.0002	36,000	13.8	0.0002	0.0002	35,000	13.4	0.0002	0.0002
0.20	1°	4	0.3°	50,000	26.4	0.0005	0.0012	45,000	21.7	0.0003	0.0006	45,000	20.5	0.0003	0.0006	45,000	20.5	0.0003	0.0004
0.20	1°	5	0.3°	48,000	21.3	0.0003	0.0008	43,000	19.7	0.0002	0.0004	43,000	18.5	0.0002	0.0004	43,000	18.5	0.0002	0.0004
0.20	1°	6	0.3°	45,000	18.9	0.0003	0.0008	40,000	16.5	0.0002	0.0004	40,000	15.7	0.0002	0.0004	40,000	15.7	0.0002	0.0004
0.25	0.5°	4	0.3°	50,000	47.2	0.0006	0.0016	48,000	35.4	0.0004	0.0008	48,000	33.5	0.0004	0.0008	48,000	33.5	0.0004	0.0006
0.25	0.5°	6	0.3°	38,000	37.0	0.0006	0.0008	38,000	19.7	0.0004	0.0004	38,000	18.5	0.0004	0.0004	38,000	18.5	0.0004	0.0004
0.25	0.5°	8	0.3°	30,000	29.9	0.0003	0.0008	30,000	15.7	0.0002	0.0004	30,000	15.0	0.0002	0.0004	29,000	14.2	0.0002	0.0004
0.25	0.5°	10	0.3°	30,000	19.7	0.0002	0.0008	30,000	15.7	0.0002	0.0004	30,000	11.8	0.0002	0.0004	29,000	9.8	0.0002	0.0004
0.25	1°	4	0.3°	50,000	47.2	0.0006	0.0016	48,000	35.4	0.0004	0.0008	48,000	33.5	0.0004	0.0008	48,000	33.5	0.0004	0.0004
0.25	1°	6	0.3°	50,000	47.2	0.0006	0.0016	48,000	35.4	0.0004	0.0008	48,000	33.5	0.0004	0.0008	48,000	33.5	0.0004	0.0004
0.25	1°	8	0.3°	50,000	47.2	0.0006	0.0016	48,000	35.4	0.0004	0.0008	48,000	33.5	0.0004	0.0008	48,000	33.5	0.0004	0.0004
0.25	1°	10	0.3°	30,000	29.9	0.0003	0.0008	30,000	15.7	0.0002	0.0004	30,000	15.0	0.0002	0.0004	29,000	14.2	0.0002	0.0004
0.25	1°	12	0.3°	30,000	29.9	0.0003	0.0008	30,000	15.7	0.0002	0.0004	30,000	15.0	0.0002	0.0004	29,000	14.2	0.0002	0.0004
0.30	0.5°	2	0.3°	50,000	61.0	0.0012	0.0024	50,000	47.2	0.0008	0.0012	50,000	43.3	0.0008	0.0012	50,000	43.3	0.0008	0.0012
0.30	0.5°	4	0.3°	50,000	53.1	0.0012	0.0024	45,000	39.4	0.0008	0.0012	45,000	37.4	0.0008	0.0012	45,000	37.4	0.0008	0.0012
0.30	0.5°	6	0.3°	35,000	37.8	0.0006	0.0016	30,000	26.8	0.0004	0.0008	30,000	25.2	0.0004	0.0008	30,000	25.2	0.0004	0.0008
0.30	0.5°	8	0.3°	30,000	28.3	0.0006	0.0016	26,000	23.6	0.0004	0.0008	26,000	22.4	0.0004	0.0008	25,000	21.3	0.0004	0.0008
0.30	0.5°	10	0.3°	30,000	19.7	0.0006	0.0016	26,000	18.9	0.0004	0.0008	26,000	17.7	0.0004	0.0008	25,000	15.0	0.0004	0.0008
0.30	0.5°	12	0.3°	30,000	19.7	0.0004	0.0016	26,000	18.9	0.0003	0.0008	26,000	17.7	0.0003	0.0008	25,000	15.0	0.0003	0.0004
0.30	0.5°	16	0.3°	30,000	15.7	0.0003	0.0016	26,000	15.0	0.0002	0.0008	26,000	14.2	0.0002	0.0008	25,000	11.8	0.0002	0.0004
0.30	1°	4	0.3°	50,000	53.1	0.0012	0.0024	45,000	39.4	0.0008	0.0012	45,000	37.4	0.0008	0.0012	45,000	37.4	0.0008	0.0012
0.30	1°	6	0.3°	35,000	37.8	0.0006	0.0016	30,000	26.8	0.0004	0.0008	30,000	25.2	0.0004	0.0008	30,000	25.2	0.0004	0.0008
0.30	1°	8	0.3°	35,000	37.8	0.0006	0.0016	30,000	26.8	0.0004	0.0008	30,000	25.2	0.0004	0.0008	30,000	25.2	0.0004	0.0008
0.30	1°	10	0.3°	30,000	28.3	0.0006	0.0016	26,000	23.6	0.0004	0.0008	26,000	22.4	0.0004	0.0008	25,000	21.3	0.0004	0.0008
0.30	1°	12	0.3°	30,000	28.3	0.0006	0.0016	26,000	23.6	0.0004	0.0008	26,000	22.4	0.0004	0.0008	25,000	21.3	0.0004	0.0008
0.30	1°	16	0.3°	30,000	19.7	0.0006	0.0016	26,000	18.9	0.0004	0.0008	26,000	17.7	0.0004	0.0008	25,000	15.0	0.0004	0.0008
0.40	0.5°	4	0.3°	50,000	68.9	0.0024	0.0063	48,000	63.0	0.0016	0.0031	48,000	59.1	0.0016	0.0024	48,000	59.1	0.0016	0.0016
0.40	0.5°	6	0.3°	43,000	63.0	0.0018	0.0039	34,000	37.4	0.0012	0.0020	34,000	35.4	0.0012	0.0020	34,000	35.4	0.0008	0.0010
0.40	0.5°	8	0.3°	32,000	49.2	0.0018	0.0039	30,000	31.5	0.0012	0.0020	30,000	29.9	0.0012	0.0020	30,000	29.9	0.0008	0.0010
0.40	0.5°	12	0.3°	24,000	28.3	0.0004	0.0016	23,000	17.7	0.0002	0.0004	23,000	16.5	0.0002	0.0004	23,000	16.5	0.0002	0.0010
0.40	1°	8	0.3°	43,000	63.0	0.0018	0.0039	34,000	37.4	0.0012	0.0020	34,000	35.4	0.0012	0.0020	34,000	35.4	0.0008	0.0010
0.40	1°	12	0.3°	32,000	49.2	0.0018	0.0039	30,000	31.5	0.0012	0.0020	30,000	29.9	0.0012	0.0020	30,000	29.9	0.0008	0.0010

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

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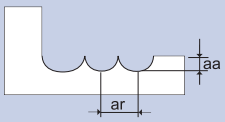
List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

High Speed Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	103~1031 SFM	78~928 SFM		76~774 SFM
Depth of Cut				

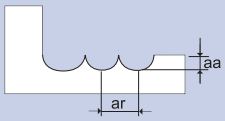
R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
0.40	1°	16	0.3°	24,000	28.3	0.0004	0.0016	23,000	17.7	0.0002	0.0004	23,000	16.5	0.0002	0.0004	23,000	16.5	0.0002	0.0006
0.50	0.5°	6	0.3°	47,000	112.2	0.0030	0.0079	36,000	90.6	0.0020	0.0039	36,000	82.7	0.0020	0.0031	36,000	82.7	0.0020	0.0020
0.50	0.5°	8	0.3°	30,000	92.5	0.0030	0.0059	27,000	66.9	0.0020	0.0039	27,000	63.0	0.0020	0.0031	27,000	63.0	0.0020	0.0020
0.50	0.5°	10	0.3°	27,000	78.7	0.0030	0.0059	26,000	63.0	0.0020	0.0039	26,000	59.1	0.0020	0.0031	26,000	59.1	0.0020	0.0020
0.50	0.5°	12	0.3°	24,000	55.1	0.0006	0.0016	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0020	21,000	37.4	0.0004	0.0008
0.50	0.5°	16	0.3°	24,000	39.4	0.0006	0.0016	22,000	30.3	0.0004	0.0008	22,000	27.6	0.0004	0.0008	21,000	26.8	0.0004	0.0008
0.50	0.5°	18	0.3°	24,000	39.4	0.0004	0.0016	22,000	30.3	0.0003	0.0008	22,000	27.6	0.0003	0.0008	21,000	26.8	0.0003	0.0008
0.50	0.5°	20	0.3°	24,000	39.4	0.0004	0.0012	22,000	30.3	0.0003	0.0006	22,000	27.6	0.0003	0.0006	21,000	26.8	0.0003	0.0006
0.50	0.5°	25	0.3°	20,000	31.5	0.0004	0.0012	18,000	23.6	0.0003	0.0006	18,000	18.9	0.0003	0.0006	17,000	21.7	0.0003	0.0006
0.50	0.5°	30	0.3°	20,000	31.5	0.0003	0.0012	18,000	23.6	0.0002	0.0006	18,000	18.9	0.0002	0.0006	17,000	21.7	0.0002	0.0006
0.50	0.5°	35	0.3°	15,000	21.7	0.0002	0.0012	14,000	17.7	0.0002	0.0004	12,000	15.7	0.0002	0.0004	11,000	13.8	0.0002	0.0004
0.50	1°	10	0.3°	30,000	92.5	0.0030	0.0059	27,000	66.9	0.0020	0.0039	27,000	63.0	0.0020	0.0020	27,000	63.0	0.0020	0.0020
0.50	1°	16	0.3°	24,000	55.1	0.0006	0.0016	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0008	21,000	37.4	0.0004	0.0008
0.50	1°	20	0.3°	24,000	39.4	0.0006	0.0016	22,000	30.3	0.0004	0.0008	22,000	27.6	0.0004	0.0008	21,000	26.8	0.0004	0.0006
0.50	1°	25	0.3°	24,000	39.4	0.0006	0.0016	22,000	30.3	0.0004	0.0008	22,000	27.6	0.0004	0.0008	21,000	26.8	0.0004	0.0006
0.50	1°	30	0.3°	24,000	39.4	0.0004	0.0016	22,000	30.3	0.0003	0.0008	22,000	27.6	0.0003	0.0008	21,000	26.8	0.0003	0.0006
0.50	1°	35	0.3°	24,000	39.4	0.0004	0.0012	22,000	30.3	0.0003	0.0006	22,000	27.6	0.0003	0.0006	21,000	26.8	0.0003	0.0006
0.50	1°	40	0.3°	22,000	39.4	0.0004	0.0012	20,000	30.3	0.0003	0.0006	20,000	27.6	0.0003	0.0006	19,000	26.8	0.0003	0.0006
0.50	1°	50	0.3°	20,000	31.5	0.0004	0.0012	18,000	23.6	0.0003	0.0006	18,000	18.9	0.0003	0.0006	17,000	21.7	0.0003	0.0004
0.50	1°	60	0.3°	18,000	31.5	0.0003	0.0012	16,000	23.6	0.0002	0.0006	16,000	18.9	0.0002	0.0006	15,000	21.7	0.0002	0.0006
0.50	1°	70	0.3°	15,000	23.6	0.0002	0.0012	14,000	18.9	0.0002	0.0006	13,000	15.0	0.0002	0.0006	12,000	17.7	0.0002	0.0006
0.50	1.5°	8	0.3°	47,000	112.2	0.0030	0.0079	36,000	90.6	0.0020	0.0039	36,000	82.7	0.0020	0.0031	36,000	82.7	0.0020	0.0020
0.50	1.5°	10	0.3°	30,000	92.5	0.0030	0.0059	27,000	66.9	0.0020	0.0039	27,000	63.0	0.0020	0.0031	27,000	63.0	0.0020	0.0020
0.50	1.5°	12	0.3°	30,000	92.5	0.0030	0.0059	27,000	66.9	0.0020	0.0039	27,000	63.0	0.0020	0.0031	27,000	63.0	0.0020	0.0020
0.50	1.5°	16	0.3°	24,000	55.1	0.0006	0.0016	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0008	21,000	37.4	0.0004	0.0008
0.50	1.5°	20	0.3°	24,000	55.1	0.0006	0.0016	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0008	21,000	37.4	0.0004	0.0008
0.50	1.5°	25	0.3°	24,000	55.1	0.0006	0.0016	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0008	21,000	37.4	0.0004	0.0008
0.50	1.5°	30	0.3°	24,000	39.4	0.0006	0.0016	22,000	30.3	0.0004	0.0008	22,000	27.6	0.0004	0.0008	21,000	26.8	0.0004	0.0008
0.50	1.5°	35	0.3°	24,000	39.4	0.0006	0.0016	22,000	30.3	0.0004	0.0008	22,000	27.6	0.0004	0.0008	21,000	26.8	0.0004	0.0008
0.50	2°	45	0.3°	24,000	55.1	0.0006	0.0016	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0008	21,000	37.4	0.0004	0.0008
0.60	0.5°	12	0.3°	30,000	78.7	0.0035	0.0083	25,000	66.9	0.0024	0.0047	25,000	63.0	0.0024	0.0039	25,000	63.0	0.0024	0.0024
0.60	0.5°	25	0.3°	24,000	39.4	0.0008	0.0016	22,000	30.3	0.0006	0.0008	22,000	27.6	0.0006	0.0008	21,000	26.8	0.0006	0.0012
0.60	1°	12	0.3°	30,000	86.6	0.0035	0.0083	25,000	78.7	0.0024	0.0047	25,000	78.7	0.0024	0.0039	25,000	74.8	0.0024	0.0024
0.60	1°	25	0.3°	30,000	78.7	0.0016	0.0083	25,000	66.9	0.0024	0.0035	25,000	63.0	0.0024	0.0020	25,000	63.0	0.0008	0.0012
0.60	1.5°	12	0.3°	30,000	86.6	0.0035	0.0083	25,000	78.7	0.0024	0.0047	25,000	78.7	0.0024	0.0039	25,000	74.8	0.0024	0.0024
0.60	1.5°	25	0.3°	30,000	78.7	0.0020	0.0083	25,000	66.9	0.0024	0.0047	25,000	63.0	0.0024	0.0039	25,000	63.0	0.0020	0.0024
0.75	0.5°	8	0.3°	32,000	118.1	0.0047	0.0118	30,000	114.2	0.0030	0.0059	30,000	106.3	0.0030	0.0047	30,000	106.3	0.0030	0.0039
0.75	0.5°	10	0.3°	30,000	104.3	0.0047	0.0118	24,000	90.6	0.0030	0.0059	24,000	82.7	0.0030	0.0047	24,000	82.7	0.0030	0.0039
0.75	0.5°	12	0.3°	30,000	94.5	0.0047	0.0118	24,000	78.7	0.0030	0.0059	24,000	74.8	0.0030	0.0047	24,000	74.8	0.0030	0.0039
0.75	0.5°	16	0.3°	24,000	55.1	0.0047	0.0079	21,000	55.1	0.0030	0.0039	21,000	51.2	0.0030	0.0035	21,000	51.2	0.0020	0.0024
0.75	0.5°	20	0.3°	22,000	55.1	0.0039	0.0079	18,000	47.2	0.0020	0.0039	18,000	43.3	0.0020	0.0028	17,000	43.3	0.0012	0.0012
0.75	0.5°	25	0.3°	22,000	43.3	0.0039	0.0079	18,000	39.4	0.0020	0.0039	18,000	35.4	0.0020	0.0028	17,000	35.4	0.0008	0.0012
0.75	0.5°	30	0.3°	22,000	43.3	0.0030	0.0079	18,000	39.4	0.0014	0.0039	18,000	35.4	0.0014	0.0028	17,000	35.4	0.0004	0.0012
0.75	0.5°	35	0.3°	20,000	39.4	0.0020	0.0079	17,000	354.3	0.0012	0.0039	17,000	31.5	0.0012	0.0028	15,000	31.5	0.0004	0.0012
0.75	1°	10	0.3°	32,000	118.1	0.0047	0.0118	30,000	114.2	0.0030	0.0059	30,000	106.3	0.0030	0.0047	30,000	106.3	0.0030	0.0039
0.75	1°	12	0.3°	30,000	104.3	0.0047	0.0118	24,000	90.6	0.0030	0.0059	24,000	82.7	0.0030	0.0047	24,000	82.7	0.0030	0.0039
0.75	1°	16	0.3°	30,000	94.5	0.0047	0.0118	24,000	78.7	0.0030	0.0059	24,000	74.8	0.0030	0.0047	24,000	74.8	0.0030	0.0039
0.75	1°	20	0.3°	24,000	55.1	0.0047	0.0079	21,000	55.1	0.0030	0.0039	21,000	51.2	0.0030	0.0035	21,000	51.2	0.0020	0.0024

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

High Speed Milling

Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	103~1031 SFM	78~928 SFM		76~774 SFM
Depth of Cut				

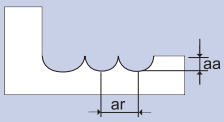
R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
0.75	1°	25	0.3°	22,000	55.1	0.0039	0.0079	18,000	47.2	0.0020	0.0039	18,000	43.3	0.0020	0.0035	17,000	43.3	0.0020	0.0024
0.75	1°	30	0.3°	22,000	55.1	0.0028	0.0079	18,000	47.2	0.0020	0.0039	18,000	43.3	0.0020	0.0028	17,000	43.3	0.0012	0.0012
0.75	1°	35	0.3°	22,000	43.3	0.0028	0.0079	18,000	39.4	0.0020	0.0039	18,000	35.4	0.0020	0.0028	17,000	35.4	0.0008	0.0012
0.75	1.5°	10	0.3°	32,000	118.1	0.0047	0.0118	30,000	114.2	0.0030	0.0059	30,000	106.3	0.0030	0.0047	30,000	106.3	0.0030	0.0039
0.75	1.5°	12	0.3°	32,000	118.1	0.0047	0.0118	30,000	114.2	0.0030	0.0059	30,000	106.3	0.0030	0.0047	30,000	106.3	0.0030	0.0039
0.75	1.5°	16	0.3°	30,000	94.5	0.0047	0.0118	24,000	78.7	0.0030	0.0059	24,000	74.8	0.0030	0.0047	24,000	74.8	0.0030	0.0039
0.75	1.5°	20	0.3°	30,000	94.5	0.0047	0.0118	24,000	78.7	0.0030	0.0059	24,000	74.8	0.0030	0.0047	24,000	74.8	0.0031	0.0039
0.75	1.5°	25	0.3°	24,000	55.1	0.0039	0.0079	21,000	55.1	0.0030	0.0039	21,000	51.2	0.0030	0.0035	21,000	51.2	0.0020	0.0024
0.75	1.5°	30	0.3°	24,000	55.1	0.0039	0.0079	21,000	55.1	0.0030	0.0039	21,000	51.2	0.0030	0.0035	21,000	51.2	0.0020	0.0024
0.75	1.5°	35	0.3°	22,000	55.1	0.0020	0.0079	18,000	47.2	0.0020	0.0039	18,000	43.3	0.0020	0.0028	17,000	43.3	0.0008	0.0012
0.75	2°	38.6	0.3°	24,000	55.1	0.0039	0.0079	21,000	55.1	0.0030	0.0039	21,000	51.2	0.0030	0.0035	21,000	51.2	0.0020	0.0024
1.00	0.5°	8	0.3°	27,000	131.9	0.0059	0.0157	25,000	102.4	0.0039	0.0079	25,000	94.5	0.0039	0.0079	23,000	86.6	0.0039	0.0079
1.00	0.5°	10	0.3°	22,000	120.1	0.0059	0.0157	20,000	94.5	0.0039	0.0079	20,000	86.6	0.0039	0.0079	19,000	78.7	0.0039	0.0079
1.00	0.5°	12	0.3°	22,000	120.1	0.0059	0.0157	20,000	94.5	0.0039	0.0079	20,000	86.6	0.0039	0.0079	19,000	78.7	0.0039	0.0079
1.00	0.5°	16	0.3°	15,000	94.5	0.0059	0.0118	15,000	70.9	0.0039	0.0079	15,000	66.9	0.0039	0.0079	14,000	59.1	0.0039	0.0079
1.00	0.5°	20	0.3°	15,000	86.6	0.0059	0.0079	14,000	66.9	0.0039	0.0039	14,000	63.0	0.0039	0.0039	13,000	55.1	0.0039	0.0039
1.00	0.5°	25	0.3°	12,000	47.2	0.0039	0.0079	12,000	47.2	0.0020	0.0039	11,000	43.3	0.0020	0.0039	10,000	39.4	0.0020	0.0039
1.00	0.5°	30	0.3°	12,000	39.4	0.0039	0.0079	12,000	39.4	0.0020	0.0039	11,000	35.4	0.0020	0.0039	10,000	31.5	0.0020	0.0039
1.00	0.5°	35	0.3°	12,000	39.4	0.0030	0.0079	12,000	39.4	0.0012	0.0039	11,000	35.4	0.0012	0.0039	10,000	31.5	0.0012	0.0039
1.00	0.5°	40	0.3°	12,000	31.5	0.0020	0.0079	12,000	31.5	0.0008	0.0039	11,000	31.5	0.0008	0.0039	10,000	27.6	0.0008	0.0039
1.00	1°	16	0.3°	22,000	120.1	0.0059	0.0157	20,000	94.5	0.0039	0.0079	20,000	86.6	0.0039	0.0079	19,000	78.7	0.0039	0.0079
1.00	1°	20	0.3°	15,000	94.5	0.0059	0.0118	15,000	70.9	0.0039	0.0079	15,000	66.9	0.0039	0.0079	14,000	59.1	0.0039	0.0079
1.00	1°	25	0.3°	15,000	86.6	0.0059	0.0079	14,000	66.9	0.0039	0.0039	14,000	63.0	0.0039	0.0039	13,000	55.1	0.0039	0.0039
1.00	1°	30	0.3°	14,000	86.6	0.0059	0.0079	14,000	66.9	0.0039	0.0039	14,000	63.0	0.0039	0.0039	13,000	55.1	0.0028	0.0039
1.00	1°	35	0.3°	12,000	47.2	0.0039	0.0079	12,000	47.2	0.0020	0.0039	11,000	43.3	0.0020	0.0039	10,000	39.4	0.0020	0.0039
1.00	1°	40	0.3°	12,000	39.4	0.0039	0.0079	12,000	39.4	0.0020	0.0039	11,000	35.4	0.0020	0.0039	10,000	31.5	0.0020	0.0039
1.00	1°	50	0.3°	12,000	39.4	0.0030	0.0079	12,000	39.4	0.0012	0.0039	11,000	35.4	0.0012	0.0039	10,000	31.5	0.0012	0.0039
1.00	1°	60	0.3°	12,000	31.5	0.0020	0.0079	12,000	31.5	0.0008	0.0039	11,000	31.5	0.0008	0.0039	10,000	27.6	0.0008	0.0039
1.00	1°	70	0.3°	12,000	31.5	0.0012	0.0039	12,000	31.5	0.0004	0.0020	11,000	31.5	0.0004	0.0020	10,000	27.6	0.0004	0.0020
1.00	1.5°	16	0.3°	22,000	120.1	0.0079	0.0157	20,000	94.5	0.0039	0.0079	20,000	86.6	0.0039	0.0079	19,000	78.7	0.0039	0.0079
1.00	1.5°	20	0.3°	22,000	120.1	0.0079	0.0157	20,000	94.5	0.0039	0.0079	20,000	86.6	0.0039	0.0079	19,000	78.7	0.0039	0.0079
1.00	1.5°	25	0.3°	15,000	94.5	0.0059	0.0118	15,000	70.9	0.0039	0.0079	15,000	66.9	0.0039	0.0079	14,000	59.1	0.0039	0.0079
1.00	1.5°	30	0.3°	15,000	86.6	0.0059	0.0079	14,000	66.9	0.0039	0.0039	14,000	63.0	0.0039	0.0039	13,000	55.1	0.0039	0.0039
1.00	1.5°	35	0.3°	15,000	86.6	0.0059	0.0079	14,000	66.9	0.0039	0.0039	14,000	63.0	0.0039	0.0039	13,000	55.1	0.0039	0.0039
1.00	1.5°	41.5	0.3°	12,000	47.2	0.0039	0.0079	12,000	47.2	0.0020	0.0039	11,000	43.3	0.0020	0.0039	10,000	39.4	0.0020	0.0039
1.00	2°	31.5	0.3°	15,000	94.5	0.0059	0.0118	15,000	70.9	0.0039	0.0079	15,000	66.9	0.0039	0.0079	14,000	59.1	0.0039	0.0079
1.50	0.5°	8	0.3°	32,000	181.1	0.0079	0.0236	30,000	177.2	0.0059	0.0118	30,000	165.4	0.0059	0.0118	25,000	137.8	0.0059	0.0118
1.50	0.5°	10	0.3°	28,000	157.5	0.0079	0.0236	25,000	149.6	0.0059	0.0118	25,000	141.7	0.0059	0.0118	20,000	110.2	0.0059	0.0118
1.50	0.5°	12	0.3°	28,000	157.5	0.0079	0.0236	25,000	149.6	0.0059	0.0118	25,000	141.7	0.0059	0.0118	20,000	110.2	0.0059	0.0118
1.50	0.5°	16	0.3°	22,000	114.2	0.0079	0.0236	18,000	106.3	0.0059	0.0118	18,000	98.4	0.0059	0.0118	15,000	78.7	0.0059	0.0118
1.50	0.5°	20	0.3°	20,000	102.4	0.0059	0.0157	16,000	78.7	0.0039	0.0079	16,000	74.8	0.0039	0.0079	13,000	59.1	0.0039	0.0079
1.50	0.5°	25	0.3°	16,000	86.6	0.0059	0.0157	14,000	70.9	0.0039	0.0079	14,000	66.9	0.0039	0.0079	11,000	51.2	0.0039	0.0079
1.50	0.5°	30	0.3°	16,000	70.9	0.0049	0.0079	12,000	47.2	0.0020	0.0039	12,000	43.3	0.0020	0.0039	9,000	32.3	0.0020	0.0039
1.50	0.5°	35	0.3°	12,000	39.4	0.0030	0.0039	10,000	31.5	0.0012	0.0020	9,000	29.9	0.0012	0.0020	7,800	23.2	0.0012	0.0020
1.50	0.5°	40	0.3°	12,000	31.5	0.0030	0.0039	10,000	23.6	0.0012	0.0020	9,000	23.6	0.0012	0.0020	7,800	18.9	0.0012	0.0020
1.50	0.5°	50	0.3°	10,000	25.6	0.0020	0.0039	8,000	19.7	0.0008	0.0020	7,500	19.7	0.0008	0.0020	6,200	15.7	0.0008	0.0020
1.50	1°	20	0.3°	22,000	114.2	0.0079	0.0236	18,000	106.3	0.0059	0.0118	18,000	98.4	0.0059	0.0118	15,000	78.7	0.0059	0.0118
1.50	1°	25	0.3°	20,000	102.4	0.0079	0.0157	16,000	78.7	0.0039	0.0079	16,000	74.8	0.0039	0.0079	13,000	59.1	0.0039	0.0079

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

continued on next page

List 3712: 2 Flute, Ball End, Stub Length, Pencil Neck (Continued)

High Speed Milling

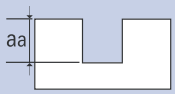
Hardness	–	Up to 32 HRC	33~41 HRC	42~50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels Pre-hardened Steels	
Cutting Speed	103~1031 SFM	78~928 SFM		76~774 SFM
Depth of Cut				

R (mm)	θn	L2 (mm)	Recom'd Cutting Angle	Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)		Speed (RPM)	Feed (in/min)	Depth of Cut (in)	
						Aa	Ar			Aa	Ar			Aa	Ar			Aa	Ar
1.50	1°	30	0.3°	16,000	86.6	0.0079	0.0157	14,000	70.9	0.0039	0.0079	14,000	66.9	0.0039	0.0079	11,000	51.2	0.0039	0.0079
1.50	1°	35	0.3°	16,000	70.9	0.0049	0.0079	12,000	47.2	0.0020	0.0039	12,000	43.3	0.0020	0.0039	9,000	32.3	0.0020	0.0039
1.50	1°	40	0.3°	16,000	70.9	0.0049	0.0079	12,000	47.2	0.0020	0.0039	12,000	43.3	0.0020	0.0039	9,000	32.3	0.0020	0.0039
1.50	1°	50	0.3°	12,000	39.4	0.0030	0.0039	10,000	31.5	0.0012	0.0020	9,000	29.9	0.0012	0.0020	7,800	23.2	0.0012	0.0020
1.50	1°	60	0.3°	12,000	31.5	0.0030	0.0039	10,000	23.6	0.0012	0.0020	9,000	23.6	0.0012	0.0020	7,800	18.9	0.0012	0.0020
1.50	1°	70	0.3°	10,000	25.6	0.0020	0.0039	8,000	19.7	0.0008	0.0020	7,500	19.7	0.0008	0.0020	6,200	15.7	0.0008	0.0020
1.50	1.5°	20	0.3°	22,000	114.2	0.0098	0.0236	18,000	106.3	0.0059	0.0118	18,000	98.4	0.0059	0.0118	15,000	78.7	0.0059	0.0118
1.50	1.5°	25	0.3°	20,000	102.4	0.0079	0.0157	16,000	78.7	0.0039	0.0079	16,000	74.8	0.0039	0.0079	13,000	59.1	0.0039	0.0079
1.50	1.5°	30	0.3°	20,000	102.4	0.0079	0.0157	16,000	78.7	0.0039	0.0079	16,000	74.8	0.0039	0.0079	13,000	59.1	0.0039	0.0079
1.50	1.5°	35	0.3°	16,000	86.6	0.0079	0.0157	14,000	70.9	0.0039	0.0079	14,000	66.9	0.0039	0.0079	11,000	51.2	0.0039	0.0079
1.50	1.5°	40	0.3°	16,000	86.6	0.0079	0.0157	14,000	70.9	0.0039	0.0079	14,000	66.9	0.0039	0.0079	11,000	51.2	0.0039	0.0079
1.50	1.5°	50	0.3°	16,000	70.9	0.0049	0.0079	12,000	47.2	0.0020	0.0039	12,000	43.3	0.0020	0.0039	9,000	32.3	0.0020	0.0039
1.50	1.5°	62.5	0.3°	12,000	39.4	0.0030	0.0039	10,000	31.5	0.0012	0.0020	9,000	29.9	0.0012	0.0020	7,800	23.2	0.0012	0.0020
1.50	1.5°	47.5	0.3°	16,000	86.6	0.0098	0.0157	14,000	70.9	0.0039	0.0079	14,000	66.9	0.0039	0.0079	11,000	51.2	0.0039	0.0079
2.00	1°	20	0.5°	20,000	135.8	0.0157	0.0236	18,000	126.0	0.0079	0.0197	18,000	118.1	0.0079	0.0197	14,000	90.6	0.0079	0.0157
2.00	1°	30	0.5°	18,000	118.1	0.0157	0.0197	16,000	110.2	0.0079	0.0157	16,000	102.4	0.0079	0.0157	12,000	74.8	0.0079	0.0157
2.00	1°	40	0.5°	18,000	118.1	0.0098	0.0236	16,000	110.2	0.0039	0.0118	16,000	102.4	0.0039	0.0118	12,000	74.8	0.0039	0.0118
2.00	1°	50	0.5°	14,000	86.6	0.0098	0.0157	12,000	70.9	0.0039	0.0079	12,000	66.9	0.0039	0.0079	9,000	66.9	0.0039	0.0079
2.00	1°	60	0.5°	16,000	70.9	0.0049	0.0079	12,000	47.2	0.0020	0.0039	12,000	43.3	0.0020	0.0039	9,000	32.3	0.0020	0.0039
2.00	1.5°	44.2	0.5°	18,000	118.1	0.0098	0.0236	16,000	110.2	0.0039	0.0118	16,000	102.4	0.0039	0.0118	12,000	74.8	0.0039	0.0118
2.00	2°	34	0.5°	20,000	135.8	0.0157	0.0236	18,000	126.0	0.0079	0.0197	18,000	118.1	0.0079	0.0197	14,000	90.6	0.0079	0.0197
2.50	1°	30	0.5°	20,000	133.9	0.0157	0.0295	15,000	126.0	0.0079	0.0118	15,000	118.1	0.0079	0.0118	12,000	94.5	0.0079	0.0118
2.50	1°	40	0.5°	16,000	114.2	0.0098	0.0295	14,000	98.4	0.0039	0.0118	14,000	90.6	0.0039	0.0118	11,000	70.9	0.0039	0.0118
2.50	1°	60	0.5°	12,000	70.9	0.0098	0.0197	10,000	47.2	0.0039	0.0079	10,000	43.3	0.0039	0.0079	8,000	34.6	0.0039	0.0079
2.50	1.5°	26.9	0.5°	18,000	149.6	0.0197	0.0492	16,000	137.8	0.0098	0.0197	16,000	129.9	0.0098	0.0197	12,000	94.5	0.0098	0.0197
2.50	1.5°	65.1	0.5°	14,000	86.6	0.0098	0.0295	12,000	63.0	0.0039	0.0118	12,000	59.1	0.0039	0.0118	9,000	43.3	0.0039	0.0118
2.50	2°	50.1	0.5°	16,000	114.2	0.0098	0.0295	14,000	98.4	0.0039	0.0118	14,000	90.6	0.0039	0.0118	11,000	70.9	0.0039	0.0118
3.00	1°	30	0.5°	14,000	157.5	0.0236	0.0492	12,000	126.0	0.0118	0.0197	12,000	118.1	0.0118	0.0197	9,000	88.6	0.0118	0.0197
3.00	1°	40	0.5°	10,000	126.0	0.0236	0.0492	10,000	102.4	0.0118	0.0197	10,000	94.5	0.0118	0.0197	8,000	74.8	0.0118	0.0197
3.00	1°	50	0.5°	9,000	118.1	0.0157	0.0394	9,000	90.6	0.0079	0.0157	9,000	82.7	0.0079	0.0157	7,000	63.0	0.0079	0.0157
3.00	1°	60	0.5°	9,000	110.2	0.0157	0.0295	9,000	78.7	0.0079	0.0118	9,000	74.8	0.0079	0.0118	7,000	55.1	0.0079	0.0118
3.00	1°	70	0.5°	7,000	90.6	0.0157	0.0295	7,000	63.0	0.0079	0.0118	7,000	59.1	0.0079	0.0118	5,500	43.3	0.0079	0.0118
3.00	1°	80	0.5°	6,000	78.7	0.0118	0.0295	6,000	51.2	0.0059	0.0118	6,000	47.2	0.0059	0.0118	5,000	35.4	0.0059	0.0118
3.00	1.5°	49	0.5°	10,000	126.0	0.0236	0.0492	10,000	102.4	0.0118	0.0197	10,000	94.5	0.0118	0.0197	8,000	74.8	0.0118	0.0197
3.00	2°	36	0.5°	14,000	157.5	0.0236	0.0492	12,000	126.0	0.0118	0.0197	12,000	118.1	0.0118	0.0197	9,000	88.6	0.0118	0.0197

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

List 3722: 2 Flute, Square End, Regular Length

Slotting

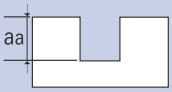
Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels, Pre-hardened Steels Stainless Steels			
Cutting Speed	52~522 SFM		33~251 SFM		33~186 SFM		33~159 SFM	
Depth of Cut	Dia. / aa D<1 / 0.1D 1≤D<3 / 0.3D 3≤D / 0.5D							
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.1	50,000	3.9	32,000	2.8	32,000	2.4	32,000	1.2
0.2	50,000	5.5	32,000	3.5	32,000	3.0	32,000	1.4
0.3	50,000	6.7	32,000	4.3	32,000	3.1	32,000	2.2
0.4	50,000	7.5	32,000	4.7	32,000	3.5	27,500	2.4
0.5	50,000	7.9	31,000	4.7	25,000	3.5	22,000	2.4
0.6	50,000	9.1	27,000	4.7	19,500	3.5	17,000	2.4
0.7	50,000	9.8	24,000	4.7	17,000	3.5	15,000	2.4
0.8	50,000	11.4	21,500	4.7	15,500	3.5	13,500	2.6
0.9	49,000	12.6	19,000	4.7	13,500	3.5	12,000	2.6
1.0	47,500	13.8	17,500	4.7	12,500	3.5	11,000	2.6
1.1	43,000	13.4	16,000	4.7	11,500	3.5	9,900	2.6
1.2	40,500	13.4	15,000	4.7	10,500	3.5	9,300	2.6
1.3	38,000	13.0	14,000	4.7	9,900	3.5	8,700	2.6
1.4	35,000	13.0	13,000	4.7	9,200	3.5	8,100	2.6
1.5	32,000	12.6	12,500	4.7	8,900	3.5	7,900	2.6
1.6	31,000	12.6	12,000	4.7	8,500	3.5	7,500	2.6
1.7	29,000	12.6	11,000	4.7	7,900	3.5	7,000	2.6
1.8	28,000	12.6	10,500	5.1	7,500	3.5	6,800	2.7
1.9	26,000	12.6	10,000	5.1	7,100	3.5	6,300	2.7
2.0	24,000	12.2	9,700	5.1	7,000	3.5	6,300	2.8
2.1	23,000	13.0	9,300	5.5	6,600	3.5	5,900	2.8
2.2	22,500	13.0	9,000	5.5	6,500	3.5	5,700	2.8
2.3	22,000	13.0	8,800	5.9	6,400	3.5	5,600	2.8
2.4	20,500	13.8	8,600	5.9	6,300	3.5	5,500	2.8
2.5	20,000	13.8	8,200	6.3	6,100	3.5	5,300	2.8
2.6	19,000	15.0	7,900	6.3	5,900	3.9	5,000	2.8
2.7	18,000	15.0	7,600	6.3	5,700	3.9	4,900	2.8
2.8	17,500	15.0	7,300	6.7	5,500	3.9	4,700	3.0
2.9	17,000	15.0	7,100	6.7	5,300	3.9	4,500	3.0
3.0	16,000	15.7	6,900	6.7	5,300	3.9	4,400	3.0
3.1	15,500	16.1	6,700	7.1	5,100	3.9	4,300	3.0
3.2	15,000	16.5	6,500	7.1	5,000	4.3	4,200	3.1
3.3	14,500	16.5	6,300	7.5	4,800	4.3	4,000	3.1
3.4	14,000	16.5	6,100	7.5	4,600	4.3	3,900	3.1
3.5	14,000	16.5	6,000	7.5	4,600	4.7	3,800	3.1
3.6	13,500	16.9	5,900	7.9	4,500	4.7	3,700	3.3
3.7	12,500	16.9	5,700	7.9	4,400	4.7	3,600	3.3
3.8	12,500	17.3	5,600	8.3	4,400	4.7	3,600	3.3
3.9	12,000	17.3	5,500	8.3	4,200	4.9	3,500	3.3
4.0	12,000	17.7	5,400	8.3	4,200	4.9	3,500	3.5
4.1	11,500	18.9	5,300	8.7	4,100	4.9	3,400	3.5
4.2	11,500	18.9	5,300	8.7	4,100	4.9	3,300	3.5
4.3	11,000	18.9	5,200	9.1	4,000	4.9	3,300	3.5
4.4	11,000	19.7	5,100	9.4	3,900	5.1	3,200	3.7
4.5	10,500	19.7	5,100	9.4	3,900	5.1	3,200	3.7
4.6	10,500	20.5	5,000	9.8	3,800	5.1	3,200	3.7
4.7	10,500	20.5	5,000	10.2	3,800	5.1	3,100	3.7
4.8	10,500	20.9	4,900	10.2	3,700	5.1	3,100	3.7
4.9	10,000	20.9	4,900	10.6	3,600	5.1	3,100	3.7

1. Use a rigid and precise machine and holder.
2. Use a suitable cutting fluid with high smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

continued on next page

List 3722: 2 Flute, Square End, Regular Length (Continued)

Slotting

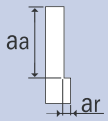
Hardness	–	Up to 32 HRC	33 to 41 HRC	42 to 50 HRC
Work Material	Copper Copper Alloy	Mild Steels Carbon Steels	Hardened Steels, Pre-hardened Steels Stainless Steels	
Cutting Speed	52~522 SFM	33~251 SFM	33~186 SFM	33~159 SFM
Depth of Cut	Dia. / aa D<1 / 0.1D 1≤D<3 / 0.3D 3≤D / 0.5D			

Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
5.0	9,500	21.3	4,800	10.6	3,500	5.1	3,000	3.9
5.1	9,500	21.3	4,700	10.6	3,500	5.1	3,000	3.9
5.2	9,300	21.3	4,600	10.6	3,400	5.1	2,900	3.9
5.3	9,200	21.3	4,600	10.6	3,400	5.1	2,900	3.9
5.4	9,000	21.3	4,500	10.6	3,300	5.1	2,800	3.9
5.5	8,800	21.3	4,400	10.6	3,200	5.1	2,700	3.9
5.6	8,700	21.3	4,300	10.6	3,100	5.1	2,600	3.9
5.7	8,500	21.3	4,200	10.6	3,100	5.1	2,600	3.9
5.8	8,400	20.9	4,200	10.6	3,000	5.1	2,600	3.9
5.9	8,200	20.9	4,100	10.6	2,900	5.1	2,500	3.9
6.0	7,900	20.9	4,000	10.6	2,900	5.1	2,500	3.9
6.5	7,500	20.9	3,700	10.6	2,700	5.1	2,300	3.9
7.0	6,900	20.9	3,400	10.6	2,500	5.1	2,100	3.9
7.5	6,400	20.9	3,200	10.6	2,300	5.1	2,000	3.9
8.0	5,900	20.5	3,000	10.2	2,200	4.9	1,900	3.9
8.5	5,600	20.5	2,800	10.2	2,000	4.9	1,700	3.9
9.0	5,300	20.1	2,600	10.2	1,900	4.9	1,500	3.9
9.5	5,100	20.1	2,500	10.2	1,800	4.9	1,400	3.7
10.0	4,700	19.7	2,400	9.8	1,700	4.9	1,500	3.7
11.0	4,400	19.7	2,200	9.8	1,600	4.9	1,100	3.7
12.0	4,000	20.1	2,000	9.8	1,400	4.9	1,200	3.7
16.0	3,000	15.7	1,500	7.9	1,100	4.5	800	3.1
18.0	2,700	14.2	1,300	7.1	900	3.9	700	2.8
20.0	2,400	11.8	1,200	5.9	800	3.5	600	2.4

1. Use a rigid and precise machine and holder.
2. Use a suitable cutting fluid with high smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

List 3723: 2 Flute, Square End, Long Length

Standard Milling

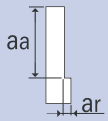
Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels, Pre-hardened Steels Stainless Steels			
Cutting Speed	66~116 SFM		46~76 SFM		39~76 SFM		57~67 SFM	
Depth of Cut	Dia. / aa / ar D<1 / 4D / 0.05D 1≤D / 4D / 0.01D		Dia. / aa / ar D<0.3 / 4D / 0.015D 0.3≤D<1 / 4D / 0.03D 1≤D<3 / 4D / 0.05D 3≤D / 4D / 0.1D					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.2	32,000	3.5	22,500	1.2	19,000	1.2	—	—
0.3	32,000	4.3	22,500	1.6	19,000	1.4	—	—
0.4	25,000	4.3	16,000	1.8	14,500	1.4	—	—
0.5	20,000	4.7	13,000	1.8	13,000	1.6	—	—
0.6	16,000	4.7	11,000	1.8	10,000	1.6	—	—
0.7	16,000	4.7	9,400	1.8	6,800	1.6	—	—
0.8	12,000	4.7	8,400	1.8	6,000	1.6	—	—
0.9	12,000	4.7	7,500	1.8	5,400	1.6	—	—
1.0	9,800	4.7	5,700	1.8	5,400	1.6	—	—
1.1	9,500	5.5	5,200	1.8	5,000	1.6	—	—
1.2	8,600	5.1	4,800	1.8	4,500	1.6	—	—
1.3	8,100	5.1	4,500	1.8	4,200	1.6	—	—
1.4	7,500	5.1	4,200	1.8	3,900	1.6	—	—
1.5	7,000	5.1	3,900	1.8	3,600	1.6	—	—
1.6	6,400	4.7	3,700	1.8	3,500	1.6	—	—
1.7	6,200	4.7	3,600	1.8	3,400	1.6	—	—
1.8	5,800	4.7	3,300	1.8	3,100	1.6	—	—
1.9	5,500	4.7	3,200	1.8	3,000	1.6	—	—
2.0	5,200	4.7	3,000	1.8	2,800	1.6	—	—
2.1	4,800	4.7	2,900	1.8	2,800	1.6	—	—
2.2	4,600	5.1	2,700	2.0	2,600	1.6	—	—
2.3	4,500	5.1	2,700	2.0	2,600	1.6	—	—
2.4	4,400	5.1	2,600	2.2	2,500	1.6	—	—
2.5	4,100	5.5	2,500	2.2	2,500	1.6	—	—
2.6	3,900	5.5	2,400	2.2	2,400	1.6	—	—
2.7	3,700	5.9	2,300	2.2	2,300	1.8	—	—
2.8	3,600	5.9	2,200	2.2	2,200	1.8	—	—
2.9	3,500	5.9	2,100	2.4	2,100	1.8	—	—
3.0	3,400	5.9	2,100	2.4	2,100	2.0	1,900	3.0
3.1	3,200	6.3	2,000	2.4	2,000	2.0	1,800	3.0
3.2	3,000	6.3	2,000	2.6	2,000	2.0	1,800	3.1
3.3	2,900	6.3	1,900	2.6	1,900	2.2	1,700	3.1
3.4	2,800	6.3	1,800	2.8	1,800	2.2	1,700	3.1
3.5	2,800	6.3	1,800	2.8	1,800	2.2	1,600	3.1
3.6	2,700	6.3	1,800	2.8	1,800	2.4	1,600	3.3
3.7	2,700	6.7	1,700	2.8	1,700	2.4	1,500	3.3
3.8	2,500	6.7	1,700	2.8	1,700	2.4	1,500	3.3
3.9	2,400	6.7	1,600	3.0	1,600	2.4	1,500	3.3
4.0	2,400	6.7	1,600	3.0	1,600	2.6	1,400	3.5
4.1	2,400	7.1	1,600	3.0	1,600	2.6	1,400	3.5
4.2	2,300	7.5	1,600	3.1	1,600	2.6	1,400	3.5
4.3	2,300	7.5	1,500	3.1	1,500	2.6	1,400	3.5
4.4	2,100	7.5	1,500	3.1	1,500	2.6	1,400	3.7
4.5	2,100	7.9	1,500	3.3	1,500	2.6	1,300	3.7
4.6	2,100	7.9	1,500	3.3	1,500	2.6	1,300	3.7
4.7	2,100	7.9	1,500	3.5	1,500	2.6	1,300	3.7
4.8	2,100	7.9	1,500	3.5	1,500	2.6	1,300	3.7
4.9	2,000	8.3	1,400	3.5	1,400	2.6	1,300	3.7
5.0	2,000	8.3	1,400	3.7	1,400	2.6	1,300	3.9

1. Use a rigid and precise machine and holder.
2. Use a suitable cutting fluid with high smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

continued on next page

List 3723: 2 Flute, Square End, Long Length (Continued)

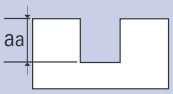
Standard Milling

Hardness	–		Up to 32 HRC		33 to 41 HRC		42 to 50 HRC	
Work Material	Copper Copper Alloy		Mild Steels Carbon Steels		Hardened Steels, Pre-hardened Steels Stainless Steels			
Cutting Speed	66~116 SFM		46~76 SFM		39~76 SFM		57~67 SFM	
Depth of Cut	Dia. / aa / ar D<1 / 4D / 0.05D 1≤D / 4D / 0.01D		Dia. / aa / ar D<0.3 / 4D / 0.015D 0.3≤D<1 / 4D / 0.03D 1≤D<3 / 4D / 0.05D 3≤D / 4D / 0.1D					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
5.1	1,900	8.3	1,400	3.7	1,400	2.6	1,200	3.9
5.2	1,900	8.3	1,400	3.7	1,400	2.6	1,200	3.9
5.3	1,800	8.3	1,300	3.7	1,300	2.6	1,200	3.9
5.4	1,800	8.3	1,300	3.7	1,300	2.6	1,200	3.9
5.5	1,800	8.3	1,300	3.7	1,300	2.6	1,100	3.9
5.6	1,700	8.3	1,300	3.7	1,300	2.6	1,100	3.9
5.7	1,700	8.3	1,300	3.7	1,300	2.6	1,100	3.9
5.8	1,700	8.3	1,200	3.7	1,200	2.6	1,100	3.9
5.9	1,600	8.3	1,200	3.7	1,200	2.6	1,000	3.9
6.0	1,600	8.3	1,200	3.7	1,200	2.6	1,000	3.9
8.0	1,100	7.9	900	3.7	900	2.6	800	3.9
10.0	900	7.9	700	3.5	700	2.6	630	3.7
12.0	800	7.9	600	3.5	600	2.6	525	3.7

1. Use a rigid and precise machine and holder.
2. Use a suitable cutting fluid with high smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

List 3770: 2 Flute, Corner Radius, Regular Length

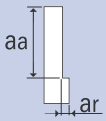
Slotting

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steel Carbon Steels		Alloy Steels Tool Steels		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	275 SFM		220 SFM		180 SFM		150 SFM		100 SFM		65 SFM	
Depth of Cut			Dia. / aa D<1 / 0.1D 1≤D<3 / 0.3D 3<D / 0.5D						Dia. / aa D<1 / 0.2D 1≤D / 0.5D		Dia. / aa D<1 / 0.1D 1≤D<3 / 0.2D 3<D / 0.5D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.2	32,000	3.5	32,000	3.5	32,000	3.0	32,000	1.4	32,000	1.2	25,000	1.0
0.3	32,000	4.5	32,000	4.5	32,000	3.1	32,000	2.2	23,000	1.2	16,500	1.0
0.4	32,000	4.9	32,000	4.9	32,000	3.5	27,500	2.4	17,500	1.2	12,500	1.0
0.5	32,000	4.9	29,500	4.9	25,000	3.5	22,000	2.4	14,000	1.2	10,000	1.0
0.6	32,000	4.9	24,500	4.9	21,000	3.5	18,500	2.4	11,500	1.2	8,450	1.0
0.8	24,500	4.9	18,500	4.9	15,500	3.5	13,500	2.6	8,750	1.2	6,350	1.0
1.0	19,500	5.1	14,500	4.9	12,500	3.5	11,000	2.6	7,000	1.2	5,050	1.0
1.5	14,000	5.1	10,500	4.9	8,900	3.5	7,950	2.6	5,050	1.6	3,550	1.0
2.0	11,000	5.3	8,400	4.9	7,000	3.5	6,350	2.8	3,950	1.6	2,750	1.0
3.0	7,400	7.9	6,350	5.9	5,300	3.9	4,450	3.0	2,750	1.8	2,000	1.2
4.0	5,950	9.3	4,900	7.3	4,250	4.9	3,500	3.5	2,200	2.0	1,550	1.2
5.0	5,300	12.4	4,300	9.3	3,550	5.1	3,050	3.9	1,900	2.2	1,250	1.2
6.0	4,450	12.2	3,600	9.3	2,950	5.1	2,500	3.9	1,550	2.2	1,050	1.0
8.0	3,300	11.6	2,700	9.3	2,200	4.9	1,900	3.9	1,150	2.0	795	1.0
10.0	2,650	11.0	2,150	9.1	1,750	4.9	1,500	3.7	955	2.0	635	1.0
12.0	2,200	11.0	1,800	9.1	1,450	4.9	1,250	3.7	795	1.8	530	0.8
14.0	1,900	11.0	1,500	8.5	1,250	4.3	1,050	3.7	680	1.6	455	0.7
16.0	1,650	10.2	1,350	7.9	1,100	3.9	955	3.3	595	1.4	395	0.6
18.0	1,450	9.1	1,200	7.1	990	3.5	845	3.0	530	1.2	350	0.6
20.0	1,300	8.1	1,050	6.1	890	3.1	760	2.6	475	1.2	315	0.5
22.0	1,200	7.5	980	5.7	810	2.8	690	2.4	430	1.0	285	0.4
24.0	1,100	6.9	900	5.3	740	2.6	635	2.2	395	1.0	265	0.4
25.0	1,050	6.5	865	5.1	710	2.6	610	2.2	380	0.8	255	0.4
30.0	890	5.5	720	4.1	590	2.0	505	1.8	315	0.8	210	0.4

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

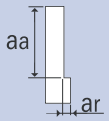
List 3771: 4 Flute, Corner Radius, Regular Length

Side Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steel Carbon Steels Cast Iron		Alloy Steels Tool Steels		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	396 SFM		294 SFM		258 SFM		192 SFM		156 SFM		96 SFM	
Depth of Cut	a_a=1.2D a_r=0.2D 						a_a=1D a_r=0.1D		a_a=1D a_r=0.05D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
3	12,870	40.8	9,660	28.8	8,370	25.0	6,450	19.3	5,160	13.3	3,240	5.8
4	9,600	46.1	7,200	31.7	6,240	27.5	4,800	21.1	3,840	15.4	2,400	7.7
5	8,040	51.5	6,000	36.0	5,220	31.3	4,020	22.5	3,180	17.8	1,980	9.5
6	6,450	55.2	4,830	38.4	4,170	30.7	3,210	23.6	2,580	16.4	1,620	9.0
8	4,800	57.6	3,600	38.9	3,120	32.4	2,400	24.0	1,920	16.9	1,200	9.6
10	4,020	56.3	3,000	38.4	2,640	30.6	1,980	22.2	1,620	16.2	1,020	9.4
12	3,240	54.8	2,430	36.9	2,130	29.4	1,620	20.7	1,290	15.0	795	8.3

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

High Speed Light Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC	
Work Material	Carbon Steels 1045, 1055		Alloy Steels 4140, 4340		Hardened Steels Pre-hardened Steels D2, H13, 17-4PH		Tool Steels, Hardened Steels Pre-hardened Steels, D2, H13		Hardened Steels Heat Resistant Steels	
Cutting Speed	1,560 SFM		1,380 SFM		960 SFM		600 SFM		130 SFM	
Depth of Cut	Dia. / a_a / a_r D<3 / 1.5D / 0.01D 3≤D / 1.5D / 0.02D 								Dia. / a_a / a_r D<8 / 1.0D / 0.01D 8≤D / 1.0D / 0.02D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
3	24,000	220.8	21,000	184.8	14,760	118.1	9,000	72.0	4,800	32.6
4	20,400	212.2	18,000	172.8	13,200	121.4	7,920	69.7	4,200	33.6
5	18,840	226.1	16,320	176.3	12,000	124.8	7,200	72.0	3,840	33.8
6	17,220	222.2	15,060	176.4	10,980	120.2	6,600	69.6	3,480	32.5
8	15,600	218.4	13,800	176.6	9,960	115.5	6,000	67.2	3,120	31.2
10	13,200	211.2	12,000	177.6	8,640	117.5	5,160	66.0	2,760	32.0
12	12,540	212.5	11,220	170.2	8,040	110.8	4,800	61.4	2,580	29.9

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

List 3794: 4 Flute, Square End, Long Neck, Stub Length

Slotting

Hardness		–			Up to 32 HRC			33~41 HRC			42~50 HRC		
Work Material		Copper Copper Alloy			Mild Steels Carbon Steels			Hardened Steels Pre-hardened Steels Stainless Steels					
Cutting Speed		173~374 SFM			144~309 SFM			130~309 SFM			101~248 SFM		
D (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)
1.0	4	36,000	90.6	0.0031	30,000	74.8	0.0028	30,000	65.0	0.0028	22,000	38.6	0.0020
1.0	6	32,500	74.8	0.0031	27,000	63.0	0.0028	26,000	53.1	0.0024	20,000	35.4	0.0016
1.0	8	27,500	57.1	0.0020	23,000	47.2	0.0016	22,000	41.3	0.0016	18,000	23.6	0.0012
1.0	10	23,000	43.3	0.0016	19,000	37.0	0.0012	18,000	29.5	0.0011	15,000	17.7	0.0008
1.0	12	23,000	43.3	0.0008	19,000	37.0	0.0008	18,000	29.5	0.0007	15,000	17.7	0.0004
1.0	16	18,000	18.9	0.0004	15,000	15.7	0.0003	15,000	17.7	0.0003	12,000	11.8	0.0002
1.2	6	27,500	74.8	0.0039	23,000	63.0	0.0031	22,000	53.1	0.0028	17,000	35.4	0.0020
1.2	8	24,000	57.1	0.0031	20,000	47.2	0.0028	19,000	41.3	0.0020	14,000	23.6	0.0016
1.2	10	24,000	43.3	0.0024	20,000	37.0	0.0020	19,000	41.3	0.0016	14,000	23.6	0.0012
1.2	12	20,500	43.3	0.0020	17,000	37.0	0.0016	16,000	29.5	0.0012	11,000	17.7	0.0008
1.2	16	14,500	23.6	0.0004	12,000	19.7	0.0003	11,000	14.6	0.0003	10,000	13.0	0.0002
1.4	6	24,000	76.8	0.0055	20,000	63.0	0.0047	19,000	53.1	0.0043	15,000	35.4	0.0035
1.4	8	21,500	57.1	0.0043	18,000	47.2	0.0035	17,000	41.3	0.0031	13,000	23.6	0.0024
1.4	10	21,500	57.1	0.0028	18,000	47.2	0.0024	17,000	41.3	0.0020	13,000	23.6	0.0016
1.4	12	21,500	57.1	0.0024	18,000	47.2	0.0020	17,000	41.3	0.0016	13,000	23.6	0.0012
1.4	14	18,000	43.3	0.0020	15,000	37.0	0.0016	14,000	29.5	0.0014	11,000	17.7	0.0012
1.4	16	18,000	43.3	0.0016	15,000	37.0	0.0012	14,000	29.5	0.0008	11,000	17.7	0.0008
1.4	22	12,000	20.1	0.0004	10,000	16.9	0.0002	9,000	12.2	0.0002	8,000	10.6	0.0002
1.5	6	21,500	80.7	0.0055	18,000	66.9	0.0047	18,000	53.1	0.0043	14,000	35.4	0.0035
1.5	8	19,000	57.1	0.0047	16,000	47.2	0.0039	15,000	41.3	0.0031	12,000	23.6	0.0028
1.5	10	19,000	57.1	0.0039	16,000	47.2	0.0031	15,000	41.3	0.0028	12,000	23.6	0.0020
1.5	12	19,000	57.1	0.0028	16,000	47.2	0.0024	15,000	41.3	0.0020	12,000	23.6	0.0016
1.5	14	19,000	57.1	0.0024	16,000	47.2	0.0020	15,000	41.3	0.0018	12,000	23.6	0.0014
1.5	16	17,000	43.3	0.0024	14,000	37.0	0.0020	13,000	29.5	0.0016	10,000	17.7	0.0012
1.5	18	17,000	43.3	0.0016	14,000	37.0	0.0012	13,000	29.5	0.0008	10,000	17.7	0.0008
1.5	20	14,500	31.5	0.0008	12,000	26.4	0.0008	11,000	22.4	0.0006	10,000	17.7	0.0004
1.6	6	20,500	80.7	0.0067	17,000	66.9	0.0055	17,000	53.1	0.0051	13,000	35.4	0.0039
1.6	8	18,000	61.0	0.0063	15,000	51.2	0.0051	15,000	41.3	0.0047	11,000	23.6	0.0039
1.6	10	18,000	57.1	0.0051	15,000	47.2	0.0043	15,000	41.3	0.0035	11,000	23.6	0.0028
1.6	12	18,000	57.1	0.0031	15,000	47.2	0.0028	15,000	41.3	0.0024	11,000	23.6	0.0020
1.6	14	18,000	57.1	0.0028	15,000	47.2	0.0024	15,000	41.3	0.0020	11,000	23.6	0.0016
1.6	16	15,500	43.3	0.0024	13,000	37.0	0.0020	13,000	29.5	0.0016	9,000	17.7	0.0014
1.6	18	15,500	43.3	0.0020	13,000	37.0	0.0016	13,000	29.5	0.0012	9,000	17.7	0.0012
1.6	20	15,500	43.3	0.0008	13,000	37.0	0.0008	13,000	29.5	0.0008	9,000	17.7	0.0004
1.6	25	10,500	21.7	0.0004	8,900	18.1	0.0004	8,900	14.2	0.0004	6,100	8.7	0.0003
1.8	6	19,000	88.6	0.0094	16,000	74.8	0.0079	15,000	59.1	0.0071	12,000	41.3	0.0055
1.8	8	19,000	100.4	0.0091	16,000	74.8	0.0075	15,000	59.1	0.0067	12,000	41.3	0.0051
1.8	10	17,000	57.1	0.0055	14,000	47.2	0.0047	14,000	41.3	0.0039	10,000	29.5	0.0031
1.8	12	17,000	57.1	0.0047	14,000	47.2	0.0039	14,000	41.3	0.0031	10,000	29.5	0.0028
1.8	14	17,000	57.1	0.0039	14,000	47.2	0.0031	14,000	41.3	0.0024	10,000	29.5	0.0020
1.8	16	17,000	57.1	0.0031	14,000	47.2	0.0028	14,000	41.3	0.0020	10,000	29.5	0.0016
1.8	18	14,500	43.3	0.0024	12,000	37.0	0.0020	12,000	29.5	0.0018	8,000	23.6	0.0014
1.8	20	14,500	43.3	0.0020	12,000	37.0	0.0016	12,000	29.5	0.0016	8,000	23.6	0.0012
1.8	25	9,600	22.4	0.0004	8,000	18.9	0.0004	7,000	14.6	0.0003	6,000	11.8	0.0003
2.0	6	18,000	92.5	0.0134	15,000	74.8	0.0110	14,000	59.1	0.0102	11,000	41.3	0.0083
2.0	8	18,000	92.5	0.0122	15,000	74.8	0.0102	14,000	59.1	0.0087	11,000	41.3	0.0071
2.0	10	15,500	63.4	0.0114	13,000	51.2	0.0094	12,000	41.3	0.0079	9,000	29.5	0.0063
2.0	12	15,500	59.1	0.0063	13,000	47.2	0.0051	12,000	41.3	0.0043	9,000	29.5	0.0035
2.0	14	15,500	59.1	0.0051	13,000	47.2	0.0043	12,000	41.3	0.0035	9,000	29.5	0.0028
2.0	16	15,500	59.1	0.0039	13,000	47.2	0.0031	12,000	41.3	0.0028	9,000	29.5	0.0024
2.0	18	15,500	59.1	0.0031	13,000	47.2	0.0028	12,000	41.3	0.0024	9,000	29.5	0.0020
2.0	20	13,000	45.3	0.0024	11,000	37.0	0.0020	10,000	29.5	0.0020	7,000	23.6	0.0016
2.0	25	13,000	45.3	0.0016	11,000	37.0	0.0012	10,000	29.5	0.0008	7,000	23.6	0.0008

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.
4. When length of the tool extension from the machine is long, reduce the speed and feed.

continued on next page

List 3794: 4 Flute, Square End, Long Neck, Stub Length (Continued)

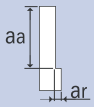
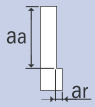
Slotting

Hardness		–			Up to 32 HRC			33~41 HRC			42~50 HRC		
Work Material		Copper Copper Alloy			Mild Steels Carbon Steels			Hardened Steels Pre-hardened Steels Stainless Steels					
Cutting Speed		173~374 SFM			144~309 SFM			130~309 SFM			101~248 SFM		
D (mm)	L2 (mm)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)	Speed (RPM)	Feed (in/min)	aa (in)
2.0	30	13,000	45.3	0.0008	11,000	37.0	0.0008	10,000	29.5	0.0004	7,000	23.6	0.0004
2.5	8	14,500	92.5	0.0165	12,000	74.8	0.0138	11,000	59.1	0.0130	9,000	41.3	0.0102
2.5	12	14,500	92.5	0.0110	12,000	74.8	0.0091	11,000	59.1	0.0075	9,000	41.3	0.0059
2.5	16	12,000	59.1	0.0055	10,000	47.2	0.0047	9,000	41.3	0.0039	7,000	29.5	0.0031
2.5	20	12,000	59.1	0.0043	10,000	47.2	0.0035	9,000	41.3	0.0031	7,000	29.5	0.0024
2.5	25	9,600	45.3	0.0039	8,000	37.0	0.0031	8,000	29.5	0.0024	6,000	23.6	0.0020
3.0	8	12,000	92.5	0.0150	10,000	74.8	0.0126	10,000	59.1	0.0118	8,000	41.3	0.0094
3.0	12	12,000	84.6	0.0126	10,000	68.9	0.0106	10,000	59.1	0.0091	8,000	41.3	0.0071
3.0	16	12,000	59.1	0.0094	10,000	47.2	0.0079	9,000	41.3	0.0067	6,000	29.5	0.0051
3.0	20	12,000	59.1	0.0063	10,000	47.2	0.0051	9,000	41.3	0.0043	6,000	29.5	0.0031
3.0	25	12,000	59.1	0.0051	10,000	47.2	0.0043	9,000	41.3	0.0035	6,000	29.5	0.0028
3.0	30	9,600	45.3	0.0043	8,000	37.0	0.0035	7,000	29.5	0.0031	5,000	23.6	0.0024

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.
4. When length of the tool extension from the machine is long, reduce the speed and feed.

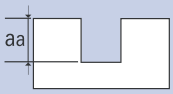
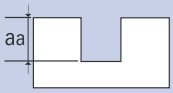
List 4445: 4 Flute, Corner Radius, High Helix, Regular Length

Side Milling

Hardness	Up to 25 HRC		25 to 35 HRC		38 to 45 HRC		40 to 50 HRC		45 to 55 HRC		20 to 45 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Alloy Steels Tool Steels		Hardened Steels 304 Stainless		Hardened Steels Pre-hardened Steels		Titanium Alloy Ti-6Al-4V		Heat Resistant Alloys Inconel	
Cutting Speed	220-328 SFM		130-220 SFM		115-210 SFM		98-150 SFM		65-195 SFM		65-130 SFM	
Depth of Cut	a_a=1.5D a_r=0.1D 						a_a=1.5D a_r=0.05D 					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/8	9,000	28.3	5,800	15.7	5,300	11.8	3,700	11.8	4,200	11.8	2,600	4.7
3/16	5,200	35.4	3,500	17.7	3,200	11.8	2,200	11.8	2,500	11.8	1,600	4.7
1/4	4,800	35.4	2,900	17.7	2,650	12.6	2,000	11.8	2,100	12.4	1,200	4.7
5/16	3,600	39.4	2,200	23.6	2,000	15.7	1,500	11.8	1,600	12.6	900	5.9
3/8	2,800	39.4	1,750	23.6	1,600	21.7	1,200	15.5	1,300	12.8	720	5.9
1/2	2,400	33.5	1,460	20.5	1,300	17.7	1,000	12.6	1,100	13.8	600	4.7

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

Slotting

Hardness	Up to 25 HRC		25 to 35 HRC		38 to 45 HRC		40 to 50 HRC		45 to 55 HRC		20 to 45 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Alloy Steels Tool Steels		Hardened Steels 304 Stainless		Hardened Steels Pre-hardened Steels		Titanium Alloy Ti-6Al-4V		Heat Resistant Alloys Inconel	
Cutting Speed	130-260 SFM		65-165 SFM		65-165 SFM		50-115 SFM		65-115 SFM		50-80 SFM	
Depth of Cut	a_r=0.5D 						a_a=0.2D 					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/8	6,400	12.6	4,200	8.3	3,700	6.3	2,600	4.3	3,000	4.7	2,100	3.1
3/16	3,800	11.8	2,500	8.3	2,200	5.9	1,600	4.3	1,800	4.7	1,250	3.0
1/4	3,200	11.8	2,100	8.3	1,900	5.9	1,300	5.1	1,500	5.5	1,060	2.8
5/16	2,400	13.8	1,600	9.8	1,400	5.9	1,000	5.9	1,100	6.7	800	3.1
3/8	1,900	13.8	1,250	9.8	1,100	5.9	750	5.9	880	6.7	640	3.1
1/2	1,600	12.6	1,060	7.1	900	6.3	660	6.3	730	5.9	500	2.8

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

Multiple End Cuts
covers a wide range of machining requirements.

WXS Coating
for superior heat and wear resistance, allowing high-speed machining in materials up to 65 HRC.

Premium Carbide Substrate
for exceptional performance in a wide range of applications in tough materials.

Multiple End Cut Varieties

Versatile Offering Covers Wide Range of Machining Requirements

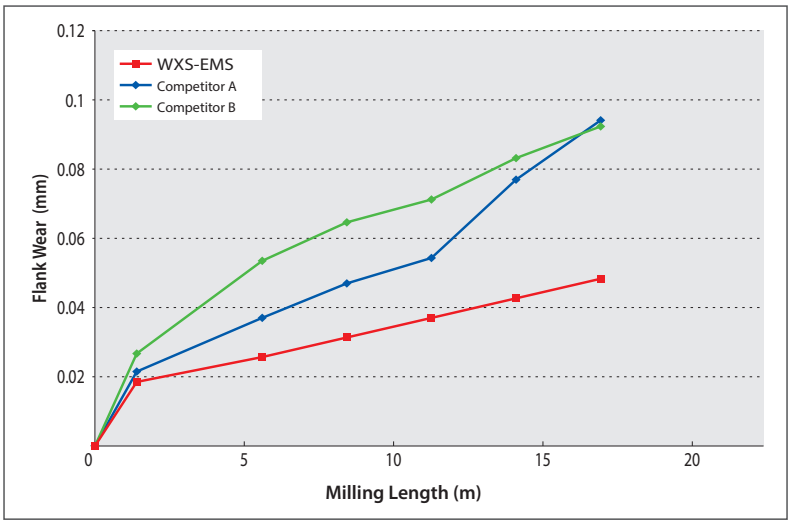
Square	
Corner Radius	
Ball Nose	
Rib Processing	

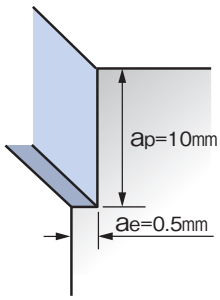
Long Tool Life in 60 HRC Tool Steel

Milling in Tool Steel (SKD11 60 HRC)

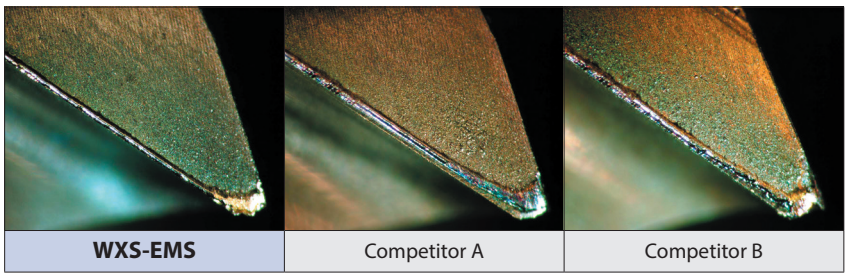
In high speed milling of heat-generating hardened steel, the effect of the OSG's WXS coating is clearly demonstrated.

Tool	WXS-EMS	Competitors
Tool Size	Ø10	
Work Material	SKD11 (60 HRC)	
Milling Method	Side Milling	
Cutting Speed	492 SFM (4,800 RPM)	
Feed Rate	33.8 IPM (0.0012 in/t)	
Depth of Cut	Aa=0.393" • Ar=0.020"	
Coolant	Air	
Machine	Vertical Machining Center	

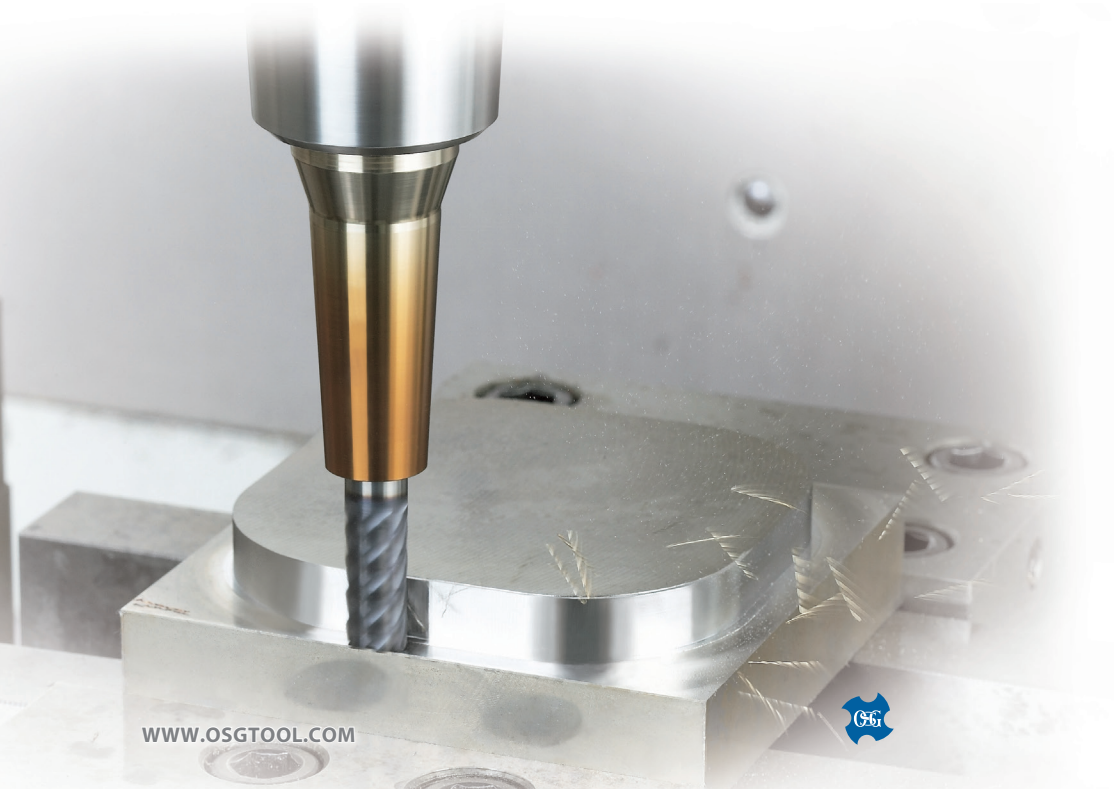




Tool wear after milling 16.8m



WXS-EMS	Competitor A	Competitor B

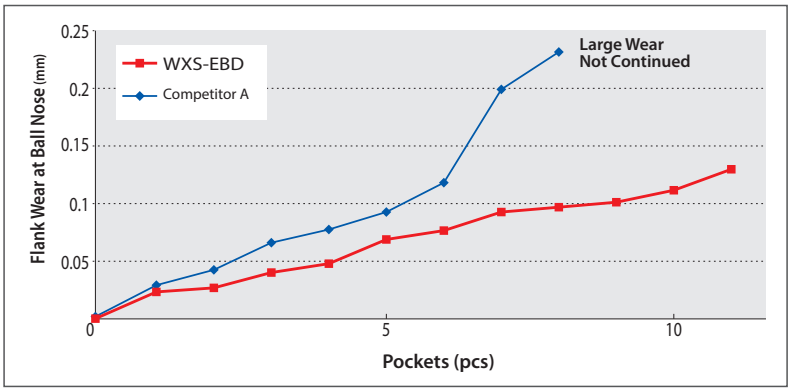


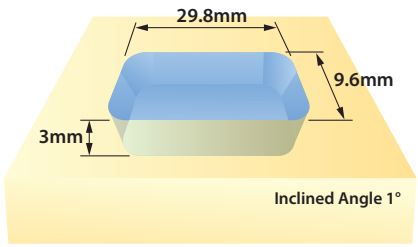
Long Tool Life in 62 HRC Tool Steel

Milling in Tool Steel (SKD11 62 HRC)

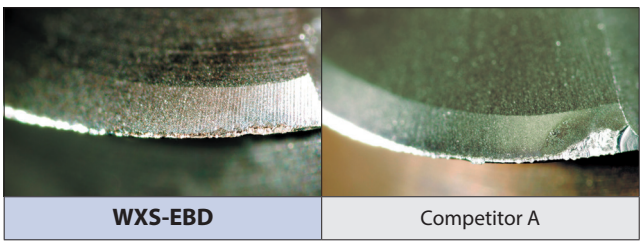
When milling in SKD11 (62 HRC) tool steel, the superior wear resistance of the OSG's WXS coating is demonstrated.

Tool	WXS-EBD	Competitor
Tool Size	R3	
Work Material	SKD11 (62 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	679 SFM (11,000 RPM)	
Feed Rate	86.6 IPM (0.004 in/t)	
Depth of Cut	Aa=0.004" • Ar=0.047"	
Coolant	Air	
Machine	Vertical Machining Center	





Tool wear after pocket milling



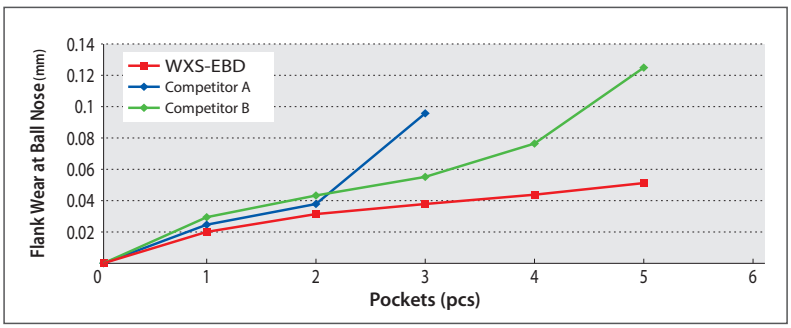
WXS-EBD	Competitor A

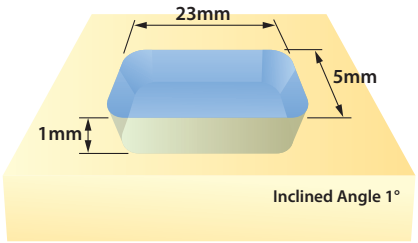
High Precision Milling in 62 HRC Tool Steel

Milling in Tool Steel (SKD11 62 HRC)

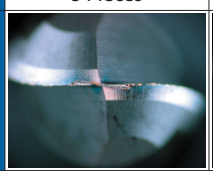
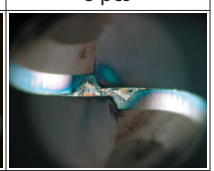
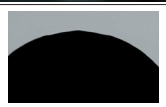
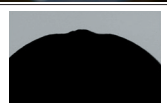
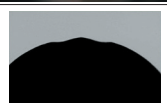
OSG's WXS coating offers high precision milling by maintaining the tool radius shape for extended periods of time.

Tool	WXS-EBD	Competitor
Tool Size	R1 x 4	
Work Material	SKD11 (62 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	656 SFM (32,000 RPM)	
Feed Rate	110.2 IPM (0.0017 in/t)	
Depth of Cut	Aa=0.0015" • Ar=0.019"	
Coolant	Air	
Machine	Vertical Machining Center	





Condition of the Cutting Edge at the End of Milling

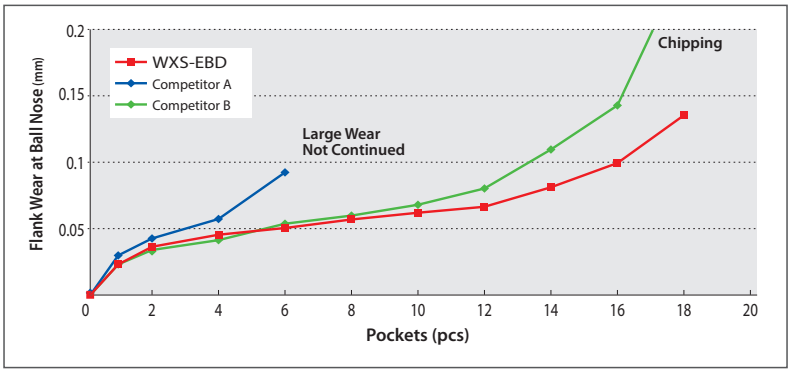
End Mill	WXS-EBD	Competitor A	Competitor B
Pockets	5 Pieces	3 pcs	5 pcs
Wear Condition			
Ball Radius Form			

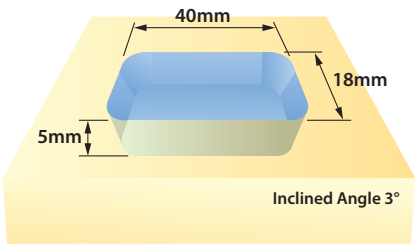
Chipping Resistance in 65 HRC Tool Steel

Milling in Tool Steel (SKH51 65 HRC)

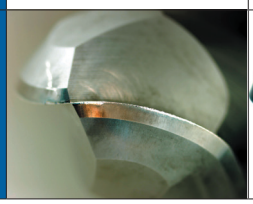
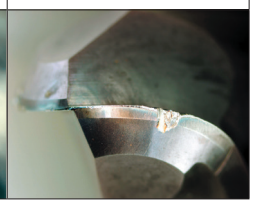
Even in 65 HRC tool steel, OSG's WXS coating enables the end mill to cut stably without chipping.

Tool	WXS-EBD	Competitors
Tool Size	R5	
Work Material	SKH51 (65 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	587 SFM (5,700 RPM)	
Feed Rate	44.9 IPM (0.004 in/t)	
Depth of Cut	Aa=0.008" • Ar=0.020"	
Coolant	Air	
Machine	Vertical Machining Center	





Tool wear after pocket milling

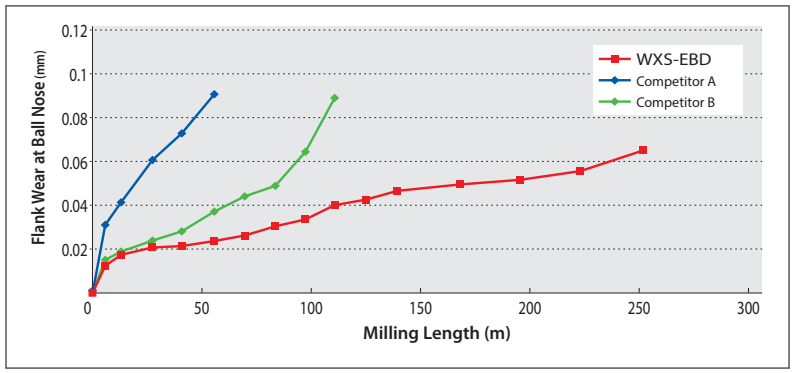
End Mill	WXS-EBD	Competitor A	Competitor B
Pockets	18 pcs	6 pcs	18 pcs
Cutting Edge			

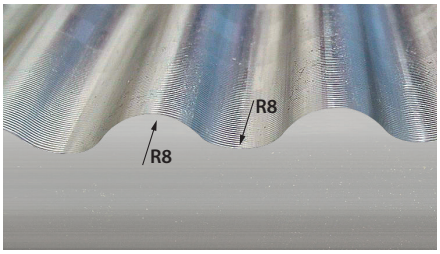
Superior Durability in 52 HRC Die Steel

Milling in Die Steel (HPM38 52 HRC)

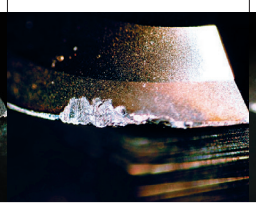
The intense ups and downs of 3D milling demonstrates the power of OSG's WXS coating.

Tool	WXS-EBD	Competitors
Tool Size	R3	
Work Material	HPM38 (52 HRC)	
Milling Method	3D Milling	
Cutting Speed	803 SFM (13,000 RPM)	
Feed Rate	122.8 IPM (0.0047 in/t)	
Depth of Cut	Aa=0.0118" • Ar=0.0236"	
Coolant	Air	
Machine	Vertical Machining Center	





Tool wear after pocket milling

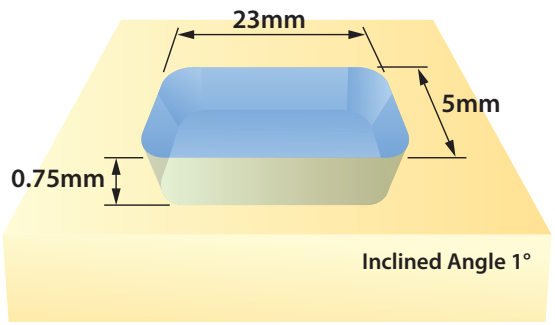
End Mill	WXS-EBD	Competitor A	Competitor B
Milling Length	128m	70m	128m
Cutting Edge			

Superior Performance in Rib Processing

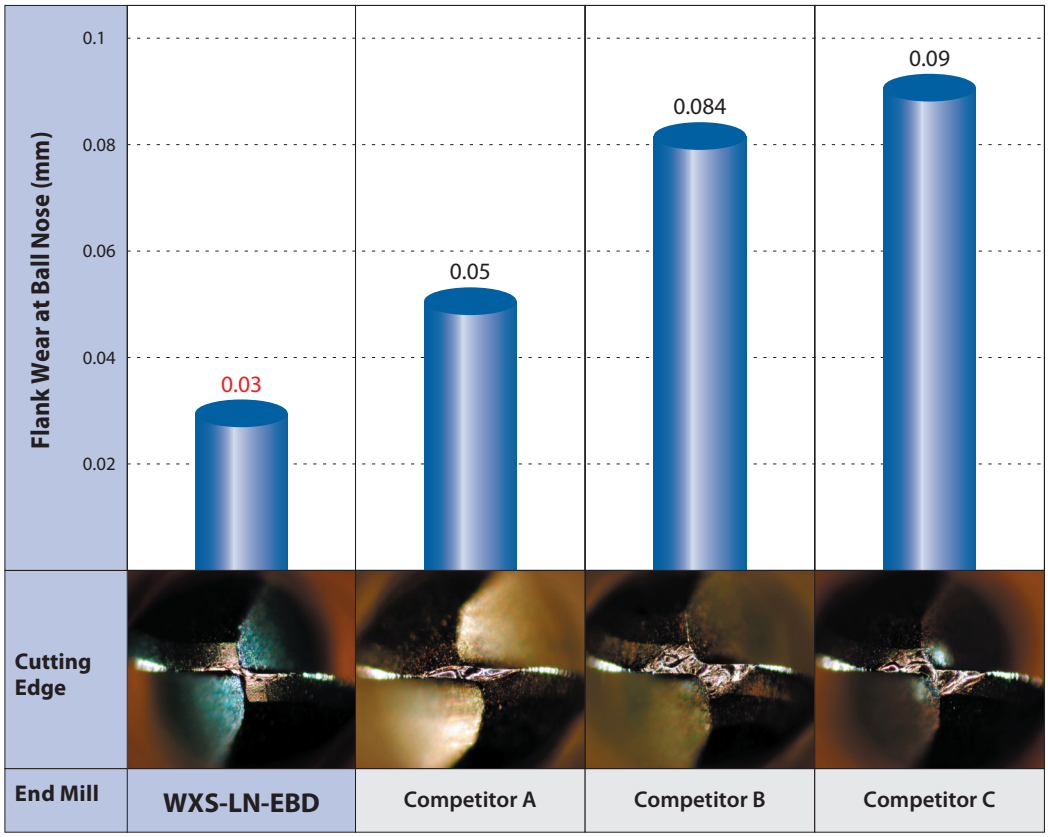
Milling in Tool Steel (SKD61 50 HRC)

Even when working with a small-diameter ball nose tool with a long neck for rib processing, the ultra-hard wxs coating exhibited superior performance.

Tool	WXS-LN-EBD	Competitors
Tool Size	R0.5 x 6	
Work Material	SKD61 (50 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	396 SFM (38,500 RPM)	
Feed Rate	35.4 IPM (0.0004 in/t)	
Depth of Cut	Aa=0.0005" • Ar=0.0012"	
Coolant	Air	
Machine	Vertical Machining Center	



Wear Comparison After Milling 1 Pocket (Milling 2 Hours)

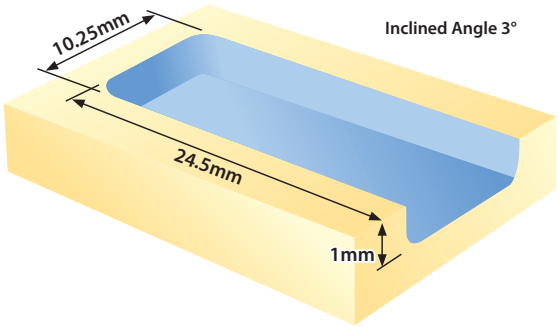


High-Precision Milling in 53 HRC Mold Steel

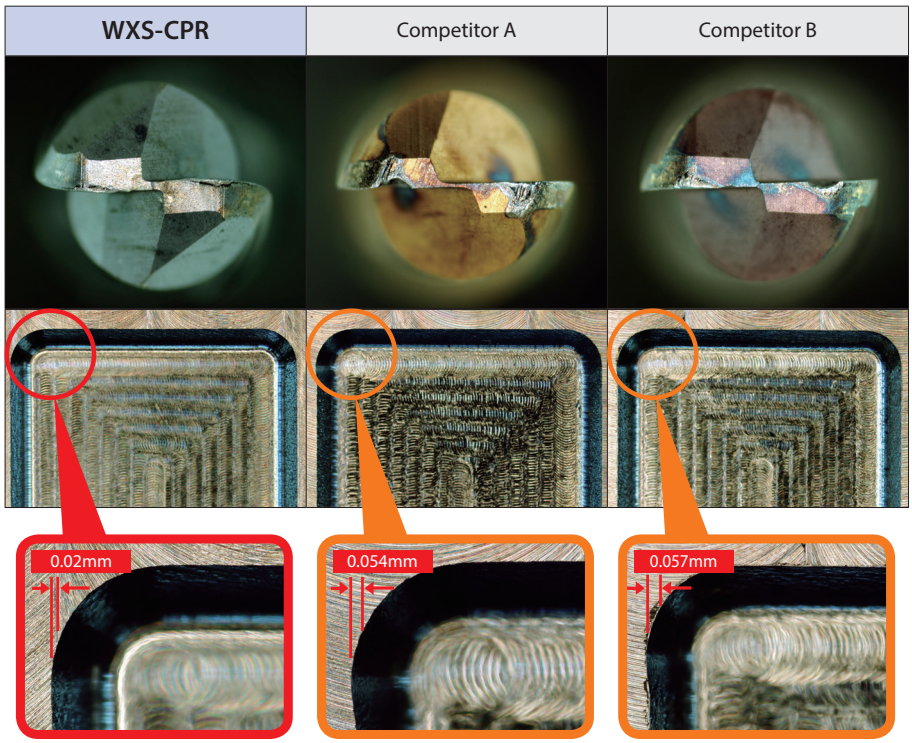
Milling in Mold Steel (STAVAX 53 HRC)

The WXS-CPR achieves stable, high-precision milling with minimal shaping errors even with an extended tool length.

Tool	WXS-CPR	Competitors
Tool Size	2 x R0.5 x 0° x 20	
Work Material	STAVAX (53 HRC)	
Milling Method	Pocket Milling	
Cutting Speed	203 SFM (10,000 RPM)	
Feed Rate	39.4 IPM (0.002 in/t)	
Depth of Cut	Aa=0.0012" • Ar=0.0236"	
Coolant	Air	
Machine	Vertical Machining Center	



Condition of the tool and workpiece after milling 8 pockets

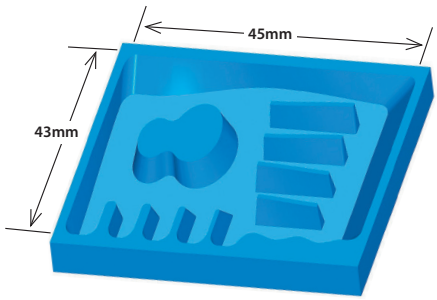


High-Precision Milling in 53 HRC Mold Steel

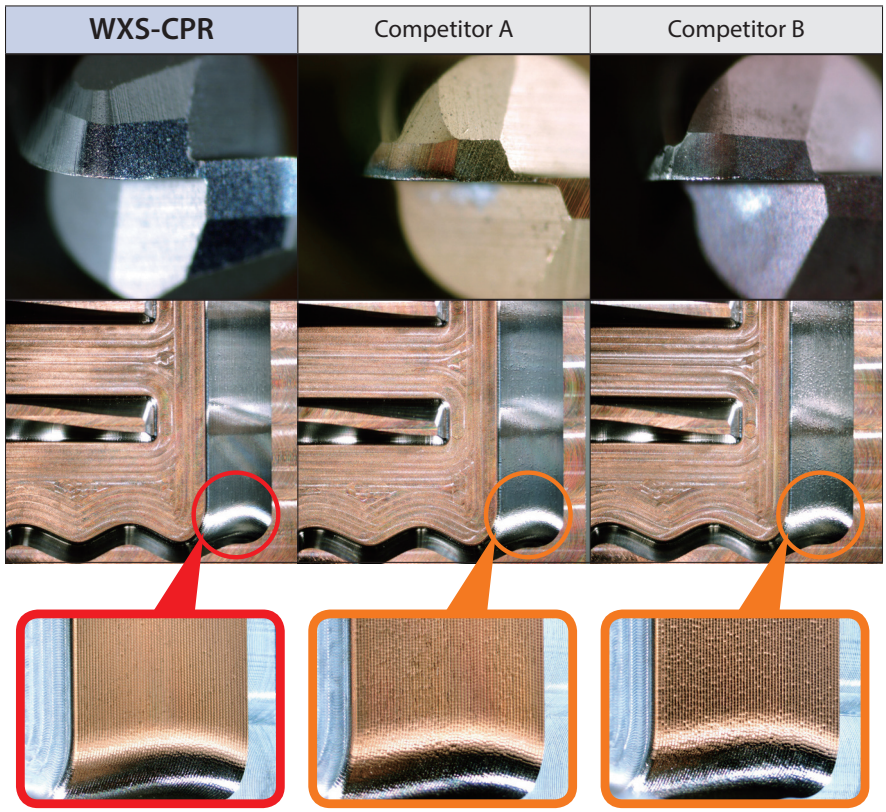
Milling in Mold Steel (STAVAX 53 HRC)

The tool's radius has a sharp and strong cutting edge to create a beautifully machined surface.

Tool	WXS-CPR	Competitors
Tool Size	2 x R0.5 x 0° x 8	
Work Material	STAVAX (53 HRC)	
Milling Method	Contour Milling	
Cutting Speed	328 SFM (16,100 RPM)	
Feed Rate	63.8 IPM (0.002 in/t)	
Depth of Cut	Aa=0.0029" • Ar=0.0039"	
Coolant	Mist	
Machine	Vertical Machining Center	



Condition of the tool and workpiece after 5-axis milling (5 hours)

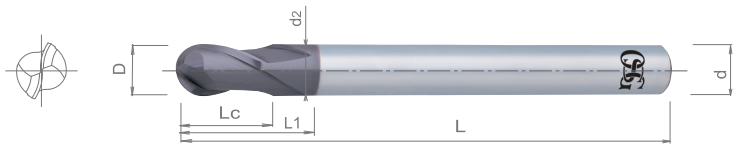


List 4410

SPEED FEED P123 | CARBIDE | WXS | REG | 30° | SHANK h6

WXS-EBD, 2 Flute, Regular Length, Ball End

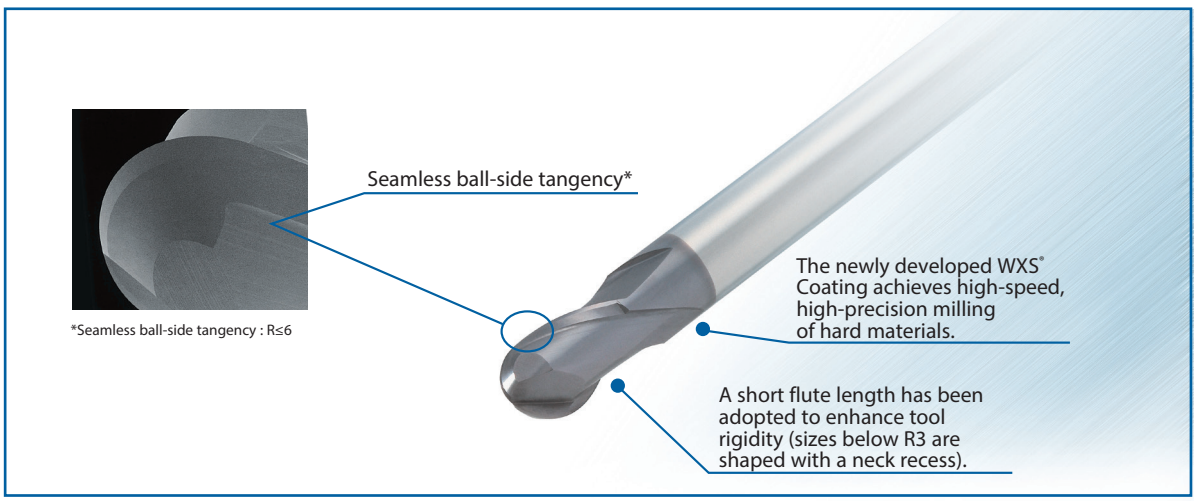
Radius Tolerance	
1/32≤D≤3/16	± 0.0002"
1/4≤D≤1/2	± 0.0003"



EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	L	Lc	L1	d2	d
44100111	1/32	1-1/2	1/32	0.094	0.029	1/4
44100211	1/16	1-1/2	1/16	0.157	0.060	1/4
44100511	3/32	1-1/2	3/32	0.189	0.092	1/4
44100711	1/8	2	1/8	0.252	0.123	1/4
44100911	3/16	2-1/2	3/16	0.283	0.185	1/4
44101111	1/4	3	1/4	0.504	0.246	1/4
44101311	5/16	3-1/2	5/16	0.630	0.308	5/16
44101411	3/8	3-1/2	3/8	0.756	0.371	3/8
44101611	1/2	4	1/2	1.000	0.496	1/2

Packed: 1 pc.
Available WXS® coating only.

HTE



Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4410	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

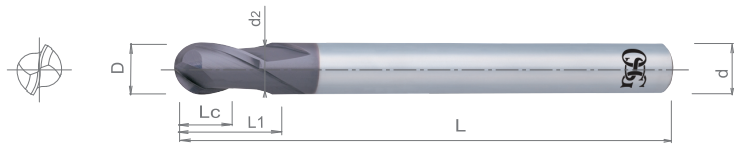
○ good ◎ best

List 4510

SPEED FEED P124 | CARBIDE | WXS | REG | 30° | SHANK h6

WXS-EBD, 2 Flute, Regular Length, Ball End

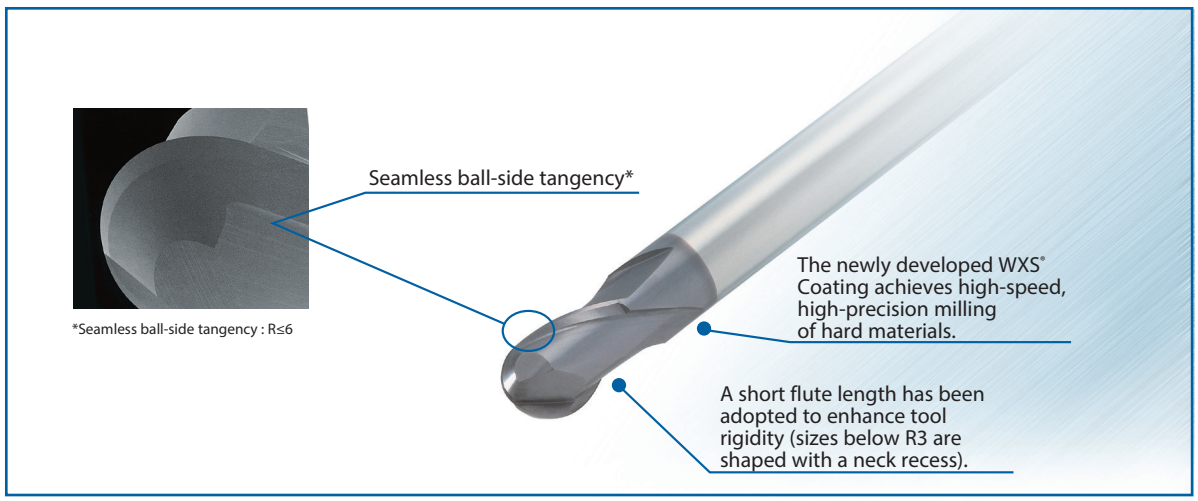
Radius Tolerance	
1≤D≤2	± 0.005mm
2<D≤12	+/- 0.007mm



EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	L	Lc	L1	d2	d
3041410	1.0	50	1	2	0.95	4
3041415	1.5	50	2	3	1.45	4
3041420	2.0	50	2	4	1.95	6
3041430	3.0	60	3	6	2.85	6
3041440	4.0	70	4	8	3.85	6
3041441	4.0	60	4	8	3.85	4
3041450	5.0	80	5	10	4.85	6
3041460	6.0	90	9	-	-	6
3041480	8.0	100	12	-	-	8
3041500	10.0	100	15	-	-	10
3041520	12.0	110	18	-	-	12

Packed: 1 pc.
Available WXS® coating only.

HTE



Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4510	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

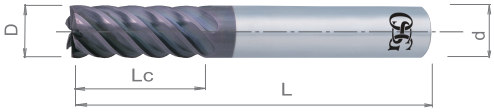
○ good ◎ best

List 4440

SPEED FEED P125 | CARBIDE | WXS | REG | 45° | SHANK h6

WXS-EMS, Multiple Flute, Regular Length

Milling Diameter Tolerance	
1/16≤D≤1/2	+0 / -0.0008"
5/8≤D≤3/4	+0 / -0.0012"



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter	Number of Flutes
	D	L	Lc	d	
44400311	1/16	2-1/2	3/16	1/4	4
44400511	3/32	2-1/2	5/16	1/4	4
44400711	1/8	2-1/2	3/8	1/4	4
44400911	3/16	2-1/2	1/2	1/4	4
44401111	1/4	2-1/2	5/8	1/4	6
44401311	5/16	2-3/4	3/4	5/16	6
44401411	3/8	3	1	3/8	6
44401611	1/2	3-1/2	1-1/8	1/2	6
44401811	5/8	4	1-1/2	5/8	6
44402011	3/4	4-1/4	1-3/4	3/4	6

Packed: 1 pc.
Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4440	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

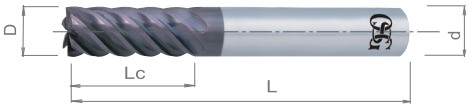
○ good ◎ best

List 4540

WXS-EMS, Multiple Flute, Regular Length

SPEED FEED P126 | CARBIDE | WXS | REG | 45° | SHANK h6

Milling Diameter Tolerance	
1≤D≤12	+0 / -0.02mm



EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Dia. d	Number of Flutes
3041010	1.0	60	2.5	6	4
3041015	1.5	60	4.0	6	4
3041020	2.0	60	6.0	6	4
3041025	2.5	60	8.0	6	4
3041030	3.0	60	8.0	6	4
3041035	3.5	60	10.0	6	4
3041040	4.0	60	11.0	6	4

EDP Number	Mill Diameter D	Overall Length L	Length of Cut Lc	Shank Dia. d	Number of Flutes
3041045	4.5	60	11.0	6	4
3041050	5.0	60	13.0	6	4
3041055	5.5	60	13.0	6	4
3041060	6.0	60	13.0	6	6
3041080	8.0	70	19.0	8	6
3041100	10.0	80	22.0	10	6
3041120	12.0	90	26.0	12	6

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4540	▢	▢	▢	▢	▢	▢	▢	▢	▢						▢	▢	▢

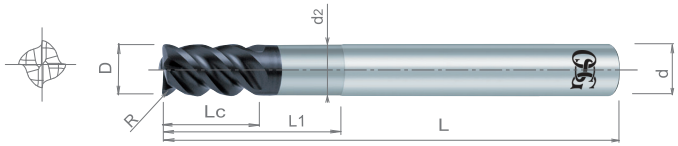
▢ good ▢ best

List 4471

SPEED FEED P127 | CARBIDE | WXS | REG | 45° | SHANK h6

WXS-PKE, 4 Flute, Regular Length, Reduced Neck, Corner Radius

Milling Diameter Tolerance	
1/16≤D≤1/2	+0 / -0.0008"



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	R	L	Lc	L1	d2	d
447100111	1/16	0.010	2.25	1/16	0.25	0.058	1/8
447100311	3/32	0.010	2.25	3/32	0.38	0.089	1/8
447100511	1/8	0.010	2.25	1/8	0.50	0.120	1/8
447100611	1/8	0.015	2.25	1/8	0.50	0.120	1/8
447100711	1/8	0.020	2.25	1/8	0.50	0.120	1/8
447101011	3/16	0.020	2.25	3/16	0.50	0.181	3/16
447101111	3/16	0.030	2.25	3/16	0.50	0.181	3/16
447101411	1/4	0.010	2.50	1/4	0.75	0.242	1/4
447101511	1/4	0.020	2.50	1/4	0.75	0.242	1/4
447101611	1/4	0.030	2.50	1/4	0.75	0.242	1/4
447102011	3/8	0.020	3.00	3/8	1.00	0.367	3/8
447102111	3/8	0.030	3.00	3/8	1.00	0.367	3/8
447102211	3/8	0.060	3.00	3/8	1.00	0.367	3/8
447102611	1/2	0.030	3.25	1/2	1.50	0.488	1/2
447102711	1/2	0.060	3.25	1/2	1.50	0.488	1/2

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4471	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

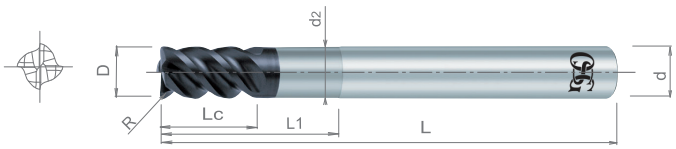
○ good ◎ best

List 4571

SPEED FEED P128 | CARBIDE | WXS | REG | 45° | SHANK h6

WXS-PKE, 4 Flute, Regular Length, Reduced Neck, Corner Radius

Milling Diameter Tolerance	
3≤D≤12	+0 / -0.02mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	R	L	Lc	L1	d2	d
457103011	3	0.2	60	5	9	2.85	6
457103111	3	0.2	70	5	15	2.85	6
457103211	3	0.5	60	5	9	2.85	6
457103311	3	0.5	70	5	15	2.85	6
457104011	4	0.2	70	6	12	3.80	6
457104111	4	0.2	80	6	20	3.80	6
457104211	4	0.5	70	6	12	3.80	6
457104311	4	0.5	80	6	20	3.80	6
457105011	5	0.2	80	8	15	4.80	6
457105111	5	0.2	90	8	25	4.80	6
457105211	5	0.5	80	8	15	4.80	6
457105311	5	0.5	90	8	25	4.80	6
457106011	6	0.5	90	9	18	5.80	6
457106111	6	1.0	90	9	18	5.80	6
457106211	6	1.0	100	9	30	5.80	6
457106311	6	0.5	100	9	30	5.80	6
457108011	8	0.5	100	12	24	7.70	8
457108111	8	0.5	110	12	40	7.70	8
457108211	8	1.0	100	12	24	7.70	8
457108311	8	1.0	110	12	40	7.70	8
457110011	10	0.5	100	15	30	9.70	10
457110111	10	0.5	120	15	50	9.70	10
457110211	10	1.0	100	15	30	9.70	10
457110311	10	1.0	120	15	50	9.70	10
457110411	10	2.0	100	15	30	9.70	10
457110511	10	2.0	120	15	50	9.70	10
457112011	12	1.0	110	18	36	11.70	12
457112111	12	1.0	130	18	60	11.70	12
457112211	12	2.0	110	18	36	11.70	12
457112311	12	2.0	130	18	60	11.70	12

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4571	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

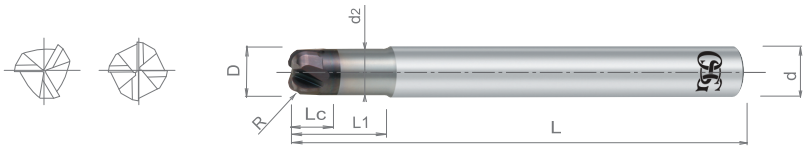
○ good ◎ best

List 4470

SPEED FEED P129 | CARBIDE | WXS | REG | 0° | SHANK h6

WXS-CRE, Regular Length, High Feed, Corner Radius

Milling Diameter Tolerance	
1/8≤D≤3/16	+0 / -0.0008"
1/4≤D≤1/2	+0 / -0.0012"



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter	No. of Flutes
	D	R	L	Lc	L1	d2	d	
44700111	1/8	1/32	2-1/4	0.06	3/8	0.12	1/4	3
44700211	3/16	1/16	2-1/4	0.09	9/16	0.18	1/4	3
44700311	1/4	1/16	3	0.10	1	0.23	1/4	4
44700411	5/16	3/32	3	0.13	1-1/4	0.29	5/16	4
44700511	3/8	3/32	4	0.15	1-1/2	0.34	3/8	4
44700611	1/2	1/8	5	0.20	2	0.46	1/2	4

Packed: 1 pc. Available WXS® coating only.

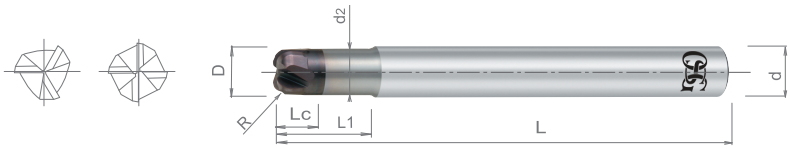
HTE

List 4570

SPEED FEED P130 | CARBIDE | WXS | REG | 0° | SHANK h6

WXS-CRE, Regular Length, High Feed, Corner Radius

Milling Diameter Tolerance	
2≤D≤5	+0 / -0.02mm
6≤D≤13	+0 / -0.03mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter	No. of Flutes
	D	R	L	Lc	L1	d2	d	
457002011	2	0.50	60	0.8	5.0	1.8	6	3
457003011	3	0.75	60	1.3	9.0	2.7	6	4
457004011	4	1.00	70	1.6	10.0	3.6	6	4
457005011	5	1.20	80	2.0	12.5	4.5	6	4
457006011	6	1.50	90	2.5	12.0	5.4	6	4
457007011	7	1.50	90	3.0	-	-	6	4
457008011	8	2.00	100	3.5	16.0	7.2	8	4
457009011	9	2.00	100	4.0	-	-	8	4
457010011	10	2.00	100	4.5	20.0	9.0	10	4
457011011	11	2.00	100	5.0	-	-	10	4
457012011	12	3.00	110	5.0	24.0	11.0	12	4
457013011	13	3.00	110	6.0	-	-	12	4

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low 1010 1018	Med. 1035 1045	High 1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4470	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎
4570	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

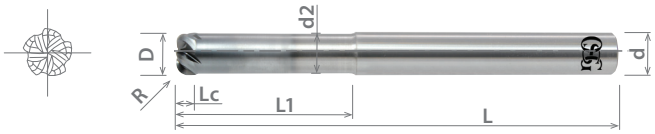
○ good ◎ best

List 4472

SPEED FEED P131 | CARBIDE | WXS | REG | SHANK h6

WXS-CRE, 5 Flute, Regular Length, High Feed, Corner Radius

Milling Diameter Tolerance	
1/8 ≤ D ≤ 3/16	+0 / -0.0008"
1/4 ≤ D ≤ 1/2	+0 / -0.0012"



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	R	L	Lc	L1	d2	d
447200013	1/8	1/32	2-1/4	0.062	0.375	0.113	1/4
447200113	3/16	1/16	2-1/4	0.094	0.562	0.168	1/4
447200213	1/4	1/16	3	0.098	1.000	0.226	1/4
447200313	5/16	3/32	3	0.129	1.250	0.280	5/16
447200413	3/8	3/32	4	0.149	1.500	0.336	3/8
447200513	1/2	1/8	5	0.200	2.000	0.460	1/2

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low 1010 1018	Med. 1035 1045	High 1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4472	◎	◎	◎	◎	◎	◎	○		◎			○	○	◎	◎	◎	◎

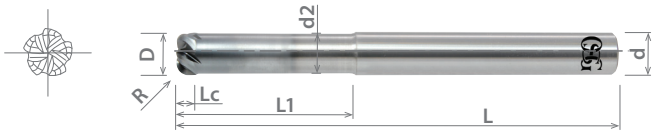
○ good ◎ best

List 4572

SPEED FEED P132 | CARBIDE | WXS | REG | SHANK h6

WXS-CRE, Multiple Flute, Regular Length, High Feed, Corner Radius

Milling Diameter Tolerance	
2 ≤ D ≤ 12	+0 / -0.03mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter	Number of Flutes
	D	R	L	Lc	L1	d2	d	
48106421	2	0.50	50	0.8	8.0	2.0	6	4
48106433	3	0.75	55	1.2	12.0	2.7	6	5
48106445	4	1.00	55	1.6	12.0	3.6	6	5
48106467	6	1.50	90	2.5	12.0	5.4	6	5
48106489	8	2.00	100	3.5	16.0	7.2	8	5
48106509	10	2.00	100	4.0	20.0	9.0	10	5
48106533	12	3.00	110	5.0	24.0	11.0	12	5

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

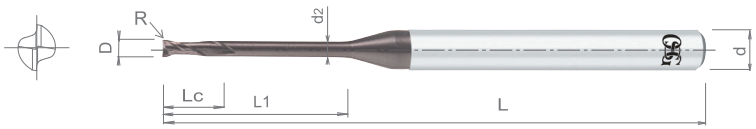
List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4572	◎	◎	◎	◎	◎	◎	○		◎			○	○	◎	◎	◎	◎

○ good ◎ best

List 4592

SPEED FEED P133 | CARBIDE | WXS | STUB | 30° | SHANK h6

WXS-CPR, 2 Flute, Stub Length, Long Neck, Corner Radius, Rib Processing



±5µm Corner Radius Tolerance

Milling Diameter Tolerance	
0.4≤D≤0.5	+0 / -0.01mm
0.5≤D≤3	+0 / -0.015mm

EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	R	L	Lc	L1	d2	d
3100403	0.4	0.05	50	0.30	2	0.37	4
3100404	0.4	0.05	50	0.30	3	0.37	4
3100405	0.4	0.05	50	0.30	4	0.37	4
3100406	0.4	0.10	50	0.30	2	0.37	4
3100407	0.4	0.10	50	0.30	3	0.37	4
3100408	0.4	0.10	50	0.30	4	0.37	4
3100501	0.5	0.05	50	0.40	1	0.46	4
3100502	0.5	0.05	50	0.40	2	0.46	4
3100503	0.5	0.05	50	0.40	3	0.46	4
3100504	0.5	0.05	50	0.40	4	0.46	4
3100505	0.5	0.05	50	0.40	5	0.46	4
3100506	0.5	0.05	50	0.40	6	0.46	4
3100508	0.5	0.10	50	0.40	2	0.46	4
3100509	0.5	0.10	50	0.40	3	0.46	4
3100510	0.5	0.10	50	0.40	4	0.46	4
3100511	0.5	0.10	50	0.40	5	0.46	4
3100512	0.5	0.10	50	0.40	6	0.46	4
3100601	0.6	0.10	50	0.48	2	0.56	4
3100602	0.6	0.10	50	0.48	4	0.56	4
3100603	0.6	0.10	50	0.48	6	0.56	4
3100803	0.8	0.20	50	0.65	4	0.76	4
3100804	0.8	0.20	50	0.65	6	0.76	4
3100805	0.8	0.20	50	0.65	8	0.76	4
3101001	1.0	0.05	50	0.80	4	0.95	4
3101002	1.0	0.05	50	0.80	6	0.95	4
3101003	1.0	0.05	50	0.80	8	0.95	4
3101004	1.0	0.05	50	0.80	10	0.95	4
3101005	1.0	0.05	50	0.80	12	0.95	4
3101006	1.0	0.10	50	0.80	4	0.95	4
3101007	1.0	0.10	50	0.80	6	0.95	4
3101008	1.0	0.10	50	0.80	8	0.95	4
3101009	1.0	0.10	50	0.80	10	0.95	4
3101010	1.0	0.10	50	0.80	12	0.95	4
3101011	1.0	0.20	50	0.80	4	0.95	4
3101012	1.0	0.20	50	0.80	6	0.95	4
3101013	1.0	0.20	50	0.80	8	0.95	4
3101014	1.0	0.20	50	0.80	10	0.95	4
3101015	1.0	0.20	50	0.80	12	0.95	4
3101016	1.0	0.20	50	0.80	16	0.95	4
3101017	1.0	0.20	50	0.80	20	0.95	4
3101018	1.0	0.30	50	0.80	4	0.95	4
3101019	1.0	0.30	50	0.80	6	0.95	4
3101020	1.0	0.30	50	0.80	8	0.95	4
3101021	1.0	0.30	50	0.80	10	0.95	4
3101022	1.0	0.30	50	0.80	12	0.95	4
3101201	1.2	0.20	50	1.00	6	1.15	4
3101202	1.2	0.20	50	1.00	8	1.15	4
3101203	1.2	0.20	50	1.00	10	1.15	4
3101501	1.5	0.20	50	1.20	6	1.45	4
3101502	1.5	0.20	50	1.20	8	1.45	4
3101503	1.5	0.20	50	1.20	10	1.45	4
3101504	1.5	0.20	50	1.20	12	1.45	4
3101505	1.5	0.20	50	1.20	16	1.45	4
3101506	1.5	0.30	50	1.20	6	1.45	4
3101507	1.5	0.30	50	1.20	8	1.45	4
3101508	1.5	0.30	50	1.20	10	1.45	4
3101509	1.5	0.30	50	1.20	12	1.45	4
3101510	1.5	0.30	50	1.20	16	1.45	4
3102001	2.0	0.10	50	1.60	8	1.95	4
3102002	2.0	0.10	50	1.60	10	1.95	4

Packed: 1 pc.
Available WXS® coating only.

continued on next page ▶ HTE

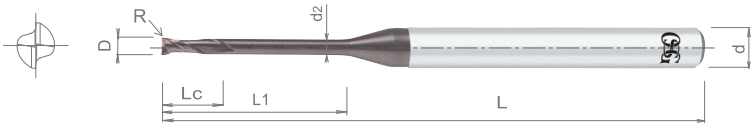
List 4592 (Continued)

WXS-CPR, 2 Flute, Stub Length, Long Neck, Corner Radius, Rib Processing

SPEED FEED P133 | CARBIDE | WXS | STUB | 30° | SHANK h6

±5µm Corner Radius Tolerance

Milling Diameter Tolerance	
0.4≤D≤0.5	+0 / -0.01mm
0.5≤D≤3	+0 / -0.015mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Neck Length	Neck Diameter	Shank Diameter
	D	R	L	Lc	L1	d2	d
3102003	2.0	0.10	50	1.60	12	1.95	4
3102004	2.0	0.10	60	1.60	16	1.95	4
3102005	2.0	0.10	60	1.60	20	1.95	4
3102006	2.0	0.10	70	1.60	25	1.95	4
3102007	2.0	0.20	50	1.60	8	1.95	4
3102008	2.0	0.20	50	1.60	10	1.95	4
3102009	2.0	0.20	50	1.60	12	1.95	4
3102010	2.0	0.20	60	1.60	16	1.95	4
3102011	2.0	0.20	60	1.60	20	1.95	4
3102012	2.0	0.20	70	1.60	25	1.95	4
3102013	2.0	0.30	50	1.60	8	1.95	4
3102014	2.0	0.30	50	1.60	10	1.95	4
3102015	2.0	0.30	50	1.60	12	1.95	4
3102016	2.0	0.30	60	1.60	16	1.95	4
3102017	2.0	0.30	60	1.60	20	1.95	4
3102018	2.0	0.30	70	1.60	25	1.95	4
3102019	2.0	0.50	50	1.60	8	1.95	4
3102020	2.0	0.50	50	1.60	10	1.95	4
3102021	2.0	0.50	50	1.60	12	1.95	4
3102022	2.0	0.50	60	1.60	16	1.95	4
3102023	2.0	0.50	60	1.60	20	1.95	4
3102024	2.0	0.50	70	1.60	25	1.95	4
3102501	2.5	0.20	50	2.20	10	2.40	4
3102502	2.5	0.20	60	2.20	20	2.40	4
3102503	2.5	0.20	70	2.20	30	2.40	4
3102504	2.5	0.50	50	2.20	10	2.40	4
3102505	2.5	0.50	60	2.20	20	2.40	4
3102506	2.5	0.50	70	2.20	30	2.40	4
3103001	3.0	0.20	60	2.50	8	2.85	6
3103002	3.0	0.20	60	2.50	12	2.85	6
3103003	3.0	0.20	60	2.50	16	2.85	6
3103004	3.0	0.20	70	2.50	20	2.85	6
3103005	3.0	0.20	70	2.50	25	2.85	6
3103006	3.0	0.20	70	2.50	30	2.85	6
3103007	3.0	0.20	80	2.50	35	2.85	6
3103008	3.0	0.30	60	2.50	12	2.85	6
3103009	3.0	0.30	60	2.50	16	2.85	6
3103010	3.0	0.30	70	2.50	20	2.85	6
3103011	3.0	0.30	70	2.50	25	2.85	6
3103012	3.0	0.30	70	2.50	30	2.85	6
3103013	3.0	0.30	80	2.50	35	2.85	6
3103014	3.0	0.50	60	2.50	12	2.85	6
3103015	3.0	0.50	60	2.50	16	2.85	6
3103016	3.0	0.50	70	2.50	20	2.85	6
3103017	3.0	0.50	70	2.50	25	2.85	6
3103018	3.0	0.50	70	2.50	30	2.85	6
3103019	3.0	0.50	80	2.50	35	2.85	6

Packed: 1 pc.
Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4592	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	○

○ good ◎ best

List 4590

SPEED FEED P134-135 | CARBIDE | WXS | STUB | 30° | SHANK h6

WXS-LN-EBD, 2 Flute, Stub Length, Long Neck, Ball End, Rib Processing

±5µm Corner Radius Tolerance

EDP Number	Mill Dia.	Overall Length	Length of Cut	Neck Length	Neck Dia.	Shank Dia.
	D	L	Lc	L1	d2	d
3050100	0.1	45	0.08	0.30	0.09	4
3050101	0.1	45	0.08	0.50	0.09	4
3050201	0.2	45	0.16	0.50	0.18	4
3049921	0.2	45	0.16	0.75	0.18	4
3050202	0.2	45	0.16	1.00	0.18	4
3049922	0.2	45	0.16	1.25	0.18	4
3050203	0.2	45	0.16	1.50	0.18	4
3049923	0.2	45	0.16	1.75	0.18	4
3050204	0.2	45	0.16	2.00	0.18	4
3050205	0.2	45	0.16	2.50	0.18	4
3050206	0.2	45	0.16	3.00	0.18	4
3050301	0.3	45	0.16	0.60	0.28	4
3050302	0.3	45	0.24	1.00	0.28	4
3049932	0.3	45	0.24	1.25	0.28	4
3050303	0.3	45	0.24	1.50	0.28	4
3049933	0.3	45	0.24	1.75	0.28	4
3050304	0.3	45	0.24	2.00	0.28	4
3049934	0.3	45	0.24	2.25	0.28	4
3050305	0.3	45	0.24	2.50	0.28	4
3050306	0.3	45	0.24	3.00	0.28	4
3050307	0.3	45	0.24	3.50	0.28	4
3050308	0.3	45	0.24	4.00	0.28	4
3050309	0.3	45	0.24	4.50	0.28	4
3050310	0.3	45	0.24	5.00	0.28	4
3050401	0.4	45	0.30	0.80	0.37	4
3050402	0.4	45	0.30	1.00	0.37	4
3050403	0.4	45	0.30	1.50	0.37	4
3050404	0.4	45	0.30	2.00	0.37	4
3050405	0.4	45	0.30	2.50	0.37	4
3050406	0.4	45	0.30	3.00	0.37	4
3050407	0.4	45	0.30	3.50	0.37	4
3050408	0.4	45	0.30	4.00	0.37	4
3050409	0.4	45	0.30	4.50	0.37	4
3050410	0.4	45	0.30	5.00	0.37	4
3050411	0.4	45	0.30	5.50	0.37	4
3050412	0.4	45	0.30	6.00	0.37	4
3050500	0.5	45	0.40	1.00	0.45	4
3050501	0.5	45	0.40	1.50	0.45	4
3050502	0.5	45	0.40	2.00	0.45	4
3049952	0.5	45	0.40	2.50	0.45	4
3050503	0.5	45	0.40	3.00	0.45	4
3049953	0.5	45	0.40	3.50	0.45	4
3050504	0.5	45	0.40	4.00	0.45	4
3049954	0.5	45	0.40	4.50	0.45	4
3050505	0.5	45	0.40	5.00	0.45	4
3049955	0.5	45	0.40	5.50	0.45	4
3050506	0.5	45	0.40	6.00	0.45	4
3050507	0.5	45	0.40	7.00	0.45	4
3050508	0.5	45	0.40	8.00	0.45	4
3050509	0.5	45	0.40	9.00	0.45	4
3050510	0.5	45	0.40	10.00	0.45	4
3050601	0.6	45	0.50	1.20	0.55	4
3050602	0.6	45	0.50	2.00	0.55	4
3049962	0.6	45	0.50	2.50	0.55	4
3050603	0.6	45	0.50	3.00	0.55	4
3049963	0.6	45	0.50	3.50	0.55	4
3050604	0.6	45	0.50	4.00	0.55	4
3049964	0.6	45	0.50	4.50	0.55	4

EDP Number	Mill Dia.	Overall Length	Length of Cut	Neck Length	Neck Dia.	Shank Dia.
	D	L	Lc	L1	d2	d
3050605	0.6	45	0.50	5.00	0.55	4
3049965	0.6	45	0.50	5.50	0.55	4
3050606	0.6	45	0.50	6.00	0.55	4
3049966	0.6	45	0.50	6.50	0.55	4
3050607	0.6	45	0.50	7.00	0.55	4
3049967	0.6	45	0.50	7.50	0.55	4
3050608	0.6	45	0.50	8.00	0.55	4
3049968	0.6	45	0.50	8.50	0.55	4
3050609	0.6	45	0.50	9.00	0.55	4
3049969	0.6	45	0.50	9.50	0.55	4
3050610	0.6	45	0.50	10.00	0.55	4
3050611	0.6	50	0.50	11.00	0.55	4
3050612	0.6	50	0.50	12.00	0.55	4
3050802	0.8	45	0.60	2.00	0.75	4
3050803	0.8	45	0.60	3.00	0.75	4
3050804	0.8	45	0.60	4.00	0.75	4
3050805	0.8	45	0.60	5.00	0.75	4
3050806	0.8	45	0.60	6.00	0.75	4
3050807	0.8	45	0.60	7.00	0.75	4
3050808	0.8	45	0.60	8.00	0.75	4
3050810	0.8	45	0.60	10.00	0.75	4
3050812	0.8	50	0.60	12.00	0.75	4
3051002	1.0	45	0.80	2.00	0.95	4
3051003	1.0	45	0.80	3.00	0.95	4
3051004	1.0	45	0.80	4.00	0.95	4
3051005	1.0	45	0.80	5.00	0.95	4
3051006	1.0	45	0.80	6.00	0.95	4
3051007	1.0	45	0.80	7.00	0.95	4
3051008	1.0	45	0.80	8.00	0.95	4
3051009	1.0	45	0.80	9.00	0.95	4
3051010	1.0	45	0.80	10.00	0.95	4
3051012	1.0	45	0.80	12.00	0.95	4
3051014	1.0	50	0.80	14.00	0.95	4
3051016	1.0	50	0.80	16.00	0.95	4
3051018	1.0	55	0.80	18.00	0.95	4
3051020	1.0	55	0.80	20.00	0.95	4
3051022	1.0	60	0.80	22.00	0.95	4
3051202	1.2	45	1.00	2.40	1.15	4
3051204	1.2	45	1.00	4.00	1.15	4
3051206	1.2	45	1.00	6.00	1.15	4
3051208	1.2	45	1.00	8.00	1.15	4
3051210	1.2	45	1.00	10.00	1.15	4
3051212	1.2	45	1.00	12.00	1.15	4
3051214	1.2	50	1.00	14.00	1.15	4
3051216	1.2	50	1.00	16.00	1.15	4
3051218	1.2	55	1.00	18.00	1.15	4
3051220	1.2	55	1.00	20.00	1.15	4
3051503	1.5	45	1.20	3.00	1.45	4
3051504	1.5	45	1.20	4.00	1.45	4
3051506	1.5	45	1.20	6.00	1.45	4
3051508	1.5	45	1.20	8.00	1.45	4
3051510	1.5	45	1.20	10.00	1.45	4
3051512	1.5	45	1.20	12.00	1.45	4
3051514	1.5	50	1.20	14.00	1.45	4
3051516	1.5	50	1.20	16.00	1.45	4
3051518	1.5	55	1.20	18.00	1.45	4
3051520	1.5	55	1.20	20.00	1.45	4
3051522	1.5	60	1.20	22.00	1.45	4

Packed: 1 pc. Available WXS® coating only.

continued on next page

HTE

List 4590 (Continued)

SPEED FEED P134-135 | CARBIDE | WXS | STUB | 30° | SHANK h6

WXS-LN-EBD, 2 Flute, Stub Length, Long Neck, Ball End, Rib Processing

±5µm Corner Radius Tolerance

EDP Number	Mill Dia. D	Overall Length L	Length of Cut Lc	Neck Length L1	Neck Dia. d2	Shank Dia. d
3051530	1.5	70	1.20	30.00	1.45	4
3051608	1.6	45	1.30	8.00	1.55	4
3051612	1.6	45	1.30	12.00	1.55	4
3051616	1.6	50	1.30	16.00	1.55	4
3051620	1.6	55	1.30	20.00	1.55	4
3052004	2.0	45	1.60	4.00	1.95	4
3052006	2.0	45	1.60	6.00	1.95	4
3052008	2.0	45	1.60	8.00	1.95	4
3052010	2.0	45	1.60	10.00	1.95	4
3052012	2.0	45	1.60	12.00	1.95	4
3052014	2.0	50	1.60	14.00	1.95	4
3052016	2.0	50	1.60	16.00	1.95	4
3052018	2.0	55	1.60	18.00	1.95	4
3052020	2.0	55	1.60	20.00	1.95	4
3052022	2.0	60	1.60	22.00	1.95	4
3052025	2.0	65	1.60	25.00	1.95	4
3052030	2.0	70	1.60	30.00	1.95	4
3052035	2.0	70	1.60	35.00	1.95	4
3052040	2.0	80	1.60	40.00	1.95	4
3052510	2.5	45	2.00	10.00	2.35	4
3052515	2.5	50	2.00	15.00	2.35	4
3052520	2.5	55	2.00	20.00	2.35	4
3052525	2.5	65	2.00	25.00	2.35	4
3052530	2.5	70	2.00	30.00	2.35	4
3052535	2.5	70	2.00	35.00	2.35	4
3053006	3.0	50	2.40	6.00	2.85	6
3053008	3.0	50	2.40	8.00	2.85	6
3053010	3.0	50	2.40	10.00	2.85	6
3053012	3.0	55	2.40	12.00	2.85	6
3053014	3.0	55	2.40	14.00	2.85	6
3053015	3.0	55	2.40	15.00	2.85	6
3053016	3.0	55	2.40	16.00	2.85	6
3053020	3.0	60	2.40	20.00	2.85	6
3053025	3.0	65	2.40	25.00	2.85	6
3053030	3.0	70	2.40	30.00	2.85	6
3053035	3.0	80	2.40	35.00	2.85	6
3053040	3.0	90	2.40	40.00	2.85	6

EDP Number	Mill Dia. D	Overall Length L	Length of Cut Lc	Neck Length L1	Neck Dia. d2	Shank Dia. d
3053515	3.5	55	2.80	15.00	3.35	6
3053520	3.5	60	2.80	20.00	3.35	6
3053525	3.5	65	2.80	25.00	3.35	6
3053530	3.5	70	2.80	30.00	3.35	6
3053535	3.5	80	2.80	35.00	3.35	6
3053540	3.5	90	2.80	40.00	3.35	6
3053545	3.5	90	2.80	45.00	3.35	6
3054008	4.0	60	3.20	8.00	3.85	6
3054010	4.0	60	3.20	10.00	3.85	6
3054012	4.0	60	3.20	12.00	3.85	6
3054015	4.0	60	3.20	15.00	3.85	6
3054016	4.0	60	3.20	16.00	3.85	6
3054020	4.0	65	3.20	20.00	3.85	6
3054025	4.0	70	3.20	25.00	3.85	6
3054030	4.0	80	3.20	30.00	3.85	6
3054035	4.0	80	3.20	35.00	3.85	6
3054040	4.0	90	3.20	40.00	3.85	6
3054045	4.0	90	3.20	45.00	3.85	6
3054050	4.0	100	3.20	50.00	3.85	6
3055010	5.0	60	4.00	10.00	4.85	6
3055015	5.0	60	4.00	15.00	4.85	6
3055020	5.0	70	4.00	20.00	4.85	6
3055025	5.0	70	4.00	25.00	4.85	6
3055030	5.0	80	4.00	30.00	4.85	6
3055035	5.0	80	4.00	35.00	4.85	6
3055040	5.0	90	4.00	40.00	4.85	6
3055045	5.0	100	4.00	45.00	4.85	6
3055050	5.0	100	4.00	50.00	4.85	6
3056012	6.0	60	4.80	12.00	5.85	6
3056020	6.0	70	4.80	20.00	5.85	6
3056025	6.0	70	4.80	25.00	5.85	6
3056030	6.0	80	4.80	30.00	5.85	6
3056035	6.0	80	4.80	35.00	5.85	6
3056040	6.0	90	4.80	40.00	5.85	6
3056045	6.0	100	4.80	45.00	5.85	6
3056050	6.0	120	4.80	50.00	5.85	6

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material																			
	P					M			K	N		S		H				
List No.	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels				
	Low	Med.	High															
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4590	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	○

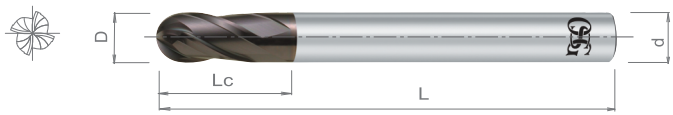
○ good ◎ best

List 4430

SPEED FEED P136 | CARBIDE | WXS | REG | 30° | SHANK h6

WXS-EBM, True 4 Flute, Regular Length, Ball End

Radius Tolerance	
1/4≤D≤1/2	± 0.0006"



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
44301111	1/4	3-1/2	1/2	1/4
44301311	5/16	4	5/8	5/16

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
44301411	3/8	4	3/4	3/8
44301611	1/2	4-3/8	7/8	1/2

Packed: 1 pc.
Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4430	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

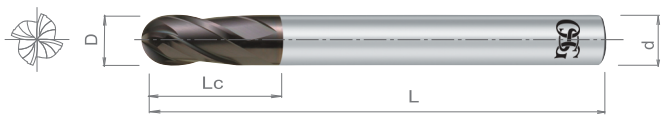
○ good ◎ best

List 4530

WXS-EBM, True 4 Flute, Regular Length, Ball End

SPEED FEED P137 | CARBIDE | WXS | REG | 30° | SHANK h6

Radius Tolerance	
6≤D≤12	± 0.015mm



EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
45300001	6	90	12	6
45300002	8	100	14	8

EDP Number	Mill Diameter	Overall Length	Length of Cut	Shank Diameter
	D	L	Lc	d
45300003	10	100	18	10
45300004	12	110	22	12

Packed: 1 pc.
Available WXS® coating only.

HTE

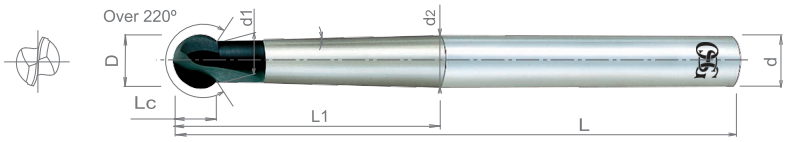
Work Material																		
	P					M			K	N		S		H				
List No.	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels				
	Low	Med.	High															
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4530	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

○ good ◎ best

List 4513

SPEED FEED P138 | CARBIDE | WXS | REG | 30° | SHANK h6

WXS-EQD, 2 Flute, Regular Length, Ball End, Sphere Type



Radius Tolerance	
1≤D≤4	±0.05mm
6≤D≤12	±0.015mm

EDP Number	Mill Diameter	Overall Length	Length of Cut	Neck Length	Min. Neck Diameter	Max Neck Diameter	Neck Incline	Shank Diameter
	D	L	Lc	L1	d1	d2		d
45130001	1	60	0.7	5	0.85	0.85	-	6
45130002	2	60	1.5	10	1.70	1.70	-	6
45130003	3	70	2.3	15	2.70	2.70	-	6
45130004	4	70	3.0	20	3.70	3.70	-	6
45130005	6	90	4.0	30	4.60	5.90	1.5°	6
45130006	8	100	5.4	40	6.20	7.90	1.5°	8
45130007	10	110	6.7	50	7.70	9.90	1.5°	10
45130008	12	110	8.1	60	9.20	11.90	1.5°	12

Packed: 1 pc. Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4513	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

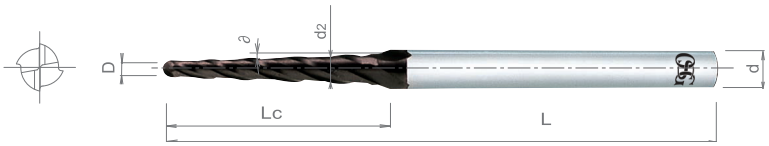
○ good ◎ best

List 4581

WXS-RB-TPB, 4 Flute, Tapered, Ball End, Rib Processing

SPEED FEED P139 | CARBIDE | WXS | 25° | SHANK h6

Side Cutting Edge Incline Tolerance
±0°5′



EDP Number	Mill Diameter	Overall Length	Length of Cut	Max Diameter	Cut Incline	Shank Diameter
	D	L	Lc	d2	α	d
45810026	1.0	45	8	1.13	0.50°	4
45810035	1.0	45	8	1.39	1.50°	4
45810040	1.0	45	12	1.80	2.00°	4
45810072	1.5	45	10	1.82	1.00°	4
45810073	1.5	45	12	1.90	1.00°	4
45810078	1.5	45	12	2.09	1.50°	4
45810083	1.5	45	12	2.29	2.00°	4
45810140	2.0	55	25	2.42	0.50°	4
45810144	2.0	55	20	2.50	0.75°	4
45810145	2.0	55	25	2.63	0.75°	4
45810150	2.0	55	25	2.84	1.00°	4
45810152	2.0	45	12	2.58	1.50°	4
45810154	2.0	55	20	3.00	1.50°	4
45810156	2.0	45	10	2.63	2.00°	4
45810175	2.5	55	25	3.33	1.00°	4
45810178	2.5	50	16	3.27	1.50°	4
45810180	2.5	55	25	3.74	1.50°	4

Packed: 1 pc.
Available WXS® coating only.

HTE

Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4581	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	○

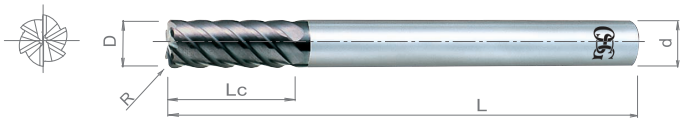
○ good ◎ best

List 4541

SPEED FEED P140-141 | CARBIDE | WXS | REG | 45° | SHANK h6

WXS-CR-EMS, Regular Length, Corner Radius

Milling Diameter Tolerance	
3≤D≤12	+0 / -0.02mm



EDP Number	Mill Diameter	Corner Radius	Overall Length	Length of Cut	Shank Diameter	Number of Flutes
	D	R	L	Lc	d	
45410000	3	0.2	60	8	6	4
45410001	3	0.5	60	8	6	4
45410002	4	0.2	70	11	6	4
45410003	4	0.5	70	11	6	4
45410004	4	1.0	70	11	6	4
45410005	5	0.2	80	13	6	4
45410006	5	0.5	80	13	6	4
45410007	5	1.0	80	13	6	4
45410008	6	0.2	90	13	6	6
45410009	6	0.5	90	13	6	6
45410010	6	1.0	90	13	6	6
45410011	6	1.5	90	13	6	6
45410012	6	2.0	90	13	6	6
45410013	8	0.5	100	19	8	6
45410014	8	1.0	100	19	8	6
45410015	8	1.5	100	19	8	6
45410016	8	2.0	100	19	8	6
45410017	10	0.5	100	22	10	6
45410018	10	1.0	100	22	10	6
45410019	10	1.5	100	22	10	6
45410020	10	2.0	100	22	10	6
45410021	10	3.0	100	22	10	6
45410022	12	0.5	110	26	12	6
45410023	12	1.0	110	26	12	6
45410024	12	1.5	110	26	12	6
45410025	12	2.0	110	26	12	6
45410026	12	3.0	110	26	12	6

Packed: 1 pc.
Available WXS® coating only.

HTE

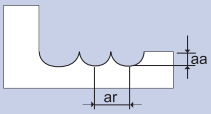
Work Material

List No.	P					M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels			
	Low	Med.	High														
	1010 1018	1035 1045	1065	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC
4541	◎	◎	◎	◎	◎	○	○	○	◎						◎	◎	◎

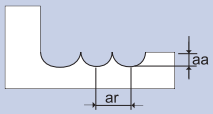
○ good ◎ best

List 4410: Ball End, Regular Length, 2 Flute

Standard Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Cutting Speed	825 SFM		660 SFM		490 SFM		410 SFM		330 SFM	
Depth of Cut	a_a=0.05D a_r=0.1D a_a Max = less than 0.024″ 				a_a=0.03D a_r=0.1D a_a Max = less than 0.020″		a_a=0.02D a_r=0.05D a_a Max = less than 0.012″			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/32	50,000	50.0	50,000	50.0	50,000	50.0	50,000	50.0	40,339	40.3
1/16	50,000	80.0	40,339	64.5	29,949	47.9	25,059	40.1	20,170	32.3
3/32	33,616	107.6	26,893	86.1	19,966	63.9	16,706	53.5	13,446	43.0
1/8	25,212	100.8	20,170	80.7	14,974	59.9	12,530	50.1	10,085	40.3
3/16	16,808	90.8	13,446	72.6	9,983	53.9	8,353	45.1	6,723	36.3
1/4	12,606	108.4	10,085	86.7	7,487	64.4	6,265	53.9	5,042	43.4
5/16	10,085	100.8	8,068	80.7	5,990	59.9	5,012	50.1	4,034	40.3
3/8	8,404	92.4	6,723	74.0	4,991	54.9	4,177	45.9	3,362	37.0
1/2	6,303	88.2	5,042	70.6	3,744	52.4	3,132	43.9	2,521	35.3

High Speed Light Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Cutting Speed	1275 SFM		985 SFM		820 SFM		650 SFM		490 SFM	
Depth of Cut	a_a=0.02D a_r=0.05D a_a Max=less than 0.012″ 				a_a=0.02D a_r=0.05D a_a Max = less than 0.008″		a_a=0.01D a_r=0.05D a_a Max = less than 0.004″			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/32	50,000	50.0	50,000	50.0	50,000	50.0	50,000	50.0	50,000	50.0
1/16	50,000	80.0	50,000	80.0	50,000	80.0	39,728	63.6	29,949	47.9
3/32	50,000	160.0	40,135	128.4	33,412	106.9	26,485	84.8	19,966	63.9
1/8	38,964	155.9	30,102	120.4	25,059	100.2	19,864	79.5	14,974	59.9
3/16	25,976	140.3	20,068	108.4	16,706	90.2	13,243	71.5	9,983	53.9
1/4	19,482	167.5	15,051	129.4	12,530	107.8	9,932	85.4	7,487	64.4
5/16	15,586	155.9	12,041	120.4	10,024	100.2	7,946	79.5	5,990	59.9
3/8	12,988	142.9	10,034	110.4	8,353	91.9	6,621	72.8	4,991	54.9
1/2	9,741	136.4	7,525	105.4	6,265	87.7	4,966	69.5	3,744	52.4

List 4510: Ball End - Regular Length - 2 Flute

Standard Milling

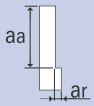
Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Cutting Speed	825 SFM		660 SFM		490 SFM		410 SFM		330 SFM	
Depth of Cut	a_a=0.05D a_r=0.1D a_a Max = less than 0.024"				a_a=0.02D a_r=0.1D a_a Max = less than 0.020"		a_a=0.02D a_r=0.05D a_a Max = less than 0.012"			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1.0	50,000	50.0	50,000	50.0	47,544	47.5	39,781	39.8	32,000	32.0
1.5	50,000	80.0	42,692	68.3	32,000	51.2	26,500	42.4	21,000	33.6
2.0	40,024	80.0	32,000	64.0	24,000	48.0	20,000	40.0	16,000	32.0
3.0	26,500	100.7	21,000	79.8	16,000	60.8	13,500	51.3	10,500	39.9
4.0	20,000	92.0	16,000	73.6	12,000	55.2	9,950	45.8	7,950	36.6
5.0	16,000	92.8	12,500	72.5	9,550	55.4	7,950	46.1	6,350	36.8
6.0	13,350	114.8	10,500	90.3	7,950	68.4	6,650	57.2	5,300	45.6
8.0	9,950	99.5	7,950	79.5	5,950	59.5	4,950	49.5	4,000	40.0
10.0	7,950	89.0	6,350	71.1	4,800	53.8	4,000	44.8	3,200	35.8
12.0	6,650	93.1	5,300	74.2	4,000	56.0	3,300	46.2	2,650	37.1
16.0	4,950	74.3	4,000	60.0	3,000	45.0	2,500	37.5	2,000	30.0
20.0	4,000	60.0	3,200	48.0	2,400	36.0	2,000	30.0	1,600	24.0
25.0	3,200	48.0	2,550	38.3	1,900	28.5	1,600	24.0	1,250	18.8

High Speed Light Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Cutting Speed	1275 SFM		985 SFM		820 SFM		650 SFM		490 SFM	
Depth of Cut	a_a=0.02D a_r=0.05D a_a Max = less than 0.012"				a_a=0.02D a_r=0.05D a_a Max = less than 0.008"		a_a=0.01D a_r=0.05D a_a Max = less than 0.004"			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1.0	50,000	50.0	50,000	50.0	50,000	50.0	50,000	50.0	47,500	47.5
1.5	50,000	80.0	50,000	80.0	50,000	80.0	42,500	68.0	32,000	51.2
2.0	50,000	100.0	47,500	95.0	40,000	80.0	32,000	64.0	24,000	48.0
3.0	41,500	157.7	32,000	121.6	26,500	100.7	21,000	79.8	16,000	60.8
4.0	31,000	142.6	24,000	110.4	20,000	92.0	16,000	73.6	12,000	55.2
5.0	25,000	145.0	19,000	110.2	16,000	92.8	13,000	75.4	9,550	55.4
6.0	20,500	176.3	16,000	137.6	13,500	116.1	10,500	90.3	7,950	68.4
8.0	15,500	155.0	12,000	120.0	9,950	99.5	7,950	79.5	5,950	59.5
10.0	12,500	140.0	9,550	107.0	7,950	89.0	6,350	71.1	4,800	53.8
12.0	10,500	147.0	7,950	111.3	6,650	93.1	5,300	74.2	4,000	56.0
16.0	7,750	116.3	5,950	89.3	4,950	74.3	4,000	60.0	3,000	45.0
20.0	6,200	93.0	4,800	72.0	4,000	60.0	3,200	48.0	2,400	36.0
25.0	4,950	74.3	3,800	57.0	3,200	48.0	2,550	38.3	1,900	28.5

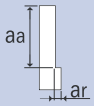
List 4440: Regular Length, Multiple Flute

Standard Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC		65 to 70 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels							
Depth of Cut					a_a=1.5D a_r=0.05D arMax=less than 0.040″		a_a=1.5D a_r=0.03D arMax=less than 0.020″		a_a=1D a_r=0.02D arMax=less than 0.020″			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	28,421	71.0	25,548	63.0	20,170	50.4	15,120	26.0	13,808	21.0	10,085	13.0
3/32	18,912	71.0	16,991	63.0	13,446	50.4	10,080	26.0	9,205	21.0	6,723	13.0
1/8	14,185	71.0	12,744	63.0	10,085	50.4	7,560	26.0	6,904	21.0	5,042	13.0
3/16	9,456	71.0	8,496	63.0	6,723	50.4	5,041	26.0	4,602	21.0	3,362	13.0
1/4	7,092	104.0	6,372	95.0	5,042	75.6	3,780	40.0	3,452	31.0	2,521	20.0
5/16	5,673	104.0	5,100	95.0	4,034	75.6	3,024	40.0	2,761	31.0	2,017	20.0
3/8	4,728	104.0	4,248	95.0	3,362	75.6	2,520	40.0	2,301	31.0	1,681	20.0
1/2	3,546	104.0	3,186	95.0	2,521	75.6	1,890	40.0	1,726	31.0	1,261	20.0
5/8	2,839	104.0	2,550	95.0	2,017	75.6	1,512	40.0	1,382	31.0	1,008	20.0
3/4	2,375	104.0	2,125	95.0	1,681	75.6	1,260	40.0	1,152	31.0	840	20.0

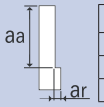
	a_a	a_r
D≤1.5	1.5D	0.02D
1.5<D≤2.5	1.5D	0.05D
2.5<D	1.5D	0.1D

High Speed Light Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC		65 to 70 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels							
Depth of Cut			a_a=1D a_r=0.05D arMax=less than 0.020″		a_a=1D a_r=0.03D arMax=less than 0.020″		a_a=1D a_r=0.02D arMax=less than 0.008″		a_a=1D a_r=0.01D arMax=less than 0.008″			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	50,000	122.5	50,000	122.5	50,000	122.8	32,144	65.0	30,240	53.0	20,160	32.0
3/32	40,096	147.4	38,400	141.1	33,412	122.8	21,429	65.0	20,160	53.0	13,440	32.0
1/8	30,072	147.4	28,800	141.1	25,059	122.8	16,072	65.0	15,120	53.0	10,080	32.0
3/16	20,048	147.4	19,200	141.1	16,706	122.8	10,714	65.0	10,080	53.0	6,720	32.0
1/4	15,036	221.0	14,400	211.7	12,530	184.2	8,036	96.5	7,560	79.0	5,040	47.0
5/16	12,028	221.0	11,520	211.7	10,024	184.2	6,428	96.5	6,048	79.0	4,032	47.0
3/8	10,024	221.0	9,600	211.7	8,353	184.2	5,357	96.5	5,040	79.0	3,360	47.0
1/2	7,518	221.0	7,200	211.7	6,265	184.2	4,018	96.5	3,780	79.0	2,520	47.0
5/8	6,012	221.0	5,764	211.7	5,012	184.2	3,216	96.5	3,025	79.0	2,017	47.0
3/4	5,010	221.0	4,804	211.7	4,177	184.2	2,680	96.5	2,521	79.0	1,681	47.0

List 4540: Regular Length, Multiple Flute

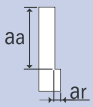
Standard Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC		65 to 70 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels							
Depth of Cut					aa=1.5D ar=0.05D arMax=less than 0.040″		aa=1.5D ar=0.03D arMax=less than 0.020″		aa=1D ar=0.02D arMax=less than 0.020″			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1	45,100	70.9	40,450	63.0	32,000	49.2	24,050	26.4	21,900	21.1	16,000	13.2
2	22,500	70.9	20,200	63.0	16,000	49.2	12,000	26.4	11,000	21.1	7,950	13.2
3	15,000	70.9	13,500	63.0	10,500	49.2	7,950	26.4	7,450	21.1	5,300	13.2
4	11,000	70.9	9,950	63.0	7,950	49.2	5,950	26.4	5,550	21.1	4,000	13.2
5	8,900	70.9	7,950	63.0	6,350	49.2	4,800	26.4	4,450	21.1	3,200	13.2
6	7,450	104.3	6,650	94.5	5,300	74.8	4,000	39.4	3,700	31.5	2,650	19.9
8	5,550	104.3	4,950	94.5	4,000	74.8	3,000	39.4	2,800	31.5	2,000	19.9
10	4,450	104.3	4,000	94.5	3,200	74.8	2,400	39.4	2,250	31.5	1,600	19.9
12	3,700	104.3	3,300	94.5	2,650	74.8	2,000	39.4	1,850	31.5	1,350	19.9

	aa	ar
D≤1.5	1.5D	0.02D
1.5<D≤2.5	1.5D	0.05D
2.5<D	1.5D	0.1D

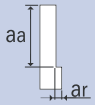
arMax=less than 0.040″

High Speed Light Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC		65 to 70 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels							
Depth of Cut			aa=1D ar=0.05D arMax=less than 0.020″		aa=1D ar=0.03D arMax=less than 0.020″		aa=1D ar=0.02D arMax=less than 0.008″		aa=1D ar=0.01D arMax=less than 0.008″			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1	50,000	63.0	50,000	78.7	50,000	78.7	50,000	63.0	47,500	53.1	32,000	28.1
2	47,500	128.0	47,500	149.6	40,000	126.0	25,500	65.0	24,000	53.1	16,000	31.5
3	32,000	135.8	32,000	149.6	26,500	126.0	17,000	65.0	16,000	53.1	10,500	31.5
4	24,000	153.5	24,000	149.6	20,000	126.0	12,500	65.0	12,000	53.1	7,950	31.5
5	19,000	161.4	19,000	149.6	16,000	126.0	10,000	65.0	9,550	53.1	6,350	31.5
6	16,000	226.4	16,000	226.4	13,500	189.0	8,500	96.5	7,950	78.7	5,300	47.2
8	12,000	226.4	12,000	226.4	9,950	189.0	6,350	96.5	5,950	78.7	4,000	47.2
10	9,550	226.4	9,550	226.4	7,950	189.0	5,100	96.5	4,800	78.7	3,200	47.2
12	7,950	226.4	7,950	226.4	6,650	189.0	4,250	96.5	4,000	78.7	2,650	47.2

List 4471: Regular Length, Four Flute, Corner Radius

Standard Milling

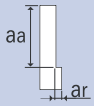
Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut					aa=1.5D ar=0.05D ar Max=less than 0.04"		aa=1.5D ar=0.03D ar Max=less than 0.02"		aa=1.0D ar=0.02D ar Max=less than 0.02"	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	28,115	78.7	25,243	70.7	20,170	56.5	15,158	36.4	14,180	22.7
3/32	18,743	75.0	16,828	67.3	13,446	53.8	10,105	30.3	9,453	22.7
1/8	14,058	73.1	12,621	65.6	10,085	52.4	7,579	27.3	7,090	25.5
3/16	9,372	60.0	8,414	53.9	6,723	43.0	5,053	22.2	4,727	20.8
1/4	7,029	101.2	6,311	90.9	5,042	72.6	3,789	37.9	3,545	31.2
3/8	4,686	105.0	4,207	94.2	3,362	75.3	2,526	39.4	2,363	31.2
1/2	3,514	99.8	3,155	89.6	2,521	71.6	1,895	38.7	1,772	31.2

	aa	ar
D=1/16	1.5D	0.05D
D>1/16	1.5D	0.10D

arMax=less than 0.04"

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

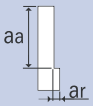
High Speed Light Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut			aa=1.0D ar=0.05D ar Max = less than 0.02"		aa=1.0D ar=0.03D ar Max = less than 0.02"		aa=1.0D ar=0.02D ar Max = less than 0.008"		aa=1.0D ar=0.01D ar Max = less than 0.008"	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/16	50,000	140.0	50,000	140.0	50,000	140.0	32,149	64.3	30,254	60.5
3/32	40,135	160.5	40,135	160.5	33,412	133.6	21,433	68.6	20,170	56.5
1/8	30,102	156.5	30,102	156.5	25,059	130.3	16,075	70.7	15,127	54.5
3/16	20,068	128.4	20,068	128.4	16,706	106.9	10,716	72.9	10,085	52.4
1/4	15,051	216.7	15,051	216.7	12,530	180.4	8,037	93.2	7,564	78.7
3/8	10,034	224.8	10,034	224.8	8,353	187.1	5,358	96.4	5,042	78.7
1/2	7,525	213.7	7,525	213.7	6,265	177.9	4,019	93.2	3,782	75.6

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

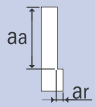
List 4571: Regular Length, 4 Flute, Corner Radius

Standard Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut										
		aa	ar							
	D=2	1.5D	0.05D							
	D>2	1.5D	0.10D							
	arMax=less than 0.04″				aa=1.5D ar=0.05D arMax=less than 0.04″		aa=1.5D ar=0.03D arMax=less than 0.02″		aa=1.0D ar=0.02D arMax=less than 0.02″	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
2	22,316	71.4	20,036	64.1	16,010	51.2	12,031	24.1	11,255	22.5
3	14,878	71.4	13,358	64.1	10,673	51.2	8,021	25.7	7,503	21.0
4	11,158	71.4	10,018	64.1	8,005	51.2	6,016	26.5	5,628	20.3
5	8,927	85.7	8,015	76.9	6,404	61.5	4,813	25.0	4,502	21.6
6	7,439	104.1	6,679	93.5	5,337	74.7	4,010	38.5	3,752	31.5
8	5,579	104.9	5,009	94.2	4,002	75.2	3,008	39.7	2,814	31.5
10	4,463	103.5	4,007	93.0	3,202	74.3	2,406	39.5	2,251	31.5
12	3,719	104.1	3,339	93.5	2,668	74.7	2,005	39.3	1,876	32.3

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

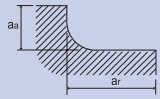
High Speed Light Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut			aa=1.0D ar=0.05D arMax=less than 0.02″		aa=1.0D ar=0.03D arMax=less than 0.02″		aa=1.0D ar=0.02D arMax=less than 0.008″		aa=1.0D ar=0.01D arMax=less than 0.008″	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
2	47,786	152.9	47,786	152.9	39,781	127.3	25,518	61.2	24,014	48.0
3	31,858	152.9	31,858	152.9	26,521	127.3	17,012	68.0	16,010	51.2
4	23,893	152.9	23,893	152.9	19,891	127.3	12,759	66.3	12,007	52.8
5	19,115	183.5	19,115	183.5	15,913	152.8	10,207	65.3	9,606	53.8
6	15,929	223.0	15,929	223.0	13,260	185.6	8,506	95.3	8,005	80.0
8	11,947	224.6	11,947	224.6	9,945	187.0	6,380	97.0	6,004	79.2
10	9,557	221.7	9,557	221.7	7,956	184.6	5,104	95.9	4,803	76.8
12	7,964	223.0	7,964	223.0	6,630	185.6	4,253	97.0	4,002	78.4

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

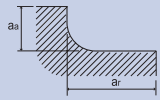
List 4470: Regular Length, Corner Radius, High Feed

Standard Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius		CR≤1/16: aa 0.2xCR, ar 0.5D CR>1/16: aa 0.02", ar 0.5D		CR≤1/16: aa 0.2xCR, ar 0.5D CR>1/16: aa 0.016", ar 0.5D		CR≤1/16: aa 0.1xCR, ar 0.5D CR>1/16: aa 0.008", ar 0.5D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/8	12,224	252	8,404	158	6,112	103	3,667	41	3,056	34
3/16	8,149	252	5,603	158	4,075	103	2,445	41	2,037	34
1/4	6,112	336	4,202	210	3,056	138	1,834	55	1,528	46
5/16	4,890	336	3,362	210	2,445	138	1,467	55	1,222	46
3/8	4,075	336	2,801	210	2,037	138	1,222	55	1,019	46
1/2	3,056	336	2,101	210	1,528	138	917	55	764	46

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

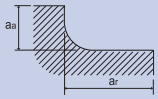
High Feed Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius		a_a=0.1CR a_r=0.3D		CR≤1/16: aa 0.1xCR, ar 0.3D CR>1/16: aa 0.008", ar 0.3D		CR≤1/16: aa 0.05xCR, ar 0.3D CR>1/16: aa 0.004", ar 0.3D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/8	23,990	495	18,030	338	16,808	284	11,918	134	9,168	103
3/16	15,993	495	12,020	338	11,205	284	7,946	134	6,112	103
1/4	11,995	660	9,015	451	8,404	378	5,959	179	4,584	138
5/16	9,596	660	7,212	451	6,723	378	4,767	179	3,667	138
3/8	7,997	660	6,010	451	5,603	378	3,973	179	3,056	138
1/2	5,997	660	4,508	451	4,202	378	2,980	179	2,292	138

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

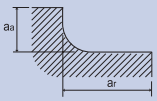
List 4570: Regular Length, Corner Radius, High Feed

Standard Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius CR≤2: aa 0.2xCR, ar 0.5D CR>2: aa 0.02″, ar 0.5D				CR≤2: aa 0.2xCR, ar 0.5D CR>2: aa 0.016″, ar 0.5D		CR≤2: aa 0.1xCR, ar 0.5D CR>2: aa 0.008″, ar 0.5D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
2	19,406	252	13,341	158	9,703	103	5,822	41	4,851	34
3	12,937	336	8,894	210	6,469	138	3,881	55	3,234	46
4	9,703	336	6,671	210	4,851	138	2,911	55	2,426	46
5	7,762	336	5,337	210	3,881	138	2,329	55	1,941	46
6	6,469	336	4,447	210	3,234	138	1,941	55	1,617	46
7	5,544	336	3,812	210	2,772	138	1,663	55	1,386	46
8	4,851	336	3,335	210	2,426	138	1,455	55	1,213	46
9	4,312	336	2,965	210	2,156	138	1,294	55	1,078	46
10	3,881	336	2,668	210	1,941	138	1,164	55	970	46
11	3,528	336	2,426	210	1,764	138	1,058	55	882	46
12	3,234	336	2,224	210	1,617	138	970	55	809	46
13	2,985	336	2,053	210	1,493	138	896	55	746	46

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

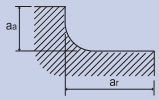
High Feed Milling

Hardness	Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Tool Steels Hardened Steels Pre-hardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius a_a=0.1xCR a_r=0.3D				CR≤2: aa 0.1xCR, ar 0.3D CR>2: aa 0.008″, ar 0.3D		CR≤2: aa 0.05xCR, ar 0.3D CR>2: aa 0.004″, ar 0.3D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
2	38,083	495	28,623	338	26,683	284	18,920	134	14,554	103
3	25,389	660	19,082	451	17,788	378	12,614	179	9,703	138
4	19,042	660	14,312	451	13,341	378	9,460	179	7,277	138
5	15,233	660	11,449	451	10,673	378	7,568	179	5,822	138
6	12,694	660	9,541	451	8,894	378	6,307	179	4,851	138
7	10,881	660	8,178	451	7,624	378	5,406	179	4,158	138
8	9,521	660	7,156	451	6,671	378	4,730	179	3,639	138
9	8,463	660	6,361	451	5,929	378	4,205	179	3,234	138
10	7,617	660	5,725	451	5,337	378	3,784	179	2,911	138
11	6,924	660	5,204	451	4,851	378	3,440	179	2,646	138
12	6,347	660	4,771	451	4,447	378	3,153	179	2,426	138
13	5,859	660	4,404	451	4,105	378	2,911	179	2,239	138

1. The indicated speeds and feeds are for high speed light milling for use with high speed/high precision machining centers.
2. Do not use flammable fluids because tools with considerable wear can cause sparks.
3. We recommend using air blow. When using cutting fluids, use a high quality fluid with high smoke retardant.

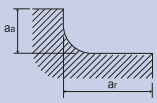
List 4472: Regular Length, Corner Radius, High Feed

Standard Milling

Hardness		Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Cast Iron	Mild Steels Carbon Steels		Tool Steels Stainless Steel Hardened Steels Prehardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius aa: CR≤1/16: 0.2xCR; CR>1/16: 0.02" ar: 0.5D					aa: CR≤1/16: 0.2xCR; CR>1/16: 0.016" ar: 0.5D		aa: CR≤1/16: 0.1xCR; CR>1/16: 0.008" ar: 0.5D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/8	10,080	255	7,950	175	7,030	150	5,040	100	3,060	40	2,690	28
3/16	6,720	265	5,300	190	4,690	165	3,360	110	2,040	42	1,790	30
1/4	5,040	275	3,970	200	3,510	175	2,520	115	1,530	45	1,340	32
5/16	4,030	275	3,180	200	2,810	175	2,020	115	1,220	45	1,080	32
3/8	3,360	275	2,650	200	2,340	175	1,680	115	1,020	45	900	32
1/2	2,520	275	1,990	200	1,760	175	1,260	115	760	45	670	32

1. Use a rigid and precise machine and holder.
2. These milling conditions are based on milling with circular interpolation at corners; for milling without circular interpolation (such as right angle cornering), reduce the speed to 50-70% and the cutting depth to 50-80% of the above conditions.
3. We recommend using air blow or MQL (mist).
4. Please adjust the speed, feed and cutting depth according to actual cutting conditions.
5. When entering into the part, reduce the feed to 30-60% of the above conditions, with a ramping angle < 2°.
6. These milling conditions are for a tool overhang less than 4xD; for longer overhangs, reduce the speed, feed and cutting depth to prevent chattering.

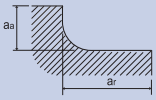
High Feed Milling

Hardness		Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Cast Iron	Mild Steels Carbon Steels		Tool Steels Stainless Steel Hardened Steels Prehardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius a_a=0.1CR a_r=0.3D					aa: CR≤1/16: 0.1xCR; CR>1/16: 0.008" ar: 0.3D		aa: CR≤1/16: 0.05xCR; CR>1/16: 0.004" ar: 0.3D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/8	19,860	490	19,860	470	14,970	330	14,970	305	10,080	125	9,780	90
3/16	13,240	500	13,240	470	9,980	355	13,240	325	6,720	140	6,520	100
1/4	9,930	545	9,930	500	7,490	375	9,930	340	5,040	150	4,890	150
5/16	7,950	545	7,950	500	5,990	375	7,950	340	4,030	150	3,910	150
3/8	6,620	545	6,620	500	4,990	375	6,620	340	3,360	150	3,260	150
1/2	4,970	545	4,970	500	3,740	375	4,970	340	2,520	150	2,440	150

1. Use a rigid and precise machine and holder.
2. These milling conditions are based on milling with circular interpolation at corners; for milling without circular interpolation (such as right angle cornering), reduce the speed to 50-70% and the cutting depth to 50-80% of the above conditions.
3. We recommend using air blow or MQL (mist).
4. Please adjust the speed, feed and cutting depth according to actual cutting conditions.
5. When entering into the part, reduce the feed to 30-60% of the above conditions, with a ramping angle < 2°.
6. These milling conditions are for a tool overhang less than 4xD; for longer overhangs, reduce the speed, feed and cutting depth to prevent chattering.

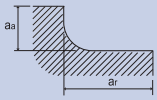
List 4572: Regular Length, Corner Radius, High Feed

Standard Milling

Hardness		Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Cast Iron	Mild Steels Carbon Steels		Tool Steels Stainless Steel Hardened Steels Prehardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius aa: CR≤1/16 0.2xCR; CR>1/16 0.02″ ar: 0.5D					aa: CR≤1/16 0.2xCR; CR>1/16 0.016″ ar: 0.5D		aa: CR≤1/16 0.1xCR; CR>1/16 0.008″ ar: 0.5D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
2	16,000	207	12,500	150	11,000	132	7,950	85	4,750	34	4,270	24
3	10,500	246	8,500	177	7,450	154	5,300	102	3,200	39	2,850	28
4	7,950	260	6,350	189	5,550	165	4,000	108	2,400	41	2,150	30
6	5,300	276	4,250	201	3,700	175	2,650	112	1,600	45	1,400	32
8	4,000	276	3,200	201	2,800	175	2,000	112	1,200	45	1,050	32
10	3,200	276	2,550	201	2,250	175	1,600	112	955	45	860	32
12	2,650	276	2,100	201	1,850	175	1,350	112	795	45	715	32

1. Use a rigid and precise machine and holder.
2. These milling conditions are based on milling with circular interpolation at corners; for milling without circular interpolation (such as right angle cornering), reduce the speed to 50-70% and the cutting depth to 50-80% of the above conditions.
3. We recommend using air blow or MQL (mist).
4. Please adjust the speed, feed and cutting depth according to actual cutting conditions.
5. When entering into the part, reduce the feed to 30-60% of the above conditions, with a ramping angle < 2°.
6. These milling conditions are for a tool overhang less than 4xD; for longer overhangs, reduce the speed, feed and cutting depth to prevent chattering.

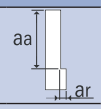
High Feed Milling

Hardness		Up to 40 HRC		40 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Cast Iron	Mild Steels Carbon Steels		Tool Steels Stainless Steel Hardened Steels Prehardened Steels		Hardened Steels					
Depth of Cut	 CR=Corner Radius aa=0.1CR ar=0.3D aa: CR≤1/16 0.1xCR; CR>1/16 0.008″ ar: 0.3D					aa: CR≤1/16 0.05xCR; CR>1/16 0.004″ ar: 0.3D					
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
2	31,850	413	32,000	376	24,000	281	24,000	254	16,000	112	14,400	81
3	21,000	492	21,000	472	16,000	331	16,000	309	10,500	130	9,450	93
4	16,000	512	16,000	472	12,000	354	12,000	323	7,950	140	7,150	100
6	10,600	551	10,600	500	7,950	376	7,950	339	5,300	150	5,300	150
8	7,950	551	7,950	500	5,950	376	5,950	339	4,000	150	4,000	150
10	6,350	551	6,350	500	4,750	376	4,750	339	3,200	150	3,200	150
12	5,300	551	5,300	500	4,000	376	4,000	339	2,650	150	2,650	150

1. Use a rigid and precise machine and holder.
2. These milling conditions are based on milling with circular interpolation at corners; for milling without circular interpolation (such as right angle cornering), reduce the speed to 50-70% and the cutting depth to 50-80% of the above conditions.
3. We recommend using air blow or MQL (mist).
4. Please adjust the speed, feed and cutting depth according to actual cutting conditions.
5. When entering into the part, reduce the feed to 30-60% of the above conditions, with a ramping angle < 2°.
6. These milling conditions are for a tool overhang less than 4xD; for longer overhangs, reduce the speed, feed and cutting depth to prevent chattering.

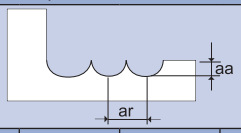
List 4592: Corner Radius, Stub Length, 2 Flute, Long Neck, Rib Processing

Standard Milling

Hardness									Up to 45 HRC		45 to 55 HRC		55 to 65 HRC	
Work Material									Hardened Steels, Pre-hardened Steels, SDK61, NAK55, NAK80, HPM1		Hardened Steels, Pre-hardened Steels, SDK 61, STAVAX, HPM38		Hardened Steels	
Depth of Cut									%'s of DOC's suggested on the left					
		aa (in)						ar (in)	aa=120% ar=120%		aa=100% ar=100%		aa=60% ar=80%	
Dia.	L1	R0.05	R0.1	R0.2	R0.3	R0.5	R1		Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
0.4	1	0.00028	—	—	—	—	—	0.0047	31,900	17.9	26,400	14.8	19,800	11.1
0.4	1.5	0.00028	—	—	—	—	—	0.0047	31,900	17.9	26,400	14.8	19,800	11.1
0.4	2	0.00020	0.00031	—	—	—	—	0.0040	31,900	12.8	26,400	10.6	19,800	7.9
0.4	3	0.00008	0.00012	—	—	—	—	0.0030	27,500	4.4	23,100	3.7	18,700	3.0
0.4	4	0.00004	0.00008	—	—	—	—	0.0014	22,000	1.8	22,000	1.8	18,700	1.5
0.5	1	0.00028	0.00039	—	—	—	—	0.0059	31,900	17.9	26,400	14.8	18,700	10.5
0.5	2	0.00028	0.00039	—	—	—	—	0.0059	31,900	17.9	26,400	14.8	18,700	10.5
0.5	3	0.00012	0.00020	—	—	—	—	0.0041	29,700	7.1	24,200	5.8	17,600	4.2
0.5	4	0.00008	0.00012	—	—	—	—	0.0004	27,500	4.4	23,100	3.7	17,050	2.7
0.5	5	0.00004	0.00008	—	—	—	—	0.0018	24,200	1.9	22,550	1.8	16,500	1.3
0.5	6	0.00004	0.00004	—	—	—	—	0.0012	22,000	1.8	22,000	1.8	16,500	1.3
0.6	2	—	0.00047	—	—	—	—	0.0071	29,700	27.9	25,300	23.8	17,600	16.5
0.6	4	—	0.00020	—	—	—	—	0.0048	27,500	11.0	22,000	8.8	16,500	6.6
0.6	6	—	0.00008	—	—	—	—	0.0021	22,000	3.5	20,900	3.3	15,400	2.5
0.8	4	—	0.00063	0.0013	—	—	—	0.0094	27,500	71.5	22,000	57.2	15,400	40.0
0.8	6	—	0.00028	0.0006	—	—	—	0.0094	23,100	27.7	19,800	23.8	14,850	17.8
0.8	8	—	—	0.0003	—	—	—	0.0085	19,800	11.9	18,700	11.2	14,300	8.6
1.0	4	0.00039	0.00079	0.0016	0.0020	—	—	0.0118	24,200	77.4	22,000	70.4	13,200	42.2
1.0	6	0.00020	0.00039	0.0008	0.0010	—	—	0.0083	22,000	35.2	18,700	29.9	13,200	21.1
1.0	8	0.00012	0.00024	0.0005	0.0006	—	—	0.0071	17,600	17.6	16,500	16.5	12,650	12.7
1.0	10	0.00008	0.00016	0.0003	0.0004	—	—	0.0035	16,500	9.9	15,400	9.2	12,100	7.3
1.0	12	0.00004	0.00012	0.0002	0.0003	—	—	0.0024	16,500	6.6	14,300	5.7	12,100	4.8
1.0	16	—	—	0.0002	—	—	—	0.0012	13,200	5.3	13,200	5.3	11,550	4.6
1.0	20	—	—	0.0001	—	—	—	0.0009	11,000	2.2	11,000	2.2	11,000	2.2
1.2	6	—	—	0.0013	0.0016	—	—	0.0142	18,700	48.6	15,400	40.0	11,000	28.6
1.2	8	—	—	0.0007	0.0009	—	—	0.0099	15,400	21.6	13,200	18.5	11,000	15.4
1.2	10	—	—	0.0004	0.0006	—	—	0.0085	15,400	12.3	13,200	10.6	9,900	7.9
1.5	6	—	—	0.0016	0.0024	—	—	0.0177	15,400	49.3	13,200	42.2	8,800	28.2
1.5	8	—	—	0.0010	0.0015	—	—	0.0150	13,200	26.4	11,000	22.0	7,700	15.4
1.5	10	—	—	0.0007	0.0011	—	—	0.0115	13,200	18.5	11,000	15.4	7,700	10.8
1.5	12	—	—	0.0005	0.0007	—	—	0.0106	13,200	13.2	11,000	11.0	7,150	7.2
1.5	16	—	—	0.0003	0.0004	—	—	0.0044	11,000	6.6	9,900	5.9	6,600	4.0
2.0	8	—	0.00079	0.0016	0.0024	0.0030	—	0.0236	12,100	38.7	9,900	31.7	6,600	21.1
2.0	10	—	0.00063	0.0013	0.0019	0.0024	—	0.0201	9,900	25.7	7,700	20.0	6,600	17.2
2.0	12	—	0.00039	0.0008	0.0012	0.0015	—	0.0165	9,900	15.8	7,700	12.3	6,600	10.6
2.0	16	—	0.00024	0.0005	0.0007	0.0009	—	0.0142	9,900	9.9	7,700	7.7	6,050	6.1
2.0	20	—	0.00016	0.0003	0.0005	0.0006	—	0.0071	7,700	4.6	7,150	4.3	5,500	3.3
2.0	25	—	0.00008	0.0002	0.0003	0.0004	—	0.0047	7,700	3.1	6,600	2.6	4,950	2.0
2.5	10	—	—	0.0016	—	0.0030	—	0.0295	9,900	31.7	8,800	28.2	5,500	17.6
2.5	20	—	—	0.0008	—	0.0015	—	0.0177	7,700	12.3	6,600	10.6	4,950	7.9
2.5	30	—	—	0.0002	—	0.0004	—	0.0059	6,600	2.6	5,500	2.2	4,400	1.8
3.0	8	—	—	0.0016	—	—	—	0.0354	8,800	28.2	7,700	24.6	5,500	17.6
3.0	12	—	—	0.0016	0.0024	0.0030	—	0.0354	8,800	28.2	7,700	24.6	5,500	17.6
3.0	16	—	—	0.0011	0.0017	0.0020	—	0.0283	6,600	14.5	6,600	14.5	5,500	12.1
3.0	20	—	—	0.0007	0.0011	0.0013	—	0.0241	6,600	9.2	6,600	9.2	5,500	7.7
3.0	25	—	—	0.0005	0.0007	0.0009	—	0.0213	6,600	6.6	6,600	6.6	4,950	5.0
3.0	30	—	—	0.0003	0.0005	0.0006	—	0.0106	5,500	3.3	5,500	3.3	4,400	2.6
3.0	35	—	—	0.0002	0.0004	0.0004	—	0.0071	5,500	2.2	4,950	2.0	4,400	1.8
4.0	16	—	—	0.0016	0.0024	0.0030	0.0047	0.0472	6,600	21.1	4,950	15.8	4,400	14.1
4.0	20	—	—	0.0013	0.0019	0.0024	0.0079	0.0402	5,500	14.3	4,400	11.4	4,400	11.4
4.0	25	—	—	0.0008	0.0012	0.0015	0.0024	0.0321	5,500	8.8	4,400	7.0	4,400	7.0
4.0	30	—	—	0.0006	0.0008	0.0010	0.0016	0.0293	5,500	6.6	4,400	5.3	4,400	5.3
4.0	40	—	—	0.0003	0.0005	0.0006	0.0009	0.0142	4,400	2.6	4,400	2.6	4,400	2.6
4.0	50	—	—	0.0002	0.0003	0.0004	0.0006	0.0085	4,400	1.8	4,400	1.8	3,850	1.5

List 4590: Ball End, Stub Length, 2 Flute, Long Neck, Rib Processing

Standard Milling (up to 38HRC)

Hardness		Up to 20 HRC				20 to 30 HRC				30 to 38 HRC			
Work Material		Mild Steels, Carbon Steels, Cast Iron				Alloy Steels, Tool Steels				Hardened Steels, Pre-hardened Steels			
Depth of Cut													
Mill Dia.	L1	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)
0.1	0.3	50,000	2.8	0.0001	0.0001	50,000	2.8	0.0001	0.0001	50,000	2.8	0.0001	0.0001
0.1	0.5	50,000	2.0	0.0001	0.0001	50,000	2.0	0.0001	0.0001	50,000	2.0	0.0001	0.0001
0.2	0.5	50,000	15.7	0.0002	0.0002	50,000	15.7	0.0002	0.0002	50,000	15.0	0.0002	0.0002
0.2	1	50,000	14.2	0.0002	0.0002	50,000	14.2	0.0002	0.0002	50,000	13.4	0.0002	0.0002
0.2	1.5	45,000	11.8	0.0002	0.0002	45,000	11.8	0.0002	0.0002	45,000	11.0	0.0002	0.0002
0.2	3	32,000	5.9	0.0002	0.0002	32,000	5.9	0.0002	0.0002	32,000	5.5	0.0002	0.0002
0.3	1	50,000	23.6	0.0002	0.0004	50,000	23.6	0.0002	0.0004	50,000	22.4	0.0002	0.0002
0.3	3	38,000	9.8	0.0002	0.0002	38,000	9.8	0.0002	0.0002	38,000	9.1	0.0002	0.0002
0.3	5	29,000	3.9	0.0002	0.0002	29,000	3.9	0.0002	0.0002	29,000	3.7	0.0002	0.0002
0.4	1	50,000	35.4	0.0004	0.0008	50,000	35.4	0.0004	0.0008	50,000	33.5	0.0004	0.0004
0.4	3	43,000	19.7	0.0002	0.0004	43,000	19.7	0.0002	0.0004	43,000	18.5	0.0002	0.0002
0.4	6	30,000	7.9	0.0002	0.0002	30,000	7.9	0.0002	0.0002	30,000	7.5	0.0002	0.0002
0.5	1	50,000	43.3	0.0006	0.0012	50,000	43.3	0.0006	0.0012	50,000	41.3	0.0006	0.0006
0.5	5	30,000	15.7	0.0002	0.0004	30,000	15.7	0.0002	0.0004	30,000	15.0	0.0002	0.0002
0.5	10	20,000	3.9	0.0002	0.0002	20,000	3.9	0.0002	0.0002	20,000	3.7	0.0002	0.0002
0.6	1	50,000	53.1	0.0012	0.0020	50,000	53.1	0.0012	0.0020	50,000	47.2	0.0012	0.0012
0.6	5	30,000	26.8	0.0004	0.0008	30,000	26.8	0.0004	0.0008	30,000	21.0	0.0004	0.0004
0.6	12	18,000	4.7	0.0002	0.0002	18,000	4.7	0.0002	0.0002	18,000	4.3	0.0002	0.0002
0.8	2	50,000	78.7	0.0016	0.0031	50,000	78.7	0.0016	0.0031	50,000	74.8	0.0016	0.0016
0.8	6	30,000	31.5	0.0012	0.0020	30,000	31.5	0.0012	0.0020	30,000	29.9	0.0012	0.0012
0.8	12	17,000	9.8	0.0002	0.0002	17,000	9.8	0.0002	0.0002	17,000	9.1	0.0002	0.0002
1.0	2	50,000	145.7	0.0020	0.0039	50,000	145.7	0.0020	0.0039	50,000	145.7	0.0020	0.0020
1.0	5	36,000	90.6	0.0020	0.0039	36,000	90.6	0.0020	0.0039	36,000	82.7	0.0020	0.0020
1.0	10	22,000	43.3	0.0004	0.0008	22,000	43.3	0.0004	0.0008	22,000	39.4	0.0004	0.0004
1.0	20	13,000	11.8	0.0002	0.0002	13,000	11.8	0.0002	0.0002	13,000	11.2	0.0002	0.0002
1.2	2	50,000	149.6	0.0024	0.0047	50,000	149.6	0.0024	0.0047	50,000	141.7	0.0024	0.0024
1.2	5	36,000	82.7	0.0024	0.0047	36,000	82.7	0.0024	0.0047	36,000	78.7	0.0024	0.0024
1.2	10	20,000	47.2	0.0020	0.0039	20,000	47.2	0.0020	0.0039	20,000	43.3	0.0020	0.0020
1.2	20	14,000	12.6	0.0002	0.0002	14,000	12.6	0.0002	0.0002	14,000	11.8	0.0002	0.0002
1.5	3	50,000	189.0	0.0030	0.0059	50,000	189.0	0.0030	0.0059	50,000	189.0	0.0030	0.0030
1.5	6	30,000	114.2	0.0030	0.0059	30,000	114.2	0.0030	0.0059	30,000	106.3	0.0030	0.0030
1.5	10	24,000	78.7	0.0020	0.0059	24,000	78.7	0.0030	0.0059	24,000	74.8	0.0030	0.0030
1.5	16	16,000	31.5	0.0020	0.0039	16,000	31.5	0.0020	0.0039	16,000	29.9	0.0020	0.0020
1.5	20	13,000	14.2	0.0008	0.0020	13,000	14.2	0.0008	0.0020	13,000	13.4	0.0008	0.0008
1.5	30	12,000	7.9	0.0002	0.0004	12,000	7.9	0.0002	0.0004	12,000	7.5	0.0002	0.0002
2.0	4	50,000	220.5	0.0039	0.0079	50,000	220.5	0.0039	0.0079	50,000	220.5	0.0039	0.0039
2.0	8	25,000	102.4	0.0039	0.0079	25,000	102.4	0.0039	0.0079	25,000	94.5	0.0039	0.0039
2.0	16	14,000	66.9	0.0039	0.0039	14,000	66.9	0.0039	0.0039	14,000	74.8	0.0039	0.0039
2.0	20	12,000	47.2	0.0020	0.0039	12,000	47.2	0.0020	0.0039	12,000	43.3	0.0020	0.0020
2.0	30	10,000	19.7	0.0008	0.0020	10,000	19.7	0.0008	0.0020	10,000	18.5	0.0008	0.0008
2.0	40	7,000	5.9	0.0008	0.0012	7,000	5.9	0.0008	0.0012	7,000	5.5	0.0008	0.0008
3.0	6	41,500	244.1	0.0059	0.0118	41,500	244.1	0.0059	0.0118	41,500	244.1	0.0059	0.0059
3.0	12	20,000	118.1	0.0059	0.0118	20,000	118.1	0.0059	0.0118	20,000	110.2	0.0059	0.0059
3.0	16	16,000	78.7	0.0039	0.0079	16,000	78.7	0.0039	0.0079	16,000	74.8	0.0039	0.0039
3.0	20	14,000	70.9	0.0039	0.0079	14,000	70.9	0.0039	0.0079	14,000	66.9	0.0039	0.0039
3.0	30	10,000	31.5	0.0012	0.0020	10,000	31.5	0.0012	0.0020	10,000	29.9	0.0012	0.0012
3.0	40	7,000	19.7	0.0008	0.0012	7,000	19.7	0.0008	0.0012	7,000	18.5	0.0008	0.0008
3.5	15	18,000	118.1	0.0039	0.0118	18,000	118.1	0.0039	0.0118	18,000	110.2	0.0039	0.0039
3.5	25	12,000	78.7	0.0039	0.0039	12,000	78.7	0.0039	0.0039	12,000	74.8	0.0039	0.0039
3.5	35	10,000	39.4	0.0020	0.0020	10,000	39.4	0.0020	0.0020	10,000	37.4	0.0020	0.0020
3.5	45	7,000	23.6	0.0012	0.0012	7,000	23.6	0.0012	0.0012	7,000	22.4	0.0012	0.0012
4.0	8	31,000	224.4	0.0079	0.0197	31,000	224.4	0.0079	0.0197	31,000	224.4	0.0079	0.0079
4.0	16	18,000	126.0	0.0079	0.0197	18,000	126.0	0.0079	0.0197	18,000	118.1	0.0079	0.0079
4.0	20	16,000	110.2	0.0079	0.0157	16,000	110.2	0.0079	0.0157	16,000	102.4	0.0079	0.0079
4.0	30	14,000	94.5	0.0039	0.0079	14,000	94.5	0.0039	0.0079	14,000	86.6	0.0039	0.0039
4.0	40	10,000	51.2	0.0020	0.0039	10,000	51.2	0.0020	0.0039	10,000	47.2	0.0020	0.0020
4.0	50	7,000	27.6	0.0008	0.0020	7,000	27.6	0.0008	0.0020	7,000	26.0	0.0008	0.0008
5.0	10	25,000	212.6	0.0098	0.0197	25,000	212.6	0.0098	0.0197	25,000	212.6	0.0098	0.0197
5.0	20	16,000	137.8	0.0098	0.0197	16,000	137.8	0.0098	0.0197	16,000	129.9	0.0098	0.0197
5.0	30	14,000	98.4	0.0039	0.0118	14,000	98.4	0.0039	0.0118	14,000	90.6	0.0039	0.0118
5.0	40	10,000	47.2	0.0039	0.0079	10,000	47.2	0.0039	0.0079	10,000	43.3	0.0039	0.0079
5.0	50	8,000	31.5	0.0039	0.0039	8,000	31.5	0.0039	0.0039	8,000	29.9	0.0039	0.0039
6.0	12	20,000	204.7	0.0118	0.0197	20,000	204.7	0.0118	0.0197	20,000	204.7	0.0118	0.0197
6.0	20	16,000	165.4	0.0118	0.0197	16,000	165.4	0.0118	0.0197	16,000	153.5	0.0118	0.0197
6.0	30	10,000	102.4	0.0118	0.0197	10,000	102.4	0.0118	0.0197	10,000	94.5	0.0118	0.0197
6.0	40	9,000	78.7	0.0079	0.0118	9,000	78.7	0.0079	0.0118	9,000	74.8	0.0079	0.0118
6.0	50	7,000	63.0	0.0079	0.0118	7,000	63.0	0.0079	0.0118	7,000	59.1	0.0079	0.0118

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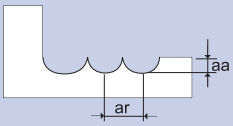
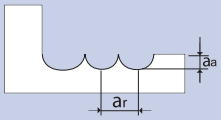
List 4590: Ball End, Stub Length, 2 Flute, Long Neck, Rib Processing (Continued)

Standard Milling (38 to 60HRC)

Hardness		38 to 45 HRC				45 to 55 HRC				55 to 60 HRC			
Work Material		Stainless Steels, Hardened Steels Pre-hardened Steels				Hardened Steels				Hardened Steels			
Depth of Cut													
Mill Dia.	L1	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)	Speed RPM	Feed in/min	aa (in)	ar (in)
0.1	0.3	50,000	2.8	0.0001	0.0001	50,000	2.4	0.0001	0.0001	–	–	–	–
0.1	0.5	50,000	2.0	0.0001	0.0001	50,000	1.6	0.0001	0.0001	–	–	–	–
0.2	0.5	50,000	15.0	0.0002	0.0002	50,000	10.2	0.0002	0.0002	50,000	7.9	0.0002	0.0002
0.2	1	50,000	13.4	0.0002	0.0002	50,000	9.1	0.0002	0.0002	43,000	7.1	0.0002	0.0002
0.2	1.5	45,000	11.0	0.0002	0.0002	45,000	7.5	0.0002	0.0002	41,000	5.1	0.0002	0.0002
0.2	3	32,000	5.5	0.0002	0.0002	31,000	3.5	0.0002	0.0002	31,000	2.8	0.0002	0.0002
0.3	1	50,000	22.4	0.0002	0.0002	50,000	15.4	0.0002	0.0002	50,000	12.2	0.0002	0.0004
0.3	3	38,000	9.1	0.0002	0.0002	37,000	5.9	0.0002	0.0002	33,000	3.9	0.0002	0.0002
0.3	5	29,000	3.7	0.0002	0.0002	28,000	2.4	0.0002	0.0002	28,000	2.0	0.0002	0.0002
0.4	1	50,000	33.5	0.0004	0.0004	50,000	20.5	0.0004	0.0004	50,000	17.3	0.0003	0.0006
0.4	3	43,000	18.5	0.0002	0.0002	43,000	11.0	0.0002	0.0002	38,000	8.7	0.0002	0.0004
0.4	6	30,000	7.5	0.0002	0.0002	29,000	4.7	0.0002	0.0002	26,000	3.9	0.0002	0.0002
0.5	1	50,000	41.3	0.0006	0.0006	50,000	28.7	0.0006	0.0006	50,000	22.8	0.0004	0.0008
0.5	5	30,000	15.0	0.0002	0.0002	29,000	9.8	0.0002	0.0002	26,000	6.7	0.0002	0.0004
0.5	10	20,000	3.7	0.0002	0.0002	20,000	3.9	0.0002	0.0002	20,000	3.5	0.0002	0.0002
0.6	1	50,000	47.2	0.0012	0.0012	50,000	33.1	0.0012	0.0012	50,000	26.4	0.0004	0.0008
0.6	5	30,000	25.2	0.0004	0.0004	30,000	17.3	0.0004	0.0004	27,000	12.2	0.0004	0.0008
0.6	12	18,000	4.3	0.0002	0.0002	17,000	3.1	0.0002	0.0002	17,000	2.8	0.0002	0.0002
0.8	2	50,000	74.8	0.0016	0.0016	50,000	63.0	0.0016	0.0016	50,000	47.2	0.0006	0.0012
0.8	6	30,000	29.9	0.0012	0.0012	30,000	25.6	0.0012	0.0012	27,000	18.1	0.0006	0.0012
0.8	12	17,000	9.1	0.0002	0.0002	16,000	6.3	0.0002	0.0002	16,000	4.3	0.0002	0.0002
1.0	2	50,000	145.7	0.0020	0.0020	50,000	145.7	0.0020	0.0020	50,000	118.1	0.0008	0.0020
1.0	5	36,000	82.7	0.0020	0.0020	36,000	63.0	0.0020	0.0020	36,000	47.2	0.0008	0.0020
1.0	10	22,000	39.4	0.0004	0.0004	21,000	29.9	0.0004	0.0004	18,000	20.5	0.0004	0.0008
1.0	20	13,000	11.2	0.0002	0.0002	12,000	7.1	0.0002	0.0002	12,000	5.5	0.0002	0.0002
1.2	2	50,000	141.7	0.0024	0.0024	50,000	141.7	0.0024	0.0024	50,000	118.1	0.0008	0.0020
1.2	5	36,000	78.7	0.0024	0.0024	32,000	63.0	0.0024	0.0024	30,000	47.2	0.0008	0.0020
1.2	10	20,000	43.3	0.0020	0.0020	18,000	31.5	0.0020	0.0020	16,000	22.0	0.0008	0.0020
1.2	20	13,000	11.8	0.0002	0.0002	12,000	7.1	0.0002	0.0002	10,000	4.7	0.0002	0.0002
1.5	3	50,000	189.0	0.0030	0.0030	50,000	189.0	0.0030	0.0030	50,000	153.5	0.0012	0.0024
1.5	6	30,000	106.3	0.0030	0.0030	30,000	86.6	0.0030	0.0030	27,000	59.1	0.0012	0.0024
1.5	10	24,000	74.8	0.0030	0.0030	24,000	59.1	0.0030	0.0030	21,000	39.4	0.0012	0.0024
1.5	16	14,000	29.9	0.0020	0.0020	13,000	22.0	0.0020	0.0020	10,000	13.4	0.0012	0.0020
1.5	20	12,000	13.4	0.0008	0.0008	11,000	9.4	0.0008	0.0008	9,000	5.9	0.0008	0.0020
1.5	30	11,000	7.5	0.0002	0.0002	10,000	4.7	0.0002	0.0002	9,000	3.5	0.0002	0.0004
2.0	4	50,000	220.5	0.0039	0.0039	47,000	208.7	0.0039	0.0039	40,000	141.7	0.0020	0.0039
2.0	8	25,000	94.5	0.0039	0.0039	24,000	90.6	0.0039	0.0039	20,000	59.1	0.0020	0.0039
2.0	16	14,000	74.8	0.0039	0.0039	13,000	55.1	0.0039	0.0039	11,000	37.4	0.0020	0.0039
2.0	20	11,000	43.3	0.0020	0.0020	10,000	35.0	0.0020	0.0020	9,000	25.2	0.0020	0.0039
2.0	30	9,000	18.5	0.0008	0.0008	9,000	14.2	0.0008	0.0008	7,500	9.4	0.0008	0.0020
2.0	40	6,000	5.5	0.0008	0.0008	6,000	3.9	0.0008	0.0008	6,000	3.5	0.0008	0.0012
3.0	6	41,500	244.1	0.0059	0.0059	32,000	189.0	0.0059	0.0059	26,500	129.9	0.0024	0.0059
3.0	12	20,000	110.2	0.0059	0.0059	18,000	98.4	0.0059	0.0059	16,000	66.9	0.0024	0.0059
3.0	16	16,000	74.8	0.0039	0.0039	13,000	59.1	0.0039	0.0039	11,000	43.3	0.0024	0.0059
3.0	20	14,000	66.9	0.0039	0.0039	11,000	39.4	0.0039	0.0039	10,000	39.4	0.0024	0.0059
3.0	30	9,000	29.9	0.0012	0.0012	7,000	23.2	0.0012	0.0012	6,000	15.7	0.0012	0.0020
3.0	40	6,500	18.5	0.0008	0.0008	5,000	14.2	0.0008	0.0008	4,000	9.1	0.0008	0.0012
3.5	15	18,000	110.2	0.0039	0.0039	14,000	78.7	0.0039	0.0039	12,000	51.2	0.0028	0.0059
3.5	25	12,000	74.8	0.0039	0.0039	9,000	51.2	0.0039	0.0039	8,000	36.2	0.0028	0.0059
3.5	35	9,000	37.4	0.0020	0.0020	7,000	27.6	0.0020	0.0020	5,000	15.7	0.0020	0.0020
3.5	45	6,500	22.4	0.0012	0.0012	5,000	16.5	0.0012	0.0012	4,000	10.2	0.0012	0.0012
4.0	8	31,000	224.4	0.0079	0.0079	24,000	173.2	0.0079	0.0079	20,000	126.0	0.0031	0.0079
4.0	16	18,000	118.1	0.0079	0.0079	14,000	98.4	0.0079	0.0079	10,000	51.2	0.0031	0.0079
4.0	20	16,000	102.4	0.0079	0.0079	14,000	90.6	0.0079	0.0079	8,000	39.4	0.0031	0.0079
4.0	30	14,000	86.6	0.0039	0.0039	12,000	74.8	0.0039	0.0039	5,000	24.8	0.0031	0.0079
4.0	40	9,000	47.2	0.0020	0.0020	8,000	39.4	0.0020	0.0020	4,000	15.7	0.0020	0.0039
4.0	50	6,500	26.0	0.0008	0.0008	6,000	23.6	0.0008	0.0008	3,600	11.0	0.0008	0.0020
5.0	10	25,000	212.6	0.0098	0.0197	19,000	157.5	0.0098	0.0197	16,000	110.2	0.0039	0.0098
5.0	20	16,000	129.9	0.0098	0.0197	13,000	106.3	0.0098	0.0197	8,000	51.2	0.0039	0.0098
5.0	30	14,000	90.6	0.0039	0.0118	11,000	70.9	0.0039	0.0118	4,000	20.5	0.0039	0.0098
5.0	40	10,000	43.3	0.0039	0.0079	9,000	39.0	0.0039	0.0079	3,000	10.2	0.0039	0.0079
5.0	50	7,500	29.9	0.0039	0.0039	7,000	24.0	0.0039	0.0039	2,800	7.5	0.0039	0.0039
6.0	12	20,000	204.7	0.0118	0.0197	16,000	133.9	0.0118	0.0197	13,500	98.4	0.0039	0.0079
6.0	20	16,000	153.5	0.0118	0.0197	12,000	118.1	0.0118	0.0197	8,000	63.0	0.0039	0.0079
6.0	30	10,000	94.5	0.0118	0.0197	9,000	82.7	0.0118	0.0197	4,000	29.1	0.0039	0.0079
6.0	40	9,000	74.8	0.0079	0.0118	9,000	70.9	0.0079	0.0118	3,000	18.9	0.0039	0.0079
6.0	50	7,000	59.1	0.0079	0.0118	7,000	55.1	0.0079	0.0118	2,500	15.7	0.0039	0.0079

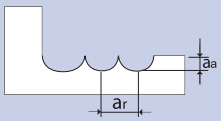
List 4430: True 4 Flute, Ball End, Regular Length

Standard Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	690 SFM		540 SFM		500 SFM		410 SFM		390 SFM		320 SFM	
Depth of Cut	a_a=0.05D a_r=0.1D 				a_a=0.03D a_r=0.1D				a_a=0.02D a_r=0.1D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/4	10,500	182	8,190	140	7,699	126	6,313	93	5,871	80	4,873	67
5/16	8,400	165	6,500	127	6,110	108	5,010	77	4,659	66	4,100	55
3/8	7,000	160	5,460	123	5,132	105	4,209	74	3,914	64	3,444	51
1/2	5,200	130	4,050	100	3,807	85	3,122	60	2,903	52	2,555	52

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

High Feed Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	1080 SFM		870 SFM		820 SFM		670 SFM		625 SFM		550 SFM	
Depth of Cut	a_a=0.05D a_r=0.05D 				a_a=0.03D a_r=0.05D				a_a=0.02D a_r=0.05D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1/4	17,000	295	13,260	227	12,464	205	10,221	151	9,505	130	7,889	108
5/16	13,590	276	10,600	212	9,964	180	8,171	128	7,599	110	6,687	91
3/8	11,300	256	8,814	197	8,285	167	6,794	119	6,318	102	5,560	82
1/2	8,520	215	6,646	165	6,247	140	5,122	100	4,764	86	4,192	86

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

List 4530: True 4 Flute, Ball End, Regular Length

Standard Milling

Hardness	Up to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	740 SFM		570 SFM		540 SFM		440 SFM		410 SFM		340 SFM	
Depth of Cut	a_a=0.05D a_r=0.1D											
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
6	11,900	207	9,280	154	8,750	139	7,160	103	6,630	85	5,480	70
8	8,950	180	6,960	141	6,570	119	5,370	87	4,970	75	4,380	62
10	7,160	163	5,570	126	5,250	106	4,300	76	3,980	65	3,500	53
12	5,970	150	4,640	117	4,380	99	3,580	70	3,320	60	2,920	44

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

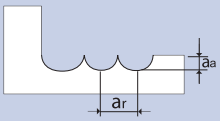
High Feed Milling

Hardness	Up to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Hardened Steels Pre-hardened Steels		Hardened Steels Pre-hardened Steels		Hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	1,100 SFM		1,050 SFM		1,010 SFM		850 SFM		690 SFM		630 SFM	
Depth of Cut	a_a=0.02D a_r=0.05D											
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
6	18,000	314	17,000	283	16,400	261	13,800	198	11,100	143	10,100	122
8	13,500	273	12,700	257	12,300	224	10,300	167	8,360	126	7,560	107
10	10,800	245	10,200	231	9,870	199	8,280	146	6,680	109	6,050	91
12	9,020	227	8,490	214	8,220	187	6,900	135	5,570	101	5,040	76

1. Use a rigid and precise machine and holder.
2. When chattering occurs, reduce the speed and feed simultaneously.
3. Use a suitable cutting fluid with high smoke retardant.

List 4513: Ball Nose, Regular Length, 2 Flute, Sphere Type

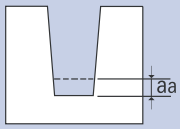
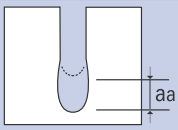
Profiling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Alloy Steels Tool Tool		Hardened Steels Pre-hardened Steels		Stainless Steels Pre-hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	720 SFM		640 SFM		580 SFM		470 SFM		520 SFM		440 SFM	
Depth of Cut	a_a=0.05D a_r=0.1D 								a_a=0.02D a_r=0.1D			
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1	32,000	33.9	32,000	33.9	32,000	33.9	32,000	33.9	32,000	33.9	32,000	29.8
2	31,500	88.6	24,000	53.1	24,000	53.1	23,500	51.2	24,000	53.1	22,000	47.2
4	17,500	98.4	15,500	70.9	14,,000	61.0	11,500	49.2	12,500	53.1	11,000	45.3
6	11,500	84.6	10,500	72.8	9,500	66.9	7,950	55.1	8,450	59.1	7,400	51.2
8	8,750	70.9	7,950	55.1	7,150	49.2	5,950	41.3	6,350	43.3	5,550	39.2
10	7,000	59.1	6,350	43.3	5,700	39.4	4,750	33.7	5,050	35.6	4,450	31.5

1. Use a rigid and precise machine and holder.
2. Use a suitable cutting fluid with high smoke retardant.

List 4581: 4 Flute, Ball End, Tapered

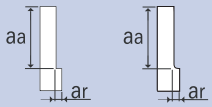
Slotting

Hardness	Up to 20 HRC			20 to 30 HRC			30 to 38 HRC			38 to 45 HRC			45 to 55 HRC		
Work Material	Mild Steels Carbon Steels Cast Iron			Alloy Steels Tool Steels			Hardened Steels Pre-hardened Steels			Stainless Steels Hardened Steels			Hardened Steels		
Cutting Speed	400 SFM			330 SFM			300 SFM			240 SFM			160 SFM		
Depth of Cut															
Mill Dia.	Speed RPM	Feed in/min	aa	Speed RPM	Feed in/min	aa	Speed RPM	Feed in/min	aa	Speed RPM	Feed in/min	aa	Speed RPM	Feed in/min	aa
0.5	50,000	40.0	0.0004	50,000	40.0	0.0004	50,000	40.0	0.0004	46,573	37.3	0.0004	31049	12.4	0.0002
0.6	50,000	85.0	0.0009	50,000	85.0	0.0009	48,514	82.5	0.0009	38,811	66.0	0.0009	25874	23.3	0.0005
0.7	50,000	130.0	0.0013	45,742	118.9	0.0013	41,583	108.1	0.0013	33,267	86.5	0.0013	22178	31.0	0.0007
0.8	48,514	169.8	0.0018	40,024	140.1	0.0018	36,386	127.3	0.0018	29,108	101.9	0.0018	19406	36.9	0.0010
0.9	43,124	189.7	0.0022	35,577	156.5	0.0022	32,343	142.3	0.0022	25,874	113.8	0.0022	17249	41.4	0.0012
1.0	38,811	205.7	0.0027	32,019	169.7	0.0027	29,108	154.3	0.0027	23,287	123.4	0.0027	15524	45.0	0.0015
1.2	32,343	200.5	0.0031	26,683	165.4	0.0031	24,257	150.4	0.0031	19,406	120.3	0.0031	12937	44.0	0.0017
1.5	25,874	183.7	0.0036	21,346	151.6	0.0036	19,406	137.8	0.0036	15,524	110.2	0.0036	10350	40.4	0.0020
1.6	24,257	194.1	0.0040	20,012	160.1	0.0040	18,193	145.5	0.0040	14,554	116.4	0.0040	9703	42.7	0.0022
1.8	21,562	191.9	0.0045	17,788	158.3	0.0045	16,171	143.9	0.0045	12,937	115.1	0.0045	8625	42.3	0.0025
2.0	19,406	190.2	0.0049	16,010	156.9	0.0049	14,554	142.6	0.0049	11,643	114.1	0.0049	7762	41.9	0.0027
2.5	15,524	166.1	0.0054	12,808	137.0	0.0054	11,643	124.6	0.0054	9,315	99.7	0.0054	6210	36.6	0.0030
3.0	12,937	150.1	0.0058	10,673	123.8	0.0058	9,703	112.6	0.0058	7,762	90.0	0.0058	5175	33.1	0.0032

1. To achieve flute depth, sequential use of each neck length is most effective.
2. When corner processing, reduce the feed rate by approximately half.
3. Use cutting fluid.

List 4541: 6 Flute, Corner Radius, Regular Length

Standard Milling

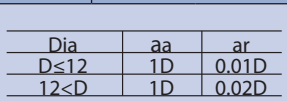
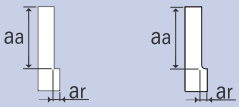
Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC		60 to 65 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Alloy Steels Tool Tool		Hardened Steels Pre-hardened Steels		Stainless Steels Pre-hardened Steels		Hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	330 SFM		240 SFM		220 SFM		200 SFM		100 SFM		65 SFM		55 SFM	
Depth of Cut	Dia / aa / ar D≤1.5 / 1.5D / 0.02D 1.5<D≤2.5 / 1.5D / 0.05D 2.5<D / 1.5D / 0.1D 								Dia / aa / ar D≤1.5 / 1.5D / 0.02D 1.5<D / 1.5D / 0.05D				a_a=0.05D a_r=0.1D	
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
1	20,000	23.6	20,000	22.0	20,000	11.0	18,000	7.1	9,500	2.8	6,350	1.6	–	–
2	15,500	39.0	11,500	28.9	10,500	17.3	9,500	11.2	4,750	4.7	3,150	2.8	2,700	1.6
3	10,500	53.1	7,950	39.4	7,000	24.6	6,350	15.9	3,150	6.5	2,100	3.7	1,800	2.4
4	7,950	57.1	5,950	41.3	5,250	24.6	4,750	15.6	2,350	7.7	1,550	3.7	1,350	2.4
5	6,350	59.1	4,750	43.3	4,200	24.6	3,800	15.6	1,900	7.7	1,250	3.7	1,050	2.2
6	5,300	98.4	3,950	68.9	3,500	45.3	3,150	35.6	1,550	10.6	1,050	5.7	900	3.1
8	3,950	90.6	2,950	66.9	2,600	45.3	2,350	36.0	1,150	10.6	795	5.5	675	2.8
10	3,150	78.7	2,350	57.1	2,100	41.3	1,900	33.7	955	11.0	635	5.1	540	2.6
12	2,650	72.8	1,950	51.2	1,750	38.0	1,550	28.7	795	10.8	530	4.7	450	2.4
14	2,250	63.0	1,700	45.3	1,500	34.1	1,350	25.2	680	9.6	455	4.1	385	2.0
16	1,950	57.1	1,450	39.4	1,300	30.7	1,150	21.5	595	8.3	395	3.7	335	1.8
18	1,750	51.2	1,300	36.8	1,150	27.2	1,050	19.5	530	7.5	350	3.1	300	1.6
20	1,550	45.3	1,150	32.5	1,050	26.8	955	17.7	475	6.7	315	3.1	270	1.4
25	1,250	45.3	955	28.5	840	26.4	760	18.5	380	6.9	255	3.1	215	1.4
30	1,050	39.0	795	23.6	700	21.9	635	15.6	315	5.7	210	2.6	180	1.2

1. Use a rigid and precise machine and holder. 2. We suggest using an air blow. If using cutting fluids, use a high quality fluid with smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

continued on next page

List 4541: 6 Flute, Corner Radius, Regular Length (Continued)

High Feed Milling

Hardness	Up to 20 HRC		20 to 30 HRC		30 to 38 HRC		38 to 45 HRC		45 to 55 HRC		55 to 60 HRC	
Work Material	Mild Steels Carbon Steels Cast Iron		Alloy Steels Tool Tool		Hardened Steels Pre-hardened Steels		Stainless Steels Pre-hardened Steels		Hardened Steels		Hardened Steels	
Cutting Speed	1,450 SFM		1,300 SFM		960 SFM		800 SFM		500 SFM		400 SFM	
Depth of Cut	 											
Mill Dia.	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min
3	47,500	246.1	42,000	210.6	31,500	104.3	26,500	65.0	15,500	32.7	12,500	23.2
4	35,500	246.1	31,500	226.4	23,500	131.9	19,500	65.0	11,500	37.8	9,500	23.4
5	28,500	263.8	25,000	236.2	19,000	141.7	15,500	65.0	9,500	39.2	7,600	23.4
6	23,500	173.2	21,000	147.6	15,500	110.2	13,000	78.7	7,950	47.2	6,350	37.8
8	17,500	169.3	15,500	147.6	11,500	110.2	9,900	80.7	5,950	49.2	4,750	37.6
10	14,000	167.3	12,500	147.6	9,500	110.2	7,950	82.7	4,750	49.2	3,800	37.6
12	11,500	155.5	10,500	137.8	7,950	102.4	6,600	76.8	3,950	45.3	3,150	34.4
14	10,000	147.6	9,050	131.9	6,800	98.4	5,650	68.9	3,400	41.3	2,700	31.3
16	8,950	137.8	7,950	122.0	5,950	90.6	4,950	63.0	2,950	38.2	2,350	29.1
18	7,950	122.0	7,050	108.3	5,300	80.7	4,400	57.1	2,650	34.8	2,100	27.2
20	7,150	110.2	6,350	98.4	4,750	72.8	3,950	53.1	2,350	30.9	1,900	24.6
25	5,700	92.5	5,050	82.7	3,800	59.1	3,150	43.3	1,900	26.6	1,500	20.7
30	4,750	76.8	4,200	68.9	3,150	49.2	2,650	37.0	1,550	21.7	1,250	17.1

1. Use a rigid and precise machine and holder. 2. We suggest using an air blow. If using cutting fluids, use a high quality fluid with smoke retardant.
3. When the length of tool extension from the machine is long, reduce the speed and feed.

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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