

**NEW
PRODUCT**

Vol. 3

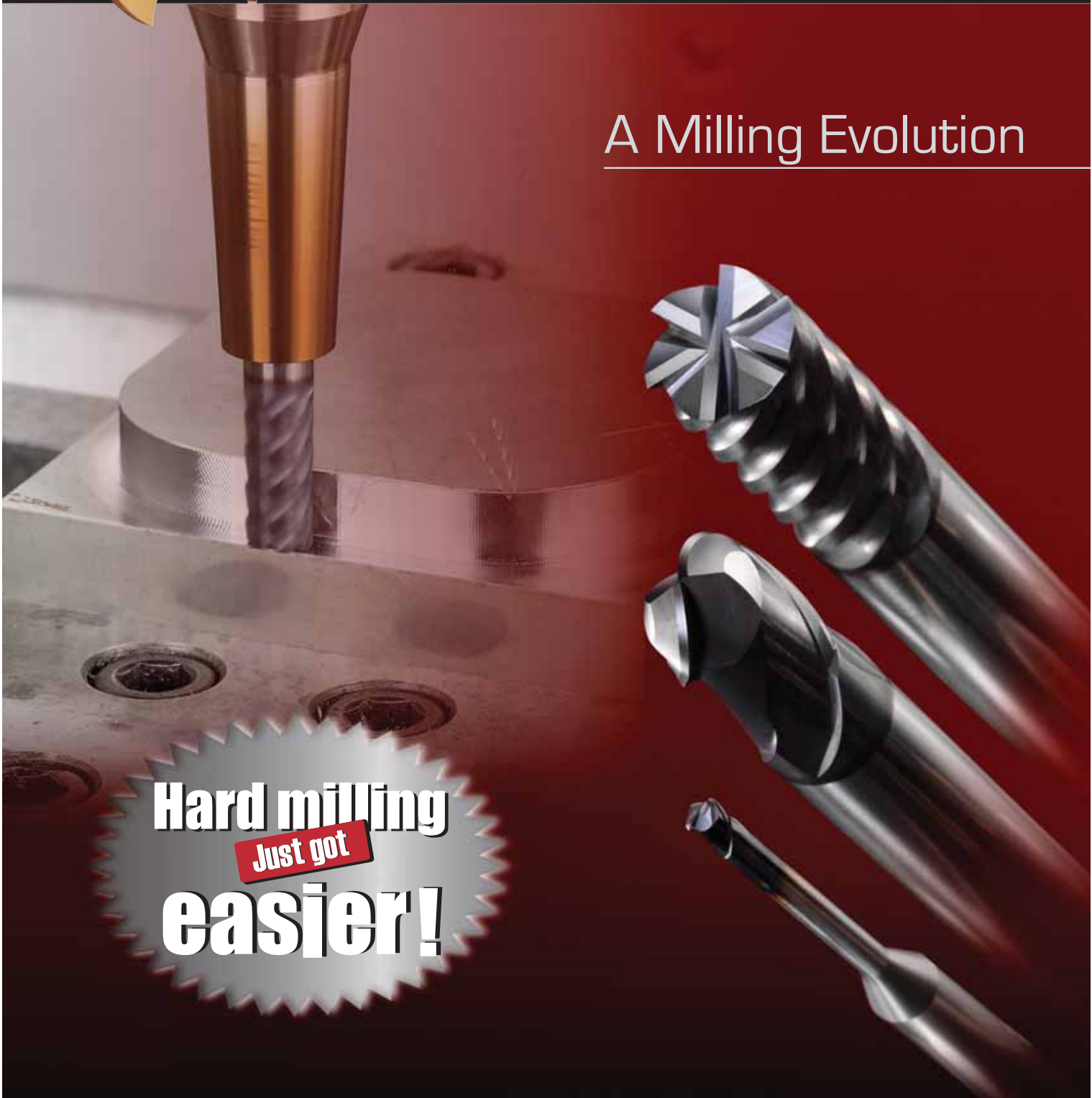


OSG
Tap & Die, Inc.

EXOCARB® - WXS®

A Milling Evolution

Hard milling
Just got
easier!



OSG's patented WXS® nanotechnology coating increases productivity and tool life versus TiAlN.

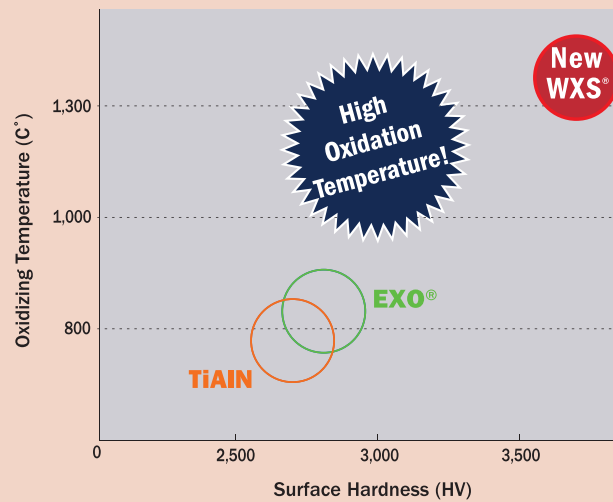
HOW:

- Increased oxidation temperature permits higher spindle speeds, leading to faster cycle times.
- Increased SFM leads to more heat generation, which actually improves surface lubricity of WXS®, thereby extending tool life.
- Optimizing the substrate with the coating increases adhesion strength, thereby decreasing the likelihood of chipping.

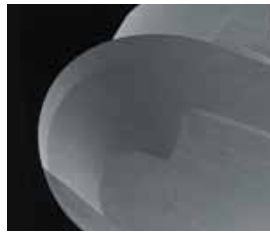
Applications for WXS® Coating



Surface Hardness and Oxidation Temperature of WXS® Coating

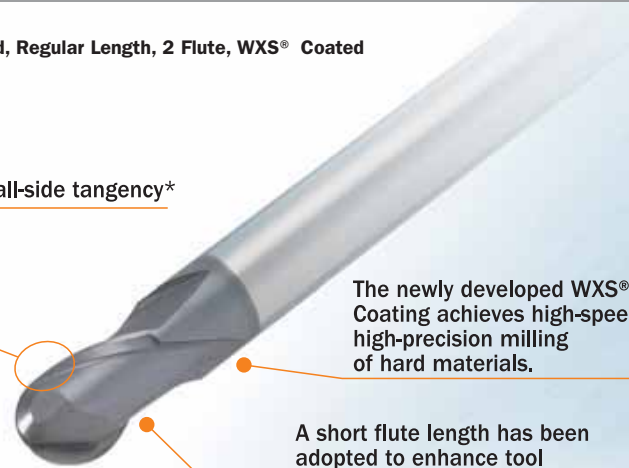


List 4410 & 4510 Ball End, Regular Length, 2 Flute, WXS® Coated



Seamless ball-side tangency*

* Seamless ball-side tangency : R≤6



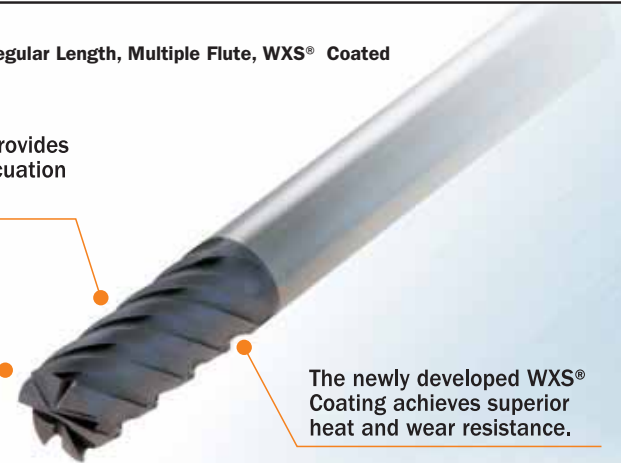
The newly developed WXS® Coating achieves high-speed, high-precision milling of hard materials.

A short flute length has been adopted to enhance tool rigidity (sizes below R3 are shaped with a neck recess).

List 4440 & 4540 Regular Length, Multiple Flute, WXS® Coated

A unique groove form provides both excellent chip evacuation and high tool rigidity.

Tool diameter tolerance 0/-0.02mm for all sizes.



The newly developed WXS® Coating achieves superior heat and wear resistance.

List 4590 Ball End, Stub Length, 2 Flute, Long Neck, Rib Processing, WXS® Coated

List 4592 Corner Radius, Stub Length, 2 Flute, Long Neck, Rib Processing, WXS® Coated

The newly developed WXS® Coating achieves long life while milling hardened steel at high speeds.

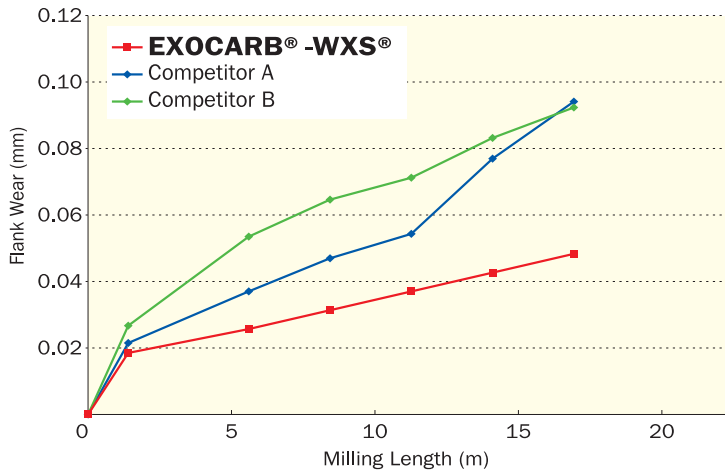
The composite radius shape at the neck dampens stress concentration.

Superior wear and chipping resistance thanks to optimally matched new WXS® Coating and carbide substrate.



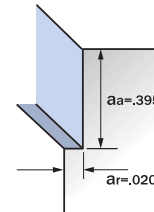
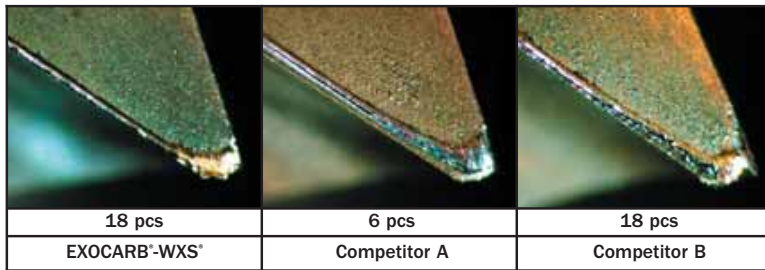
EXOCARB®-WXS®

In high-speed milling of hardened materials, the efficiency of WXS® is clearly demonstrated.

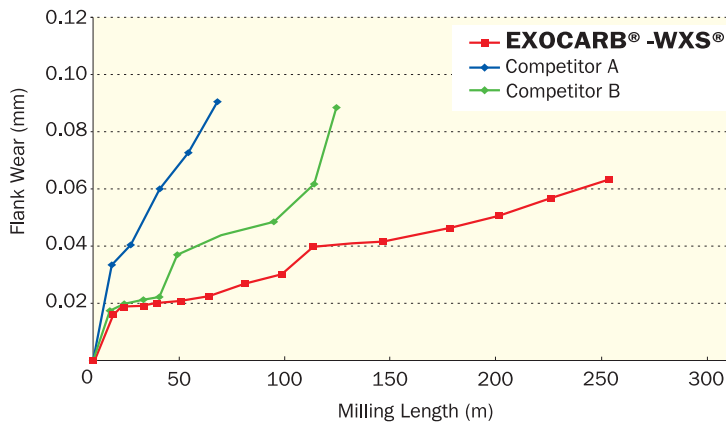


Tool:	EXOCARB®-WXS® ø10
Material:	D2 (62HRC)
Milling Speed:	4,800 RPM
Feed:	34 IPM
Milling Method:	Side Milling/ Down Cut
Milling Depth:	aa=0.395"; ar=0.020"
Coolant:	Air Blow
Machine:	Vertical Machining Center (BT40)

After Pocket Milling

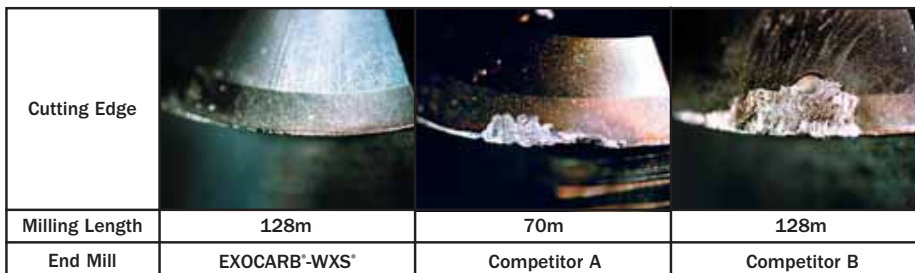


WXS® can handle the fluctuations in edge load typical in 3D hard milling.

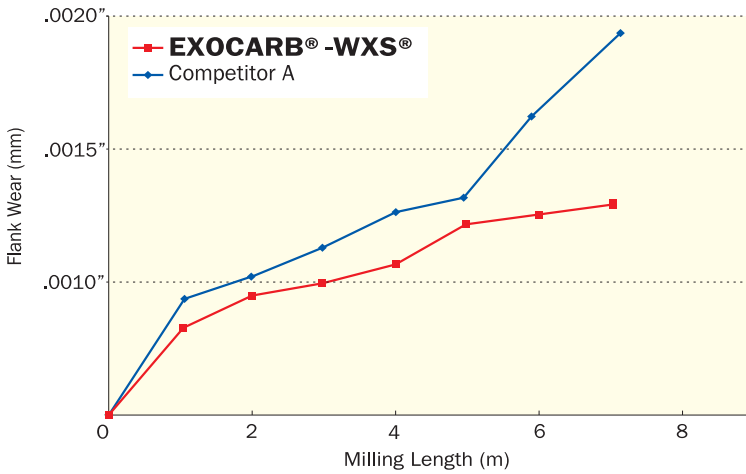


Tool:	EXOCARB®-WXS® ø6
Material:	420 Stainless (52HRC)
Milling Speed:	13,000 RPM
Feed:	123 IPM
Milling Method:	3D Milling
Milling Depth:	aa=0.11"; ar=0.23"
Coolant:	Air Blow
Machine:	Vertical Machining Center (BT40)

After Pocket Milling

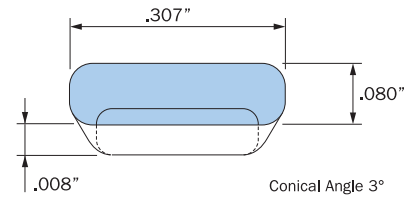


Micromachining with small R0.2 end mills is vastly improved with the newly-developed WXS® coating.



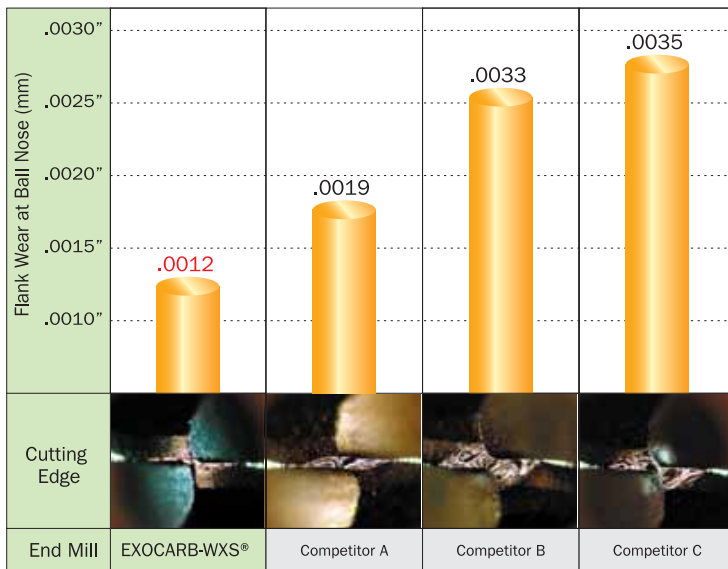
Tool:	EXOCARB®-WXS® R0.2
Material:	H13 (50HRC)
Milling Speed:	40,000RPM
Feed:	17IPM
Milling Method:	Pocket Milling
Milling Depth:	a _a =0.0002"; a _r =0.0005"
Coolant:	Air Blow
Machine:	Vertical Machining Center (HSK-E32)

After Pocket Milling

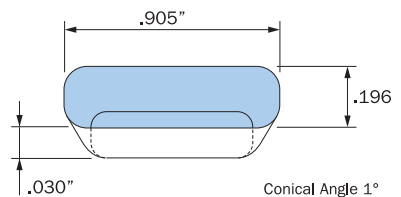


Even when working with a small-diameter ball nose with a long neck (for rib processing), the newly developed ultra-hard WXS® Coating exhibited superior performance.

Wear Comparison After Milling 1 Pocket (Milling 2 hours)



Tool:	EXOCARB®-WXS® R0.5 x 6
Material:	H13 (50HRC)
Milling Speed:	38,500RPM
Feed:	3.5IPM
Milling Method:	Pocket Milling
Milling Depth:	a _a =0.0006"; a _r =0.001"
Coolant:	Air Blow
Machine:	Vertical Machining Center (HSK-E32)



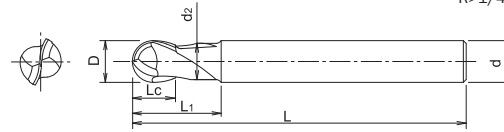
EXOCARB®-WXS®

List 4410 **NEW!**

Ball End, Regular Length, 2 Flute



Tolerance for milling diameter
 $R \leq 1/4 \pm 0.0002"$
 $R > 1/4 \pm 0.0004"$



EDP Number	Mill Dia.	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	L	Lc	d2	L1	d	
44100111	1/32	1-1/2	1/32	0.029	0.078	1/4	54.68
44100211	1/16	1-1/2	1/16	0.058	0.126	1/4	54.68
44100511	3/32	1-1/2	3/32	0.090	0.189	1/4	54.68
44100711	1/8	2	1/8	0.121	0.252	1/4	54.68
44100911	3/16	2-1/2	3/16	0.183	0.378	1/4	63.42

EDP Number	Mill Dia.	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	L	Lc	d2	L1	d	
44101111	1/4	3	1/4	0.246	0.504	1/4	63.42
44101311	5/16	3-1/2	5/16	0.308	0.630	5/16	81.91
44101411	3/8	3-1/2	3/8	0.371	0.756	3/8	103.46
44101611	1/2	4	1/2	0.496	1.000	1/2	133.66

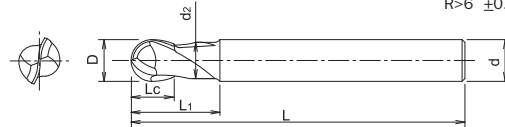
Packed: 1 pc. Available WXS® coating only.

List 4510 **NEW!**

Ball End, Regular Length, 2 Flute



Tolerance for milling diameter
 $R \leq 6 \pm 0.005"$
 $R > 6 \pm 0.010"$



EDP Number	Mill Dia.	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	L	Lc	d2	L1	d	
3041410	1.0	50	1.0	0.95	2	4	77.35
3041415	1.5	50	1.5	1.45	3	4	82.29
3041420	2.0	50	2.0	1.95	4	6	73.96
3041430	3.0	60	3.0	2.85	6	6	78.72
3041440	4.0	70	4.0	3.85	8	6	78.82
3041441	4.0	60	4.0	3.85	8	4	74.90

EDP Number	Mill Dia.	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	L	Lc	d2	L1	d	
3041450	5.0	80	5.0	4.85	10	6	92.02
3041460	6.0	90	9.0	-	-	6	88.96
3041480	8.0	100	12.0	-	-	8	116.87
3041500	10.0	100	15.0	-	-	10	147.63
3041520	12.0	110	18.0	-	-	12	190.68

Packed: 1 pc. Available WXS® coating only.

The prices listed in this flyer are in US Dollars and are good only in the United States. OSG reserves the right to change prices at any time without prior notice.

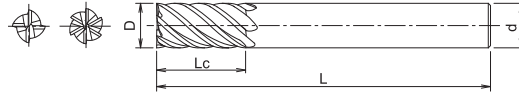


List 4440 **NEW!**

Regular Length, Multiple Flute



Tolerance for milling diameter
 R<1/2 0~-0.0008"
 1/2 D 0~-0.0012"



EDP Number	Mill Dia.	OAL	Length of Cut	Shank Dia.	No. of Flutes	List Price (Each)
	D	L	Lc	d		
44400311	1/16	2-1/2	3/16	1/4	4	46.81
44400511	3/32	2-1/2	5/16	1/4	4	46.81
44400711	1/8	2-1/2	3/8	1/4	4	46.81
44400911	3/16	2-1/2	1/2	1/4	4	48.20
44401111	1/4	2-1/2	5/8	1/4	6	48.20

EDP Number	Mill Dia.	OAL	Length of Cut	Shank Dia.	No. of Flutes	List Price (Each)
	D	L	Lc	L1		
44401311	5/16	2-3/4	3/4	5/16	6	61.89
44401411	3/8	3	1	3/8	6	82.71
44401611	1/2	3-1/2	1-1/8	1/2	6	104.00
44401811	5/8	4	1-1/2	5/8	6	245.73
44402011	3/4	4-1/4	1-3/4	3/4	6	358.66

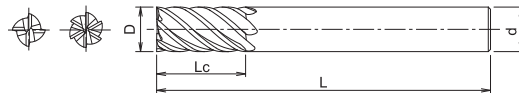
Packed: 1 pc. Available WXS® coating only.

List 4540 **NEW!**

Regular Length, Multiple Flute



Tolerance for milling diameter
 R<1/2 0~-0.0008"
 1/2 D 0~-0.0012"



EDP Number	Mill Dia.	OAL	Length of Cut	Shank Dia.	No. of Flutes	List Price (Each)
	D	L	Lc	d		
3041010	1.0	60	2.5	6	4	74.90
3041015	1.5	60	4.0	6	4	74.90
3041020	2.0	60	6.0	6	4	71.20
3041025	2.5	60	8.0	6	4	66.39
3041030	3.0	60	8.0	6	4	59.04
3041035	3.5	60	10.0	6	4	62.33
3041040	4.0	60	11.0	6	4	62.00

EDP Number	Mill Dia.	OAL	Length of Cut	Shank Dia.	No. of Flutes	List Price (Each)
	D	L	Lc	L1		
3041045	4.5	60	11.0	6	4	66.39
3041050	5.0	60	13.0	6	4	66.06
3041055	5.5	60	13.0	6	4	71.82
3041060	6.0	60	13.0	6	6	71.57
3041080	8.0	70	19.0	8	6	88.32
3041100	10.0	80	22.0	10	6	117.97
3041120	12.0	90	26.0	12	6	148.85

Packed: 1 pc. Available WXS® coating only.

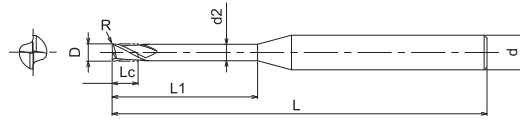


List 4592 **NEW!**

Corner Radius, Stub Length, 2 Flute, Long Neck, Rib Processing



±0.005 Radius Tolerance



EDP Number	Mill Dia.	Corner Radius	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	R	L	Lc	d2	L1	d	
3100403	0.4	0.05	50	0.3	0.37	2	4	54.92
3100404	0.4	0.05	50	0.3	0.37	3	4	54.92
3100405	0.4	0.05	50	0.3	0.37	4	4	54.92
3100406	0.4	0.1	50	0.3	0.37	2	4	54.92
3100407	0.4	0.1	50	0.3	0.37	3	4	54.92
3100408	0.4	0.1	50	0.3	0.37	4	4	54.92
3100502	0.5	0.05	50	0.4	0.46	2	4	44.61
3100503	0.5	0.05	50	0.4	0.46	3	4	44.61
3100504	0.5	0.05	50	0.4	0.46	4	4	44.61
3100505	0.5	0.05	50	0.4	0.46	5	4	44.61
3100506	0.5	0.05	50	0.4	0.46	6	4	44.61
3100508	0.5	0.1	50	0.4	0.46	2	4	44.61
3100509	0.5	0.1	50	0.4	0.46	3	4	44.61
3100510	0.5	0.1	50	0.4	0.46	4	4	44.61
3100511	0.5	0.1	50	0.4	0.46	5	4	44.61
3100512	0.5	0.1	50	0.4	0.46	6	4	44.61
3100601	0.6	0.1	50	0.48	0.56	2	4	44.61
3100602	0.6	0.1	50	0.48	0.56	4	4	44.61
3100603	0.6	0.1	50	0.48	0.56	6	4	44.61
3100803	0.8	0.2	50	0.65	0.76	4	4	50.93
3100804	0.8	0.2	50	0.65	0.76	6	4	50.93
3100805	0.8	0.2	50	0.65	0.76	8	4	50.93
3101001	1.0	0.05	50	0.8	0.95	4	4	46.94
3101002	1.0	0.05	50	0.8	0.95	6	4	46.94
3101003	1.0	0.05	50	0.8	0.95	8	4	46.94
3101004	1.0	0.05	50	0.8	0.95	10	4	46.94
3101005	1.0	0.05	50	0.8	0.95	12	4	46.94
3101006	1.0	0.1	50	0.8	0.95	4	4	46.94
3101007	1.0	0.1	50	0.8	0.95	6	4	46.94
3101008	1.0	0.1	50	0.8	0.95	8	4	46.94
3101009	1.0	0.1	50	0.8	0.95	10	4	46.94
3101010	1.0	0.1	50	0.8	0.95	12	4	46.94
3101011	1.0	0.2	50	0.8	0.95	4	4	46.94
3101012	1.0	0.2	50	0.8	0.95	6	4	46.94
3101013	1.0	0.2	50	0.8	0.95	8	4	46.94
3101014	1.0	0.2	50	0.8	0.95	10	4	46.94
3101015	1.0	0.2	50	0.8	0.95	12	4	46.94
3101016	1.0	0.2	50	0.8	0.95	16	4	71.22
3101017	1.0	0.2	50	0.8	0.95	20	4	71.22
3101018	1.0	0.3	50	0.8	0.95	4	4	46.94
3101019	1.0	0.3	50	0.8	0.95	6	4	46.94
3101020	1.0	0.3	50	0.8	0.95	8	4	46.94
3101021	1.0	0.3	50	0.8	0.95	10	4	46.94
3101022	1.0	0.3	50	0.8	0.95	12	4	46.94
3101201	1.2	0.2	50	1.0	1.15	6	4	48.60
3101202	1.2	0.2	50	1.0	1.15	8	4	48.60
3101203	1.2	0.2	50	1.0	1.15	10	4	48.60
3101501	1.5	0.2	50	1.2	1.45	6	4	48.60
3101502	1.5	0.2	50	1.2	1.45	8	4	48.60
3101503	1.5	0.2	50	1.2	1.45	10	4	48.60

Packed: 1 pc. Available WXS® coating only.

The prices listed in this flyer are in US Dollars and are good only in the United States.

OSG reserves the right to change prices at any time without prior notice.



List 4592 (Continued)

Corner Radius, Stub Length, 2 Flute, Long Neck, Rib Processing

EDP Number	Mill Dia.	Corner Radius	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	R	L	Lc	d2	L1	d	
3101504	1.5	0.2	50	1.2	1.45	12	4	48.60
3101505	1.5	0.2	50	1.2	1.45	16	4	48.60
3101506	1.5	0.3	50	1.2	1.45	6	4	48.60
3101507	1.5	0.3	50	1.2	1.45	8	4	48.60
3101508	1.5	0.3	50	1.2	1.45	10	4	48.60
3101509	1.5	0.3	50	1.2	1.45	12	4	48.60
3101510	1.5	0.3	50	1.2	1.45	16	4	48.60
3102001	2.0	0.1	50	1.6	1.95	8	4	49.39
3102002	2.0	0.1	50	1.6	1.95	10	4	49.39
3102003	2.0	0.1	50	1.6	1.95	12	4	49.39
3102004	2.0	0.1	60	1.6	1.95	16	4	49.39
3102005	2.0	0.1	60	1.6	1.95	20	4	49.39
3102006	2.0	0.1	70	1.6	1.95	25	4	49.39
3102007	2.0	0.2	50	1.6	1.95	8	4	49.39
3102008	2.0	0.2	50	1.6	1.95	10	4	49.39
3102009	2.0	0.2	50	1.6	1.95	12	4	49.39
3102010	2.0	0.2	60	1.6	1.95	16	4	49.39
3102011	2.0	0.2	60	1.6	1.95	20	4	49.39
3102012	2.0	0.2	70	1.6	1.95	25	4	49.39
3102013	2.0	0.3	50	1.6	1.95	8	4	49.39
3102014	2.0	0.3	50	1.6	1.95	10	4	49.39
3102015	2.0	0.3	50	1.6	1.95	12	4	49.39
3102016	2.0	0.3	60	1.6	1.95	16	4	49.39
3102017	2.0	0.3	60	1.6	1.95	20	4	49.39
3102018	2.0	0.3	70	1.6	1.95	25	4	49.39
3102019	2.0	0.5	50	1.6	1.95	8	4	49.39
3102020	2.0	0.5	50	1.6	1.95	10	4	49.39
3102021	2.0	0.5	50	1.6	1.95	12	4	49.39
3102022	2.0	0.5	60	1.6	1.95	16	4	49.39
3102023	2.0	0.5	60	1.6	1.95	20	4	49.39
3102024	2.0	0.5	70	1.6	1.95	25	4	49.39
3102501	2.5	0.2	50	2.2	2.4	10	4	50.93
3102502	2.5	0.2	60	2.2	2.4	20	4	52.62
3102503	2.5	0.2	70	2.2	2.4	30	4	54.16
3102504	2.5	0.5	50	2.2	2.4	10	4	50.93
3102505	2.5	0.5	60	2.2	2.4	20	4	52.62
3102506	2.5	0.5	70	2.2	2.4	30	4	54.16
3103001	3.0	0.2	60	2.5	2.85	8	6	67.38
3103002	3.0	0.2	60	2.5	2.85	12	6	67.38
3103003	3.0	0.2	60	2.5	2.85	16	6	69.08
3103004	3.0	0.2	70	2.5	2.85	20	6	69.08
3103005	3.0	0.2	70	2.5	2.85	25	6	71.22
3103006	3.0	0.2	70	2.5	2.85	30	6	74.61
3103007	3.0	0.2	80	2.5	2.85	35	6	74.61
3103008	3.0	0.3	60	2.5	2.85	12	6	67.38
3103009	3.0	0.3	60	2.5	2.85	16	6	69.08
3103010	3.0	0.3	70	2.5	2.85	20	6	69.08
3103011	3.0	0.3	70	2.5	2.85	25	6	71.22
3103012	3.0	0.3	70	2.5	2.85	30	6	74.61
3103013	3.0	0.3	80	2.5	2.85	35	6	74.61
3103014	3.0	0.5	60	2.5	2.85	12	6	67.38
3103015	3.0	0.5	60	2.5	2.85	16	6	69.08
3103016	3.0	0.5	70	2.5	2.85	20	6	69.08
3103017	3.0	0.5	70	2.5	2.85	25	6	71.22
3103018	3.0	0.5	70	2.5	2.85	30	6	74.61
3103019	3.0	0.5	80	2.5	2.85	35	6	74.61

Packed: 1 pc. Available WXS® coating only.

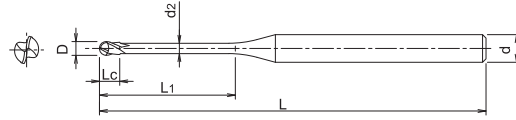


List 4590 **NEW!**

Ball End, Stub Length, 2 Flute, Long Neck, Rib Processing



±0.005 Radius Tolerance



EDP Number	Mill Dia.	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	L	Lc	d2	L1	d	
3050602	0.6	45	0.5	0.55	2	4	40.95
3050603	0.6	45	0.5	0.55	3	4	40.95
3050604	0.6	45	0.5	0.55	4	4	44.34
3050606	0.6	45	0.5	0.55	6	4	44.34
3050608	0.6	45	0.5	0.55	8	4	58.20
3050802	0.8	45	0.6	0.75	2	4	40.95
3050804	0.8	45	0.6	0.75	4	4	44.34
3050806	0.8	45	0.6	0.75	6	4	44.34
3050808	0.8	45	0.6	0.75	8	4	44.34
3050810	0.8	45	0.6	0.75	10	4	58.20
3051003	1.0	45	0.8	0.95	3	4	35.11
3051004	1.0	45	0.8	0.95	4	4	39.11
3051005	1.0	45	0.8	0.95	5	4	39.11
3051006	1.0	45	0.8	0.95	6	4	42.65
3051007	1.0	45	0.8	0.95	7	4	42.65
3051008	1.0	45	0.8	0.95	8	4	42.65
3051009	1.0	45	0.8	0.95	9	4	42.65
3051010	1.0	45	0.8	0.95	10	4	42.65
3051012	1.0	45	0.8	0.95	12	4	42.65
3051014	1.0	50	0.8	0.95	14	4	42.65
3051016	1.0	50	0.8	0.95	16	4	58.20
3051020	1.0	55	0.8	0.95	20	4	70.69
3051206	1.2	45	1.0	1.15	6	4	49.12
3051212	1.2	45	1.0	1.15	12	4	49.12
3051508	1.5	45	1.2	1.45	8	4	42.65
3051512	1.5	45	1.2	1.45	12	4	49.12

EDP Number	Mill Dia.	OAL	Length of Cut	Neck Dia.	Neck Length	Shank Dia.	List Price (Each)
	D	L	Lc	d2	L1	d	
3051516	1.5	50	1.2	1.45	16	4	49.12
3051520	1.5	55	1.2	1.45	20	4	49.12
3052004	2.0	45	1.6	1.95	4	4	35.11
3052006	2.0	45	1.6	1.95	6	4	39.11
3052008	2.0	45	1.6	1.95	8	4	42.65
3052010	2.0	45	1.6	1.95	10	4	42.65
3052012	2.0	45	1.6	1.95	12	4	42.65
3052014	2.0	50	1.6	1.95	14	4	42.66
3052016	2.0	50	1.6	1.95	16	4	42.65
3052018	2.0	55	1.6	1.95	18	4	42.66
3052020	2.0	55	1.6	1.95	20	4	42.65
3052025	2.0	65	1.6	1.95	25	4	58.20
3052030	2.0	70	1.6	1.95	30	4	67.28
3053008	3.0	50	2.4	2.85	8	6	42.65
3053010	3.0	50	2.4	2.85	10	6	49.12
3053016	3.0	55	2.4	2.85	16	6	56.67
3053020	3.0	60	2.4	2.85	20	6	56.67
3053025	3.0	65	2.4	2.85	25	6	56.67
3053030	3.0	70	2.4	2.85	30	6	61.44
3054010	4.0	60	3.2	3.85	10	6	42.65
3054016	4.0	60	3.2	3.85	16	6	56.67
3054020	4.0	65	3.2	3.85	20	6	56.67
3054025	4.0	70	3.2	3.85	25	6	56.67
3054030	4.0	80	3.2	3.85	30	6	56.67
3054035	4.0	80	3.2	3.85	35	6	63.13
3054040	4.0	90	3.2	3.85	40	6	70.21

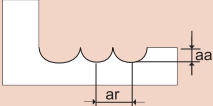
Packed: 1 pc. Available WXS® coating only.

The prices listed in this flyer are in US Dollars and are good only in the United States. OSG reserves the right to change prices at any time without prior notice.

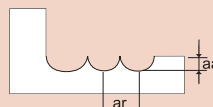


List 4410

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 Prehardened Steels		Hardened Steels					
Cutting Speed	330 - 825 SFM		330 - 660 SFM		330 - 490 SFM		330 - 410 SFM		330 SFM	
Depth of Cut	$a_a=0.05D$ $a_r=0.1D$ $a_{rMax}=less\ than\ 0.024''$ 				$a_a=0.03D$ $a_r=0.1D$ $a_{rMax}=less\ than\ 0.020''$		$a_a=0.02D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.012''$			
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	32,000	88	32,000	87	32,000	72	32,000	59	32,000	55
1/16	32,000	114	32,000	114	32,000	94	30,256	66	24,208	51
3/32	32,000	135	32,000	134	24,213	81	20,171	61	16,138	48
1/8	30,064	165	24,016	120	18,160	79	15,128	63	12,104	47
3/16	20,043	151	16,011	124	12,107	74	10,085	59	8,069	45
1/4	15,032	145	12,008	115	9,080	71	7,564	55	6,052	41
5/16	12,026	138	9,606	106	7,264	65	6,051	51	4,841	38
3/8	10,021	118	8,005	94	6,053	56	5,043	46	4,034	35
1/2	7,516	105	6,004	85	4,540	49	3,782	40	3,026	29

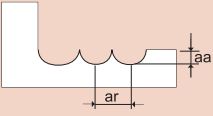
High Speed Milling

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 Prehardened Steels		Hardened Steels					
Cutting Speed	330 - 825 SFM		330 - 660 SFM		330 - 490 SFM		330 - 410 SFM		330 SFM	
Depth of Cut	$a_a=0.02D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.024''$ 				$a_a=0.02D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.020''$		$a_a=0.01D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.012''$			
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	138	50,000	132	50,000	116	50,000	95	50,000	89
1/16	50,000	172	50,000	170	50,000	141	48,032	113	36,320	84
3/32	50,000	213	48,160	201	40,107	132	32,021	108	24,213	76
1/8	47,280	244	36,120	191	30,080	131	24,016	104	18,160	72
3/16	31,520	231	24,080	179	20,053	128	16,011	98	12,107	70
1/4	23,640	222	18,060	165	15,040	115	12,008	92	9,080	66
5/16	18,912	216	14,448	147	12,032	108	9,606	86	7,264	63
3/8	15,760	181	12,040	126	10,027	94	8,005	78	6,053	58
1/2	11,820	163	9,030	118	7,520	80	6,004	67	4,540	51

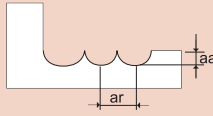


List 4510

Standard Milling

Hardness	Up 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 Prehardened Steels		Hardened Steels					
Cutting Speed	330 - 825 SFM		330 - 660 SFM		330 - 490 SFM		330 - 410 SFM		330 SFM	
Depth of Cut	$a_a=0.05D$ $a_r=0.1D$ a_{rMax} =less than 0.024"				$a_a=0.03D$ $a_r=0.1D$ a_{rMax} =less than 0.020"		$a_a=0.02D$ $a_r=0.05D$ a_{rMax} =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	32,000	92.5	32,000	92.5	32,000	78.7	32,000	63.0	32,000	57.1
1.5	32,000	120.1	32,000	120.1	32,000	98.4	26,500	74.8	21,000	55.1
2.0	32,000	141.7	32,000	139.8	24,000	86.6	20,000	68.9	16,000	49.2
3.0	26,500	157.5	21,000	126.0	16,000	78.7	13,500	63.0	10,500	47.2
4.0	20,000	143.7	16,000	116.1	12,000	74.8	9,950	59.1	7,950	45.3
5.0	16,000	137.8	12,500	104.3	9,550	66.9	7,950	53.1	6,350	39.4
6.0	13,500	131.9	10,500	90.6	7,950	61.0	6,650	49.2	5,300	37.6
8.0	9,950	112.2	7,950	80.7	5,950	53.1	4,950	41.3	4,000	32.7
10.0	7,950	100.4	6,350	70.9	4,800	45.3	4,000	34.4	3,200	27.6
12.0	6,650	94.5	5,300	65.0	4,000	37.6	3,300	31.3	2,650	25.0
16.0	4,950	70.9	4,000	49.2	3,000	30.5	2,500	23.4	2,000	18.7
20.0	4,000	57.1	3,200	39.4	2,400	24.4	2,000	18.7	1,600	15.0
25.0	3,200	45.3	2,550	32.1	1,900	19.5	1,600	15.0	1,250	12.0

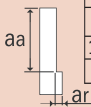
High Speed Milling

Hardness	Up 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 Prehardened Steels		Hardened Steels					
Cutting Speed	330 - 825 SFM		330 - 660 SFM		330 - 490 SFM		330 - 410 SFM		330 SFM	
Depth of Cut	$a_a=0.02D$ $a_r=0.05D$ a_{rMax} =less than 0.024"				$a_a=0.02D$ $a_r=0.05D$ a_{rMax} =less than 0.020"		$a_a=0.01D$ $a_r=0.05D$ a_{rMax} =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	50,000	145.7	50,000	145.7	50,000	122.0	50,000	102.4	47,500	94.5
2	50,000	189.0	50,000	189.0	50,000	153.5	42,500	120.1	32,000	90.6
2	50,000	220.5	47,500	210.6	40,000	143.7	32,000	110.2	24,000	82.7
3	41,500	244.1	32,000	189.0	26,500	131.9	21,000	100.4	16,000	74.8
4	31,000	224.4	24,000	173.2	20,000	126.0	16,000	94.5	12,000	70.9
5	25,000	214.6	19,000	157.5	16,000	112.2	13,000	84.6	9,550	63.0
6	20,500	204.7	16,000	135.8	13,500	100.4	10,500	80.7	7,950	61.0
8	15,500	175.2	12,000	120.1	9,950	88.6	7,950	70.9	5,950	53.1
10	12,500	155.5	9,550	104.3	7,950	74.8	6,350	61.0	4,800	45.3
12	10,500	145.7	7,950	98.4	6,650	63.0	5,300	53.1	4,000	39.2
16	7,750	110.2	5,950	74.8	4,950	51.2	4,000	41.3	3,000	30.5
20	6,200	88.6	4,800	61.0	4,000	41.3	3,200	32.7	2,400	24.4
25	4,950	70.9	3,800	47.2	3,200	32.7	2,550	26.0	1,900	19.5

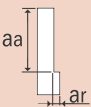


List 4440

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 Prehardened Steels		Hardened Steels									
Depth of Cut					$a_a=1.5D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.040''$		$a_a=1.5D$ $a_r=0.03D$ $a_{rMax}=less\ than\ 0.020''$		$a_a=1D$ $a_r=0.02D$ $a_{rMax}=less\ than\ 0.020''$					
			aa										ar	
			$D \leq 1.5$	1.5D									0.02D	
	$1.5 < D \leq 2.5$	1.5D	0.05D											
	$2.5 < D$	1.5D	0.1D											
	$a_{rMax}=less\ than\ 0.040''$													
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	20,000	60	20,000	63	16,013	49	15,120	26	13,808	21	7,950	13		
3/32	18,912	71	16,991	63	10,667	49	10,080	26	9,205	21	5,300	13		
1/8	14,185	71	12,744	63	8,005	49	7,560	26	6,904	21	4,000	13		
3/16	9,456	71	8,496	63	5,334	49	5,041	26	4,602	21	3,200	13		
1/4	7,092	104	6,372	95	4,000	74	3,780	40	3,452	31	2,650	20		
5/16	5,673	104	5,100	95	3,200	74	3,024	40	2,761	31	2,000	20		
3/8	4,728	104	4,248	95	2,667	74	2,520	40	2,301	31	1,600	20		
1/2	3,546	104	3,186	95	2,000	74	1,890	40	1,726	31	1,350	20		
5/8	2,839	95	2,550	88	1,601	68	1,512	35	1,382	27	1,081	18		
3/4	3,785	82	2,125	71	1,334	59	1,260	31	1,152	21	901	15		

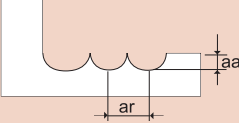
High Speed Milling

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 Prehardened Steels		Hardened Steels									
Depth of Cut					$a_a=1D$ $a_r=0.03D$ $a_{rMax}=less\ than\ 0.020''$		$a_a=1D$ $a_r=0.02D$ $a_{rMax}=less\ than\ 0.008''$		$a_a=1D$ $a_r=0.01D$ $a_{rMax}=less\ than\ 0.008''$					
			aa										ar	
			$a_a=1D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.020''$											
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	50,000	128	50,000	150	37,760	126	32,144	65	30,240	53	20,160	32		
3/32	40,096	135	38,400	150	25,173	126	21,429	65	20,160	53	13,440	32		
1/8	30,072	153	28,800	150	18,880	126	16,072	65	15,120	53	10,080	32		
3/16	20,048	161	19,200	150	12,586	126	10,714	65	10,080	53	6,720	32		
1/4	15,036	226	15,410	226	9,440	189	8,036	96.5	7,560	79	5,040	47		
5/16	12,028	226	11,520	226	7,552	189	6,428	96.5	6,048	79	4,032	47		
3/8	10,024	226	9,600	226	6,293	189	5,357	96.5	5,040	79	3,360	47		
1/2	7,518	226	7,200	226	4,720	189	4,018	96.5	3,780	79	2,520	47		
5/8	6,012	218	5,764	218	3,777	181	3,216	91	3,025	74	2,017	43		
3/4	5,010	205	4,804	200	3,148	167	2,680	78	2,521	62	1,681	36		



List 4590

Standard Milling

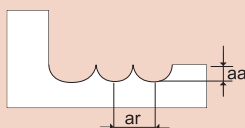
Hardness	Up to 20 HRC				20 to 30 HRC				30 to 38 HRC			
Work Material	Mild Steels, Carbon Steels, Cast Iron				Alloy Steels, Tool Steels				Hardened Steels, Prehardened Steels			
Depth of Cut												

Dia.	L1	RPM	in/min	aa	ar	RPM	in/min	aa	ar	RPM	in/min	aa	ar
0.6	2	32,000	23.6	0.0012	0.0047	32,000	23.6	0.0012	0.0047	32,000	17.7	0.0012	0.0047
0.6	3	30,000	15.7	0.0012	0.0047	30,000	15.7	0.0012	0.0047	25,000	9.8	0.0012	0.0047
0.6	4	30,000	15.7	0.0012	0.0047	30,000	15.7	0.0012	0.0047	25,000	9.8	0.0012	0.0047
0.6	6	25,000	11.8	0.0012	0.0047	25,000	11.8	0.0012	0.0047	20,000	5.9	0.0012	0.0047
0.6	8	25,000	11.8	0.0012	0.0047	25,000	11.8	0.0012	0.0047	20,000	5.9	0.0012	0.0047
0.8	2	27,000	23.6	0.0016	0.0063	27,000	23.6	0.0016	0.0063	23,000	17.7	0.0016	0.0063
0.8	4	27,000	23.6	0.0016	0.0063	27,000	23.6	0.0016	0.0063	23,000	17.7	0.0016	0.0063
0.8	6	24,000	15.7	0.0016	0.0047	24,000	15.7	0.0016	0.0047	21,000	9.8	0.0016	0.0047
0.8	8	22,000	11.8	0.0016	0.0047	22,000	11.8	0.0016	0.0047	19,000	5.9	0.0016	0.0047
0.8	10	22,000	11.8	0.0016	0.0047	22,000	11.8	0.0016	0.0047	19,000	5.9	0.0016	0.0047
1.0	3	28,000	23.6	0.0020	0.0079	28,000	23.6	0.0020	0.0079	25,000	19.7	0.0020	0.0079
1.0	4	28,000	23.6	0.0020	0.0079	28,000	23.6	0.0020	0.0079	25,000	19.7	0.0020	0.0079
1.0	5	21,000	15.7	0.0020	0.0079	21,000	15.7	0.0020	0.0079	19,000	11.8	0.0020	0.0079
1.0	6	21,000	15.7	0.0020	0.0079	21,000	15.7	0.0020	0.0079	19,000	11.8	0.0020	0.0079
1.0	7	21,000	15.7	0.0020	0.0059	21,000	15.7	0.0020	0.0059	19,000	11.8	0.0020	0.0059
1.0	8	21,000	15.7	0.0020	0.0059	21,000	15.7	0.0020	0.0059	19,000	11.8	0.0020	0.0059
1.0	9	21,000	15.7	0.0020	0.0059	21,000	15.7	0.0020	0.0059	19,000	11.8	0.0020	0.0059
1.0	10	18,000	11.8	0.0012	0.0039	18,000	11.8	0.0012	0.0039	17,000	7.9	0.0012	0.0039
1.0	12	18,000	11.8	0.0012	0.0039	18,000	11.8	0.0012	0.0039	17,000	7.9	0.0012	0.0039
1.0	14	18,000	11.8	0.0012	0.0039	18,000	11.8	0.0012	0.0039	17,000	7.9	0.0012	0.0039
1.0	16	16,000	11.8	0.0012	0.0039	16,000	11.8	0.0012	0.0039	13,000	7.9	0.0012	0.0039
1.0	20	16,000	11.8	0.0012	0.0039	16,000	11.8	0.0012	0.0039	13,000	7.9	0.0012	0.0039
1.2	6	20,000	23.6	0.0024	0.0094	20,000	23.6	0.0024	0.0094	17,000	11.8	0.0024	0.0094
1.2	12	16,000	11.8	0.0024	0.0071	16,000	11.8	0.0024	0.0071	14,000	7.9	0.0024	0.0071
1.5	8	17,000	23.6	0.0031	0.0118	17,000	23.6	0.0031	0.0118	15,000	11.8	0.0031	0.0118
1.5	12	17,000	23.6	0.0031	0.0091	17,000	23.6	0.0031	0.0091	15,000	11.8	0.0031	0.0091
1.5	16	13,000	11.8	0.0020	0.0059	13,000	11.8	0.0020	0.0059	12,000	7.9	0.0020	0.0059
1.5	20	13,000	11.8	0.0020	0.0059	13,000	11.8	0.0020	0.0059	12,000	7.9	0.0020	0.0059
2.0	4	16,500	39.4	0.0039	0.0157	16,500	39.4	0.0039	0.0157	16,500	27.6	0.0039	0.0157
2.0	6	16,500	39.4	0.0039	0.0157	16,500	39.4	0.0039	0.0157	16,500	27.6	0.0039	0.0157
2.0	8	16,500	39.4	0.0039	0.0157	16,500	39.4	0.0039	0.0157	16,500	27.6	0.0039	0.0157
2.0	10	14,000	27.6	0.0039	0.0157	14,000	27.6	0.0039	0.0157	13,000	19.7	0.0039	0.0157
2.0	12	14,000	27.6	0.0039	0.0157	14,000	27.6	0.0039	0.0157	13,000	19.7	0.0039	0.0157
2.0	14	14,000	27.6	0.0039	0.0157	14,000	27.6	0.0039	0.0157	13,000	19.7	0.0039	0.0157
2.0	16	14,000	27.6	0.0039	0.0118	14,000	27.6	0.0039	0.0118	13,000	19.7	0.0039	0.0118
2.0	18	14,000	27.6	0.0039	0.0118	14,000	27.6	0.0039	0.0118	13,000	19.7	0.0039	0.0118
2.0	20	11,000	15.7	0.0039	0.0118	11,000	15.7	0.0039	0.0118	10,000	9.8	0.0039	0.0118
2.0	25	11,000	15.7	0.0039	0.0118	11,000	15.7	0.0039	0.0118	10,000	9.8	0.0039	0.0118
2.0	30	11,000	15.7	0.0039	0.0118	11,000	15.7	0.0039	0.0118	10,000	9.8	0.0039	0.0118
3.0	8	12,000	31.5	0.0059	0.0236	12,000	31.5	0.0059	0.0236	9,500	23.6	0.0059	0.0236
3.0	10	12,000	31.5	0.0059	0.0236	12,000	31.5	0.0059	0.0236	9,500	23.6	0.0059	0.0236
3.0	16	10,000	23.6	0.0059	0.0236	10,000	23.6	0.0059	0.0236	8,500	11.8	0.0059	0.0236
3.0	20	10,000	23.6	0.0059	0.0236	10,000	23.6	0.0059	0.0236	8,500	11.8	0.0059	0.0236
3.0	25	10,000	23.6	0.0059	0.0236	10,000	23.6	0.0059	0.0236	8,500	11.8	0.0059	0.0236
3.0	30	9,000	17.7	0.0059	0.0236	9,000	17.7	0.0059	0.0236	7,500	9.8	0.0059	0.0236
4.0	10	9,000	31.5	0.0079	0.0315	9,000	31.5	0.0079	0.0315	7,500	23.6	0.0079	0.0315
4.0	16	9,000	31.5	0.0079	0.0315	9,000	31.5	0.0079	0.0315	7,500	23.6	0.0079	0.0315
4.0	20	7,000	23.6	0.0079	0.0315	7,000	23.6	0.0079	0.0315	6,000	15.7	0.0079	0.0315
4.0	25	7,000	23.6	0.0079	0.0315	7,000	23.6	0.0079	0.0315	6,000	15.7	0.0079	0.0315
4.0	30	7,000	23.6	0.0079	0.0315	7,000	23.6	0.0079	0.0315	6,000	15.7	0.0079	0.0315
4.0	35	7,000	23.6	0.0079	0.0315	7,000	23.6	0.0079	0.0315	6,000	15.7	0.0079	0.0315
4.0	40	5,000	17.7	0.0079	0.0315	5,000	17.7	0.0079	0.0315	5,000	9.8	0.0079	0.0315



List 4590 (continued)

Standard Milling

Hardness		38 to 45 HRC				45 to 55 HRC				55 to 60 HRC			
Work Material		Stainless Steels, Hardened Steels Prehardened Steels				Hardened Steels				Hardened Steels			
Depth of Cut													
Dia.	L1	RPM	in/min	aa	ar	RPM	in/min	aa	ar	RPM	in/min	aa	ar
0.6	2	32,000	11.8	0.0012	0.0047	32,000	11.8	0.0012	0.0024	21,000	7.9	0.0008	0.0016
0.6	3	24,000	7.9	0.0012	0.0047	24,000	7.9	0.0012	0.0024	17,000	5.9	0.0008	0.0016
0.6	4	24,000	7.9	0.0012	0.0047	24,000	7.9	0.0012	0.0024	17,000	5.9	0.0008	0.0016
0.6	6	20,000	5.9	0.0012	0.0047	20,000	5.9	0.0008	0.0012	17,000	5.9	0.0004	0.0008
0.6	8	20,000	5.9	0.0012	0.0047	20,000	5.9	0.0008	0.0012	17,000	5.9	0.0004	0.0008
0.8	2	21,000	11.8	0.0016	0.0063	21,000	11.8	0.0016	0.0031	14,500	7.9	0.0012	0.0031
0.8	4	21,000	11.8	0.0016	0.0063	21,000	11.8	0.0016	0.0031	14,500	7.9	0.0012	0.0031
0.8	6	19,000	7.9	0.0016	0.0047	19,000	7.9	0.0008	0.0016	12,000	5.9	0.0008	0.0016
0.8	8	17,000	5.9	0.0016	0.0047	17,000	5.9	0.0008	0.0016	12,000	3.9	0.0008	0.0016
0.8	10	17,000	5.9	0.0016	0.0047	17,000	5.9	0.0008	0.0016	12,000	3.9	0.0008	0.0016
1.0	3	21,000	11.8	0.0020	0.0079	21,000	11.8	0.0020	0.0039	14,500	7.9	0.0020	0.0039
1.0	4	21,000	11.8	0.0020	0.0079	21,000	11.8	0.0020	0.0039	14,500	7.9	0.0020	0.0039
1.0	5	16,000	7.9	0.0020	0.0079	16,000	7.9	0.0020	0.0039	11,500	5.9	0.0020	0.0039
1.0	6	16,000	7.9	0.0020	0.0079	16,000	7.9	0.0020	0.0039	11,500	5.9	0.0020	0.0039
1.0	7	16,000	7.9	0.0020	0.0059	16,000	7.9	0.0012	0.0020	11,500	5.9	0.0012	0.0020
1.0	8	16,000	7.9	0.0020	0.0059	16,000	7.9	0.0012	0.0020	11,500	5.9	0.0012	0.0020
1.0	9	16,000	7.9	0.0020	0.0059	16,000	7.9	0.0012	0.0020	11,500	5.9	0.0012	0.0020
1.0	10	14,000	5.9	0.0012	0.0039	14,000	5.9	0.0004	0.0012	9,800	3.9	0.0004	0.0012
1.0	12	14,000	5.9	0.0012	0.0039	14,000	5.9	0.0004	0.0012	9,800	3.9	0.0004	0.0012
1.0	14	14,000	5.9	0.0012	0.0039	14,000	5.9	0.0004	0.0012	9,800	3.9	0.0004	0.0012
1.0	16	10,000	5.9	0.0012	0.0039	10,000	5.9	0.0004	0.0012	9,800	3.9	0.0004	0.0012
1.0	20	10,000	5.9	0.0012	0.0039	10,000	5.9	0.0004	0.0012	9,800	3.9	0.0004	0.0012
1.2	6	14,000	7.9	0.0024	0.0094	14,000	7.9	0.0024	0.0047	9,500	7.9	0.0024	0.0047
1.2	12	11,000	5.9	0.0024	0.0071	11,000	5.9	0.0016	0.0024	7,500	3.9	0.0012	0.0024
1.5	8	12,000	9.8	0.0031	0.0118	12,000	9.8	0.0031	0.0059	8,000	7.9	0.0031	0.0059
1.5	12	12,000	9.8	0.0031	0.0091	12,000	9.8	0.0031	0.0059	8,000	7.9	0.0031	0.0059
1.5	16	9,500	5.9	0.0020	0.0059	9,500	5.9	0.0004	0.0020	6,500	3.9	0.0004	0.0012
1.5	20	9,500	5.9	0.0020	0.0059	9,500	5.9	0.0004	0.0020	6,500	3.9	0.0004	0.0012
2.0	4	13,500	19.7	0.0039	0.0157	13,500	19.7	0.0039	0.0079	7,500	9.8	0.0039	0.0079
2.0	6	13,500	19.7	0.0039	0.0157	13,500	19.7	0.0039	0.0079	7,500	9.8	0.0039	0.0079
2.0	8	13,500	19.7	0.0039	0.0157	13,500	19.7	0.0039	0.0079	7,500	9.8	0.0039	0.0079
2.0	10	10,000	11.8	0.0039	0.0157	10,000	11.8	0.0039	0.0079	5,500	7.9	0.0039	0.0079
2.0	12	10,000	11.8	0.0039	0.0157	10,000	11.8	0.0039	0.0079	5,500	7.9	0.0039	0.0079
2.0	14	10,000	11.8	0.0039	0.0157	10,000	11.8	0.0039	0.0079	5,500	7.9	0.0039	0.0079
2.0	16	10,000	11.8	0.0039	0.0118	10,000	11.8	0.0024	0.0039	5,500	7.9	0.0024	0.0039
2.0	18	10,000	11.8	0.0039	0.0118	10,000	11.8	0.0024	0.0039	5,500	7.9	0.0024	0.0039
2.0	20	8,000	7.9	0.0039	0.0118	8,000	7.9	0.0024	0.0039	5,500	7.9	0.0024	0.0039
2.0	25	8,000	7.9	0.0039	0.0118	8,000	7.9	0.0024	0.0039	5,500	7.9	0.0024	0.0039
2.0	30	8,000	7.9	0.0039	0.0118	8,000	7.9	0.0024	0.0039	5,500	7.9	0.0024	0.0039
3.0	8	7,500	15.7	0.0059	0.0236	7,500	15.7	0.0059	0.0118	4,000	7.9	0.0059	0.0118
3.0	10	7,500	15.7	0.0059	0.0236	7,500	15.7	0.0059	0.0118	4,000	7.9	0.0059	0.0118
3.0	16	6,500	9.8	0.0059	0.0236	6,500	9.8	0.0059	0.0118	3,000	5.9	0.0059	0.0118
3.0	20	6,500	9.8	0.0059	0.0236	6,500	9.8	0.0059	0.0118	3,000	5.9	0.0059	0.0118
3.0	25	6,500	9.8	0.0059	0.0236	6,500	9.8	0.0035	0.0059	3,000	5.9	0.0035	0.0059
3.0	30	6,000	7.9	0.0059	0.0236	6,000	7.9	0.0035	0.0059	3,000	5.9	0.0035	0.0059
4.0	10	6,000	15.7	0.0079	0.0315	6,000	15.7	0.0079	0.0157	3,000	7.9	0.0079	0.0157
4.0	16	6,000	15.7	0.0079	0.0315	6,000	15.7	0.0079	0.0157	3,000	7.9	0.0079	0.0157
4.0	20	5,000	9.8	0.0079	0.0315	5,000	9.8	0.0079	0.0157	2,500	3.9	0.0079	0.0157
4.0	25	5,000	9.8	0.0079	0.0315	5,000	9.8	0.0079	0.0157	2,500	3.9	0.0079	0.0157
4.0	30	5,000	9.8	0.0079	0.0315	5,000	9.8	0.0047	0.0079	2,500	3.9	0.0047	0.0079
4.0	35	5,000	9.8	0.0079	0.0315	5,000	9.8	0.0047	0.0079	2,500	3.9	0.0047	0.0079
4.0	40	4,000	7.9	0.0079	0.0315	4,000	7.9	0.0047	0.0079	2,500	3.9	0.0047	0.0079

▶ continued on next page ▶



List 4590 (continued)

High Speed Milling

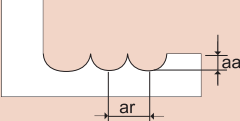
Hardness	Up to 20 HRC				20 to 30 HRC				30 to 38 HRC			
Work Material	Mild Steels, Carbon Steels, Cast Iron				Alloy Steels, Tool Steels				Hardened Steels, Prehardened Steels			
Depth of Cut												

Dia.	L1	RPM	in/min	aa	ar	RPM	in/min	aa	ar	RPM	in/min	aa	ar
0.6	2	50,000	53.1	0.0012	0.0024	50,000	53.1	0.0012	0.0024	50,000	47.2	0.0012	0.0024
0.6	3	50,000	53.1	0.0012	0.0024	50,000	53.1	0.0012	0.0024	50,000	47.2	0.0012	0.0024
0.6	4	40,000	35.4	0.0012	0.0024	40,000	35.4	0.0012	0.0024	40,000	33.5	0.0012	0.0024
0.6	6	30,000	21.7	0.0006	0.0012	30,000	21.7	0.0006	0.0012	30,000	19.7	0.0006	0.0012
0.6	8	-	-	-	-	-	-	-	-	-	-	-	-
0.8	2	50,000	68.9	0.0016	0.0031	50,000	68.9	0.0016	0.0031	50,000	61.0	0.0016	0.0031
0.8	4	50,000	68.9	0.0016	0.0031	50,000	68.9	0.0016	0.0031	50,000	61.0	0.0016	0.0031
0.8	6	30,000	35.4	0.0008	0.0016	30,000	35.4	0.0008	0.0016	30,000	31.5	0.0008	0.0016
0.8	8	30,000	29.5	0.0008	0.0016	30,000	29.5	0.0008	0.0016	30,000	25.6	0.0008	0.0016
0.8	10	-	-	-	-	-	-	-	-	-	-	-	-
1.0	3	50,000	82.7	0.0020	0.0059	50,000	82.7	0.0020	0.0059	50,000	74.8	0.0020	0.0059
1.0	4	50,000	82.7	0.0020	0.0059	50,000	82.7	0.0020	0.0059	50,000	74.8	0.0020	0.0059
1.0	5	50,000	82.7	0.0020	0.0039	50,000	82.7	0.0020	0.0039	50,000	74.8	0.0020	0.0039
1.0	6	40,000	57.1	0.0020	0.0039	40,000	57.1	0.0020	0.0039	40,000	51.2	0.0020	0.0039
1.0	7	40,000	57.1	0.0020	0.0039	40,000	57.1	0.0020	0.0039	40,000	51.2	0.0020	0.0039
1.0	8	30,000	41.3	0.0010	0.0020	30,000	41.3	0.0010	0.0020	30,000	37.4	0.0010	0.0020
1.0	9	30,000	41.3	0.0010	0.0020	30,000	41.3	0.0010	0.0020	30,000	37.4	0.0010	0.0020
1.0	10	30,000	35.4	0.0010	0.0020	30,000	35.4	0.0010	0.0020	30,000	31.5	0.0010	0.0020
1.0	12	-	-	-	-	-	-	-	-	-	-	-	-
1.0	14	-	-	-	-	-	-	-	-	-	-	-	-
1.0	16	-	-	-	-	-	-	-	-	-	-	-	-
1.0	20	-	-	-	-	-	-	-	-	-	-	-	-
1.2	6	48,000	90.6	0.0024	0.0047	48,000	90.6	0.0024	0.0047	42,000	72.8	0.0024	0.0047
1.2	12	28,500	39.4	0.0012	0.0024	28,500	39.4	0.0012	0.0024	25,000	31.5	0.0012	0.0024
1.5	8	38,000	90.6	0.0030	0.0059	38,000	90.6	0.0030	0.0059	34,000	72.8	0.0030	0.0059
1.5	12	38,000	45.3	0.0030	0.0059	38,000	45.3	0.0030	0.0059	34,000	37.4	0.0030	0.0059
1.5	16	-	-	-	-	-	-	-	-	-	-	-	-
1.5	20	-	-	-	-	-	-	-	-	-	-	-	-
2.0	4	28,500	114.2	0.0039	0.0118	28,500	114.2	0.0039	0.0118	25,500	92.5	0.0039	0.0118
2.0	6	28,500	114.2	0.0039	0.0118	28,500	114.2	0.0039	0.0118	25,500	92.5	0.0039	0.0118
2.0	8	28,500	114.2	0.0039	0.0118	28,500	114.2	0.0039	0.0118	25,500	92.5	0.0039	0.0118
2.0	10	28,500	114.2	0.0039	0.0079	28,500	114.2	0.0039	0.0079	25,500	92.5	0.0039	0.0079
2.0	12	22,500	80.7	0.0039	0.0079	22,500	80.7	0.0039	0.0079	20,000	65.0	0.0039	0.0079
2.0	14	22,500	80.7	0.0039	0.0079	22,500	80.7	0.0039	0.0079	20,000	65.0	0.0039	0.0079
2.0	16	17,000	61.0	0.0020	0.0039	17,000	61.0	0.0020	0.0039	15,000	49.2	0.0020	0.0039
2.0	18	17,000	61.0	0.0020	0.0039	17,000	61.0	0.0020	0.0039	15,000	49.2	0.0020	0.0039
2.0	20	17,000	53.1	0.0020	0.0039	17,000	53.1	0.0020	0.0039	15,000	41.3	0.0020	0.0039
2.0	25	-	-	-	-	-	-	-	-	-	-	-	-
2.0	30	-	-	-	-	-	-	-	-	-	-	-	-
3.0	8	19,000	114.2	0.0059	0.0177	19,000	114.2	0.0059	0.0177	17,000	90.6	0.0059	0.0177
3.0	10	19,000	114.2	0.0059	0.0177	19,000	114.2	0.0059	0.0177	17,000	90.6	0.0059	0.0177
3.0	16	19,000	114.2	0.0059	0.0118	19,000	114.2	0.0059	0.0118	17,000	90.6	0.0059	0.0118
3.0	20	15,000	78.7	0.0059	0.0118	15,000	78.7	0.0059	0.0118	13,500	63.0	0.0059	0.0118
3.0	25	11,000	59.1	0.0028	0.0059	11,000	59.1	0.0028	0.0059	10,000	47.2	0.0030	0.0059
3.0	30	11,000	51.2	0.0028	0.0059	11,000	51.2	0.0028	0.0059	10,000	41.3	0.0030	0.0059
4.0	10	14,500	114.2	0.0079	0.0236	14,500	114.2	0.0079	0.0236	12,500	90.6	0.0079	0.0236
4.0	16	14,500	114.2	0.0079	0.0236	14,500	114.2	0.0079	0.0236	12,500	90.6	0.0079	0.0236
4.0	20	14,500	114.2	0.0079	0.0157	14,500	114.2	0.0079	0.0157	12,500	90.6	0.0079	0.0157
4.0	25	11,500	80.7	0.0079	0.0157	11,500	80.7	0.0079	0.0157	10,000	63.0	0.0079	0.0157
4.0	30	8,700	61.0	0.0039	0.0079	8,700	61.0	0.0039	0.0079	7,500	47.2	0.0039	0.0079
4.0	35	8,700	61.0	0.0039	0.0079	8,700	61.0	0.0039	0.0079	7,500	47.2	0.0039	0.0079
4.0	40	8,700	53.1	0.0039	0.0079	8,700	53.1	0.0039	0.0079	7,500	41.3	0.0039	0.0079



List 4590 (continued)

High Speed Milling

Hardness		38 to 45 HRC				45 to 55 HRC				55 to 60 HRC			
Work Material		Stainless Steels, Hardened Steels Prehardened Steels				Hardened Steels				Hardened Steels			
Depth of Cut													
Dia.	L1	RPM	in/min	aa	ar	RPM	in/min	aa	ar	RPM	in/min	aa	ar
0.6	2	50,000	45.3	0.0012	0.0024	50,000	33.5	0.0006	0.0012	50,000	29.5	0.0006	0.0012
0.6	3	50,000	45.3	0.0012	0.0024	50,000	33.5	0.0006	0.0012	50,000	29.5	0.0006	0.0012
0.6	4	40,000	31.5	0.0012	0.0024	40,000	23.6	0.0004	0.0007	40,000	19.7	0.0004	0.0007
0.6	6	30,000	19.7	0.0006	0.0012	30,000	13.8	0.0004	0.0007	30,000	11.8	0.0004	0.0007
0.6	8	-	-	-	-	-	-	-	-	-	-	-	-
0.8	2	50,000	57.1	0.0016	0.0031	50,000	43.3	0.0008	0.0016	40,000	29.5	0.0008	0.0016
0.8	4	50,000	57.1	0.0016	0.0031	50,000	43.3	0.0008	0.0016	40,000	29.5	0.0008	0.0016
0.8	6	30,000	29.5	0.0008	0.0016	30,000	21.7	0.0005	0.0009	24,000	13.8	0.0005	0.0009
0.8	8	30,000	23.6	0.0008	0.0016	30,000	17.7	0.0005	0.0009	24,000	11.8	0.0005	0.0009
0.8	10	-	-	-	-	-	-	-	-	-	-	-	-
1.0	3	48,000	66.9	0.0020	0.0059	48,000	51.2	0.0010	0.0020	32,000	29.5	0.0010	0.0020
1.0	4	48,000	66.9	0.0020	0.0059	48,000	51.2	0.0010	0.0020	32,000	29.5	0.0010	0.0020
1.0	5	48,000	66.9	0.0020	0.0039	48,000	51.2	0.0010	0.0020	32,000	29.5	0.0010	0.0020
1.0	6	38,500	45.3	0.0020	0.0039	38,500	35.4	0.0006	0.0012	25,500	19.7	0.0006	0.0012
1.0	7	38,500	45.3	0.0020	0.0039	38,500	35.4	0.0006	0.0012	25,500	19.7	0.0006	0.0012
1.0	8	28,500	33.5	0.0010	0.0020	28,500	25.6	0.0006	0.0012	19,000	15.0	0.0006	0.0012
1.0	9	28,500	33.5	0.0010	0.0020	28,500	25.6	0.0006	0.0012	19,000	15.0	0.0006	0.0012
1.0	10	28,500	27.6	0.0010	0.0020	28,500	21.7	0.0006	0.0012	19,000	12.6	0.0006	0.0012
1.0	12	-	-	-	-	-	-	-	-	-	-	-	-
1.0	14	-	-	-	-	-	-	-	-	-	-	-	-
1.0	16	-	-	-	-	-	-	-	-	-	-	-	-
1.0	20	-	-	-	-	-	-	-	-	-	-	-	-
1.2	6	40,000	65.0	0.0024	0.0047	40,000	43.3	0.0012	0.0024	26,000	23.6	0.0012	0.0024
1.2	12	24,000	27.6	0.0012	0.0024	24,000	17.7	0.0007	0.0014	15,500	9.8	0.0007	0.0014
1.5	8	32,000	65.0	0.0030	0.0059	32,000	39.4	0.0009	0.0018	21,000	21.7	0.0015	0.0030
1.5	12	32,000	33.5	0.0030	0.0059	32,000	19.7	0.0009	0.0018	12,500	9.8	0.0015	0.0030
1.5	16	-	-	-	-	-	-	-	-	-	-	-	-
1.5	20	-	-	-	-	-	-	-	-	-	-	-	-
2.0	4	24,000	82.7	0.0039	0.0118	24,000	49.2	0.0020	0.0039	16,000	27.6	0.0020	0.0039
2.0	6	24,000	82.7	0.0039	0.0118	24,000	49.2	0.0020	0.0039	16,000	27.6	0.0020	0.0039
2.0	8	24,000	82.7	0.0039	0.0118	24,000	49.2	0.0020	0.0039	16,000	27.6	0.0020	0.0039
2.0	10	24,000	82.7	0.0039	0.0079	24,000	49.2	0.0020	0.0039	16,000	27.6	0.0020	0.0039
2.0	12	19,000	57.1	0.0039	0.0079	19,000	35.4	0.0012	0.0024	12,500	19.7	0.0020	0.0039
2.0	14	19,000	57.1	0.0039	0.0079	19,000	35.4	0.0012	0.0024	12,500	19.7	0.0012	0.0024
2.0	16	14,000	45.3	0.0020	0.0039	14,000	25.6	0.0012	0.0024	9,500	13.8	0.0012	0.0024
2.0	18	14,000	45.3	0.0020	0.0039	14,000	25.6	0.0012	0.0024	9,500	13.8	0.0012	0.0024
2.0	20	14,000	37.4	0.0020	0.0039	14,000	21.7	0.0012	0.0024	9,500	11.8	0.0012	0.0024
2.0	25	-	-	-	-	-	-	-	-	-	-	-	-
2.0	30	-	-	-	-	-	-	-	-	-	-	-	-
3.0	8	16,000	80.7	0.0059	0.0177	16,000	49.2	0.0030	0.0059	10,500	27.6	0.0030	0.0059
3.0	10	16,000	80.7	0.0059	0.0177	16,000	49.2	0.0030	0.0059	10,500	27.6	0.0030	0.0059
3.0	16	16,000	80.7	0.0059	0.0118	16,000	49.2	0.0030	0.0059	10,500	27.6	0.0030	0.0059
3.0	20	12,500	57.1	0.0059	0.0118	12,500	35.4	0.0018	0.0035	8,400	19.7	0.0018	0.0035
3.0	25	9,600	41.3	0.0030	0.0059	9,600	25.6	0.0018	0.0035	6,300	13.8	0.0018	0.0035
3.0	30	9,600	37.4	0.0030	0.0059	9,600	23.6	0.0018	0.0035	6,300	11.8	0.0018	0.0035
4.0	10	12,000	80.7	0.0079	0.0236	12,000	49.2	0.0039	0.0079	8,000	27.6	0.0039	0.0079
4.0	16	12,000	80.7	0.0079	0.0236	12,000	49.2	0.0039	0.0079	8,000	27.6	0.0039	0.0079
4.0	20	12,000	80.7	0.0079	0.0157	12,000	49.2	0.0039	0.0079	8,000	27.6	0.0039	0.0079
4.0	25	9,600	57.1	0.0079	0.0157	9,600	35.4	0.0024	0.0047	6,400	19.7	0.0024	0.0047
4.0	30	7,200	41.3	0.0039	0.0079	7,200	25.6	0.0024	0.0047	4,800	13.8	0.0024	0.0047
4.0	35	7,200	41.3	0.0039	0.0079	7,200	25.6	0.0024	0.0047	4,800	13.8	0.0024	0.0047
4.0	40	7,200	37.4	0.0039	0.0079	7,200	23.6	0.0024	0.0047	4,800	11.8	0.0024	0.0047



List 4540

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 Prehardened Steels		Hardened Steels							
Depth of Cut				$a_a=1.5D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.040''$	$a_a=1.5D$ $a_r=0.03D$ $a_{rMax}=less\ than\ 0.020''$	$a_a=1D$ $a_r=0.02D$ $a_{rMax}=less\ than\ 0.020''$						
		D≤1.5	aa				ar					
		1.5<D≤2.5	1.5D				0.02D					
2.5<D	1.5D	0.05D	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	20,000	31.5	20,000	31.5	20,000	31.5	20,000	22.0	20,000	18.9	16,000	13.2
2	20,000	63.0	20,000	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

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 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 Prehardened Steels		Hardened Steels							
Depth of Cut				$a_a=1D$ $a_r=0.05D$ $a_{rMax}=less\ than\ 0.020''$	$a_a=1D$ $a_r=0.03D$ $a_{rMax}=less\ than\ 0.020''$	$a_a=1D$ $a_r=0.02D$ $a_{rMax}=less\ than\ 0.008''$	$a_a=1D$ $a_r=0.01D$ $a_{rMax}=less\ than\ 0.008''$					
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 4592

Standard Milling

		Hardness							Up to 45 HRC		45 to 55 HRC		55 to 65 HRC		
		Work Material							Hardened Steels, PreHardened Steels		Hardened Steels, PreHardened Steels		Hardened Steels		
Dia.	L1								$a_a=120\%$ $a_r=120\%$	Speed RPM	Feed mm/min	Speed RPM	Feed mm/min	Speed RPM	Feed mm/min
		a_a						a_r							
		R0.05	R0.1	R0.2	R0.3	R0.5	R1								
0.4	1	0.007	-	-	-	-	-	0.120	29,500	750	26,000	580	24,500	470	
	1.5	0.007	-	-	-	-	-	0.120	29,500	750	26,000	580	24,500	470	
	2	0.005	0.008	-	-	-	-	0.102	27,500	675	24,500	520	23,000	420	
	3	0.002	0.003	-	-	-	-	0.075	23,000	470	20,000	360	19,000	290	
	4	0.001	0.002	-	-	-	-	0.036	21,000	380	18,500	290	17,500	235	
0.5	1	0.007	0.010	-	-	-	-	0.150	29,000	820	26,000	670	26,000	620	
	2	0.007	0.010	-	-	-	-	0.150	29,000	820	26,000	670	26,000	620	
	3	0.003	0.005	-	-	-	-	0.105	27,500	695	24,500	570	24,500	525	
	4	0.002	0.003	-	-	-	-	0.090	22,500	510	20,000	420	20,000	385	
	5	0.001	0.002	-	-	-	-	0.045	21,000	415	18,500	340	18,500	315	
	6	0.001	0.001	-	-	-	-	0.030	19,500	360	17,000	295	17,000	270	
0.6	2	-	0.012	-	-	-	-	0.180	29,000	980	26,000	805	21,500	620	
	4	-	0.005	-	-	-	-	0.122	24,500	695	21,500	570	18,000	440	
	6	-	0.002	-	-	-	-	0.054	21,000	495	18,500	410	15,500	315	
0.8	4	-	0.016	0.032	-	-	-	0.240	23,500	1,000	20,500	800	17,000	565	
	6	-	0.007	0.014	-	-	-	0.240	19,500	700	16,500	555	14,000	390	
	8	-	-	0.008	-	-	-	0.216	18,000	570	15,500	450	13,000	320	
1.0	4	0.010	0.020	0.040	0.050	-	-	0.30	23,000	1,300	20,000	1,050	17,000	755	
	6	0.005	0.010	0.020	0.025	-	-	0.21	20,500	1,050	18,000	835	15,500	605	
	8	0.003	0.006	0.012	0.015	-	-	0.18	18,000	800	15,500	650	13,500	470	
	10	0.002	0.004	0.008	0.010	-	-	0.09	16,500	650	14,500	530	12,500	380	
	12	0.001	0.003	0.006	0.007	-	-	0.06	15,500	565	13,500	460	11,500	335	
	16	-	-	0.004	-	-	-	0.03	12,000	400	10,500	325	9,150	235	
	20	-	-	0.003	-	-	-	0.024	10,000	285	8,900	230	7,650	170	
1.2	6	-	-	0.032	0.040	-	-	0.360	19,000	1,200	18,000	1,050	14,500	735	
	8	-	-	0.018	0.022	-	-	0.252	17,000	965	16,000	845	13,000	580	
	10	-	-	0.011	0.014	-	-	0.216	16,000	850	15,000	740	12,000	510	
1.5	6	-	-	0.040	0.060	-	-	0.450	17,000	1,450	16,000	1,250	13,500	880	
	8	-	-	0.026	0.039	-	-	0.382	16,000	1,250	15,500	1,100	12,500	750	
	10	-	-	0.018	0.027	-	-	0.292	14,500	1,000	13,500	900	11,000	625	
	12	-	-	0.012	0.018	-	-	0.270	13,500	900	12,500	790	10,500	550	
	16	-	-	0.007	0.010	-	-	0.112	9,150	525	8,650	460	7,150	320	
2.0	8	-	0.020	0.04	0.060	0.075	-	0.60	13,000	1,450	13,000	1,300	11,500	7,000	
	10	-	0.016	0.032	0.048	0.060	-	0.51	12,000	1,300	12,000	1,150	11,000	905	
	12	-	0.010	0.020	0.030	0.037	-	0.42	11,500	1,150	11,500	1,050	10,000	810	
	16	-	0.006	0.012	0.018	0.022	-	0.36	10,000	900	10,000	800	8,900	630	
	20	-	0.004	0.008	0.012	0.015	-	0.18	9,300	730	9,300	650	8,250	510	
	25	-	0.002	0.004	0.007	0.009	-	0.12	8,600	625	8,600	560	7,650	440	
2.5	10	-	-	0.004	-	0.075	-	0.75	11,500	1,600	10,500	1,200	9,150	1,000	
	20	-	-	0.020	-	0.037	-	0.45	8,900	1,000	8,000	740	7,150	630	
	30	-	-	0.006	-	0.011	-	0.15	7,650	700	6,850	520	6,100	445	
3.0	8	-	-	0.040	-	-	-	0.90	9,550	1,500	8,600	1,150	7,650	825	
	12	-	-	0.040	0.060	0.075	-	0.90	9,550	1,500	8,600	1,150	7,650	825	
	16	-	-	0.028	0.042	0.052	-	0.72	8,500	1,200	7,650	910	6,800	660	
	20	-	-	0.018	0.027	0.033	-	0.612	7,400	985	6,700	750	5,950	545	
	25	-	-	0.012	0.018	0.022	-	0.54	7,100	830	6,400	630	5,700	460	
	30	-	-	0.008	0.012	0.015	-	0.27	6,900	755	6,200	575	5,500	420	
	35	-	-	0.006	0.009	0.011	-	0.18	6,350	655	5,700	500	5,100	365	
4.0	16	-	-	0.040	0.060	0.075	0.120	1.20	7,150	2,050	6,450	1,550	5,000	965	
	20	-	-	0.032	0.048	0.060	0.200	1.020	6,750	1,950	6,100	1,450	4,750	910	
	25	-	-	0.020	0.030	0.037	0.060	0.816	5,950	1,700	5,350	1,300	4,150	800	
	30	-	-	0.014	0.021	0.026	0.040	0.744	5,550	1,600	5,000	1,200	3,900	750	
	40	-	-	0.008	0.012	0.015	0.024	0.360	5,150	1,500	4,650	1,100	3,600	695	
	50	-	-	0.004	0.007	0.009	0.014	0.216	4,550	1,300	4,100	980	3,150	610	





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



OSG TAP & DIE, INC.

676 E. Fullerton Avenue • Glendale Heights • IL 60139
800.837.2223 • FAX: 800.837.3334 • www.osgtool.com