

# Titanium, Steel & High-Temp Alloys Tools

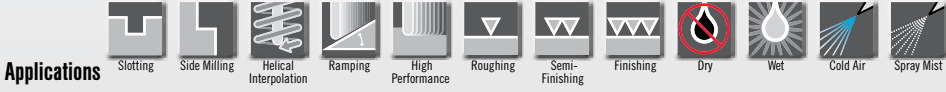
<b>XG / MXG</b> 400/402	4 Flute Tuffy Grade		<b>36</b>
<b>XG / MXG</b> 500/502	5 Flute Tuffy Grade		<b>37</b>
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# XG/MXG Tuffy Grade Carbide End Mills



Characteristics



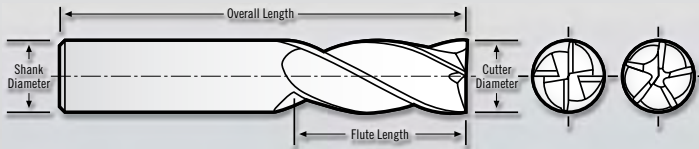
Applications



Materials



Coatings



### XG/XF Tolerances

Cutting Dia. =  $-.001/-0.002$ "  
 Shank Dia. =  $-.0001/-0.0002$ "  
 LOC =  $+0.060/-0.000$ "  
 OAL =  $+/-0.060$ "

### MXG Tolerances

Cutting Dia. =  $-.025/-0.050$ mm  
 Shank Dia. =  $-.002/-0.005$ mm  
 LOC =  $+0.50/+1.50$ mm  
 OAL =  $+/-1.00$ mm



## XG-400 4 Flute Stub Length

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AlTiN Coated	Tool Number No Flats, AlTiN Coated
1/4"	.017-.019"	1/4"	3/8"	2-1/2"	XG-400-08 FL	XG-400-08
5/16"	.020-.022"	5/16"	7/16"	2-1/2"	XG-400-10 FL	XG-400-10
3/8"	.023-.025"	3/8"	1/2"	2-1/2"	XG-400-12 FL	XG-400-12
1/2"	.025-.027"	1/2"	5/8"	3"	XG-400-16 FL	XG-400-16
5/8"	.027-.029"	5/8"	3/4"	3-1/2"	XG-400-20 FL	XG-400-20
3/4"	.028-.030"	3/4"	1"	4"	XG-400-24 FL	XG-400-24
1"	.028-.030"	1"	1-1/8"	5"	XG-400-32 FL	XG-400-32

## XG-402 4 Flute Standard Length

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AlTiN Coated	Tool Number No Flats, AlTiN Coated
1/4"	.017-.019"	1/4"	3/4"	2-1/2"	XG-402-08 FL	XG-402-08
5/16"	.020-.022"	5/16"	13/16"	2-1/2"	XG-402-10 FL	XG-402-10
3/8"	.023-.025"	3/8"	7/8"	2-1/2"	XG-402-12 FL	XG-402-12
1/2"	.025-.027"	1/2"	1"	3"	XG-402-16 FL	XG-402-16
5/8"	.027-.029"	5/8"	1-1/4"	3-1/2"	XG-402-20 FL	XG-402-20
3/4"	.028-.030"	3/4"	1-1/2"	4"	XG-402-24 FL	XG-402-24
1"	.028-.030"	1"	2"	5"	XG-402-32 FL	XG-402-32

## MXG-402 Metric 4 Flute Standard Length METRIC

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AlTiN Coated	Tool Number No Flats, AlTiN Coated
6mm	.50-.55mm	6mm	14mm	57mm	—	MXG-402-06
8mm	.55-.60mm	8mm	16mm	63mm	—	MXG-402-08
10mm	.60-.65mm	10mm	20mm	72mm	—	MXG-402-10
12mm	.65-.70mm	12mm	25mm	83mm	—	MXG-402-12
16mm	.70-.75mm	16mm	32mm	92mm	—	MXG-402-16
20mm	.90-1.0mm	20mm	38mm	104mm	—	MXG-402-20

NOTE: Metric tools do not have flats.

Steel & Hi-Temp Alloys

# Tuffy Grade Carbide End Mills **XG/MXG**



Add Flats for High Torque Cuts!

## XG-500 5 Flute Stub Length

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AITiN Coated	Tool Number No Flats, AITiN Coated
1/4"	.017-.019"	1/4"	3/8"	2-1/2"	XG-500-08 FL	XG-500-08
5/16"	.020-.022"	5/16"	7/16"	2-1/2"	XG-500-10 FL	XG-500-10
3/8"	.023-.025"	3/8"	1/2"	2-1/2"	XG-500-12 FL	XG-500-12
1/2"	.025-.027"	1/2"	5/8"	3"	XG-500-16 FL	XG-500-16
5/8"	.027-.029"	5/8"	3/4"	3-1/2"	XG-500-20 FL	XG-500-20
3/4"	.028-.030"	3/4"	1"	4"	XG-500-24 FL	XG-500-24
1"	.028-.030"	1"	1-1/8"	5"	XG-500-32 FL	XG-500-32

## XG-502 5 Flute Standard Length

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AITiN Coated	Tool Number No Flats, AITiN Coated
1/4"	.017-.019"	1/4"	3/4"	2-1/2"	XG-502-08 FL	XG-502-08
5/16"	.020-.022"	5/16"	13/16"	2-1/2"	XG-502-10 FL	XG-502-10
3/8"	.023-.025"	3/8"	7/8"	2-1/2"	XG-502-12 FL	XG-502-12
1/2"	.025-.027"	1/2"	1"	3"	XG-502-16 FL	XG-502-16
5/8"	.027-.029"	5/8"	1-1/4"	3-1/2"	XG-502-20 FL	XG-502-20
3/4"	.028-.030"	3/4"	1-1/2"	4"	XG-502-24 FL	XG-502-24
1"	.028-.030"	1"	2"	5"	XG-502-32 FL	XG-502-32

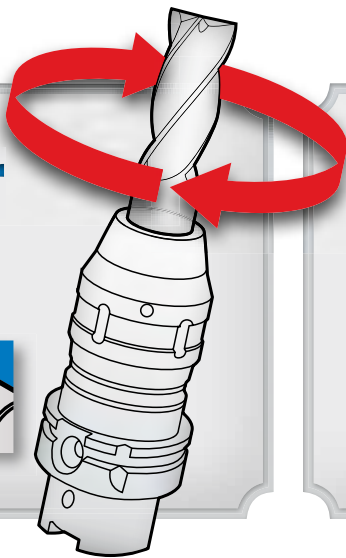
## MXG-502 Metric 5 Flute Standard Length **METRIC**

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AITiN Coated	Tool Number No Flats, AITiN Coated
6mm	.50-.55mm	6mm	14mm	57mm	—	MXG-502-06
8mm	.55-.60mm	8mm	16mm	63mm	—	MXG-502-08
10mm	.60-.65mm	10mm	20mm	72mm	—	MXG-502-10
12mm	.65-.70mm	12mm	25mm	83mm	—	MXG-502-12
16mm	.70-.75mm	16mm	32mm	92mm	—	MXG-502-16
20mm	.90-1.0mm	20mm	38mm	104mm	—	MXG-502-20

NOTE: Metric tools do not have flats.

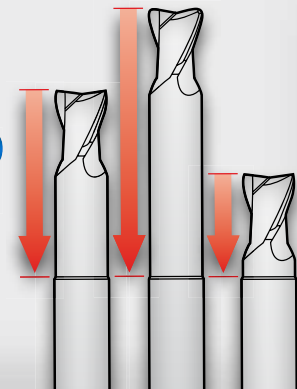
## Tool Holder Slippage?

Add Flats! Use shrink fit or equivalent gripping force. If not, use flats.



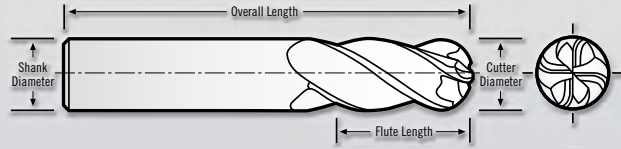
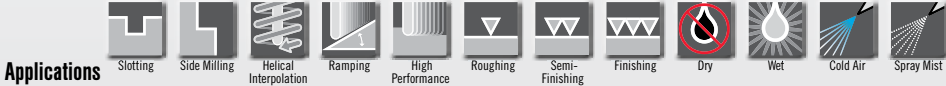
## Need Reach?

See End Mill Modifications (page 7)

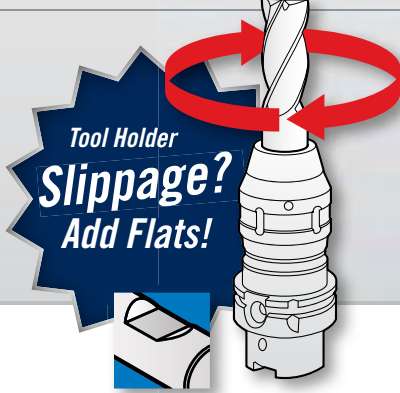


# XG/MXG Tuffy Grade Carbide End Mills

Steel & Hi-Temp Alloys



**XG-BN Tolerances**  
 Cutting Dia. =  $-.001/-0.002$ "  
 LOC =  $+.060/-0.000$ "  
 Shank Dia. =  $-.0001/-0.0002$ "  
 OAL =  $+/-0.060$ "



Add Flats for High Torque Cuts!

## XG-402BN 4 Flute Ball End Standard Length

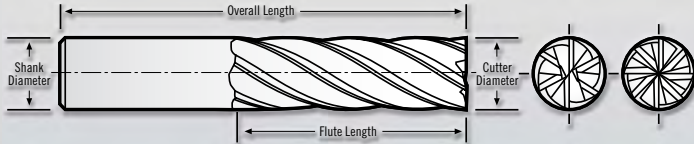
Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AlTiN Coated	Tool Number No Flats, AlTiN Coated
1/4"	—	1/4"	3/4"	2-1/2"	XG-402-08BN FL	XG-402-08BN
5/16"	—	5/16"	13/16"	2-1/2"	XG-402-10BN FL	XG-402-10BN
3/8"	—	3/8"	7/8"	2-1/2"	XG-402-12BN FL	XG-402-12BN
1/2"	—	1/2"	1"	3"	XG-402-16BN FL	XG-402-16BN
5/8"	—	5/8"	1-1/4"	3-1/2"	XG-402-20BN FL	XG-402-20BN
3/4"	—	3/4"	1-1/2"	4"	XG-402-24BN FL	XG-402-24BN
1"	—	1"	2"	5"	XG-402-32BN FL	XG-402-32BN

## MXG-402BN Metric 4 Flute Ball End Standard Length METRIC

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AlTiN Coated	Tool Number No Flats, AlTiN Coated
6mm	—	6mm	14mm	57mm	—	MXG-402-06BN
8mm	—	8mm	16mm	63mm	—	MXG-402-08BN
10mm	—	10mm	20mm	72mm	—	MXG-402-10BN
12mm	—	12mm	25mm	83mm	—	MXG-402-12BN
16mm	—	16mm	32mm	92mm	—	MXG-402-16BN
20mm	—	20mm	38mm	104mm	—	MXG-402-20BN

NOTE: Metric tools do not have flats.

# Tuffy Grade Carbide End Mills **XF/MXF**



**XF Tolerances**  
 Cutting Dia. =  $-.001/-0.002$ "  
 LOC =  $+0.060/-0.000$ "  
 Shank Dia. =  $-.0001/-0.0002$ "  
 OAL =  $+/-0.060$ "

**MXF Tolerances**  
 Cutting Dia. =  $-.025/-0.050$ mm  
 LOC =  $+0.500/+1.500$ mm  
 Shank Dia. =  $-.002/-0.005$ mm  
 OAL =  $\pm 1.000$ mm

Steel & Hi-Temp Alloys



## XF-602/802 6/8 Flute Standard Length

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AITiN Coated	Tool Number No Flats, AITiN Coated
3/8"	0.030"	3/8"	7/8"	2-1/2"	XF-602-12-030 FL	XF-602-12-030
3/8"	0.060"	3/8"	7/8"	2-1/2"	XF-602-12-060 FL	XF-602-12-060
3/8"	0.090"	3/8"	7/8"	2-1/2"	XF-602-12-090 FL	XF-602-12-090
1/2"	0.030"	1/2"	1"	3"	XF-602-16-030 FL	XF-602-16-030
1/2"	0.060"	1/2"	1"	3"	XF-602-16-060 FL	XF-602-16-060
1/2"	0.090"	1/2"	1"	3"	XF-602-16-090 FL	XF-602-16-090
1/2"	0.120"	1/2"	1"	3"	XF-602-16-120 FL	XF-602-16-120
5/8"	0.030"	5/8"	1-1/4"	3-1/2"	XF-602-20-030 FL	XF-602-20-030
5/8"	0.060"	5/8"	1-1/4"	3-1/2"	XF-602-20-060 FL	XF-602-20-060
5/8"	0.090"	5/8"	1-1/4"	3-1/2"	XF-602-20-090 FL	XF-602-20-090
5/8"	0.120"	5/8"	1-1/4"	3-1/2"	XF-602-20-120 FL	XF-602-20-120
3/4"	0.060"	3/4"	1-1/2"	4"	XF-802-24-060 FL	XF-802-24-060
3/4"	0.090"	3/4"	1-1/2"	4"	XF-802-24-090 FL	XF-802-24-090
3/4"	0.120"	3/4"	1-1/2"	4"	XF-802-24-120 FL	XF-802-24-120
1"	0.060"	1"	2"	5"	XF-802-32-060 FL	XF-802-32-060
1"	0.090"	1"	2"	5"	XF-802-32-090 FL	XF-802-32-090
1"	0.120"	1"	2"	5"	XF-802-32-120 FL	XF-802-32-120



[www.youtube.com/RobblackCorp](http://www.youtube.com/RobblackCorp)  
 or  
[www.robblack.com/videos](http://www.robblack.com/videos)

## MXF-602/802 6/8 Flute Standard Length **METRIC**

Cutting Diameter	Corner Radius	Shank Diameter	Flute Length	Overall Length	Tool Number Flats, AITiN Coated	Tool Number No Flats, AITiN Coated
10mm	2.0mm	10mm	20mm	72mm	—	MXF-602-10-020
10mm	2.5mm	10mm	20mm	72mm	—	MXF-602-10-025
10mm	3.0mm	10mm	20mm	72mm	—	MXF-602-10-030
12mm	2.0mm	12mm	25mm	83mm	—	MXF-602-12-020
12mm	2.5mm	12mm	25mm	83mm	—	MXF-602-12-025
12mm	3.0mm	12mm	25mm	83mm	—	MXF-602-12-030
16mm	2.0mm	16mm	32mm	92mm	—	MXF-602-16-020
16mm	2.5mm	16mm	32mm	92mm	—	MXF-602-16-025
16mm	3.0mm	16mm	32mm	92mm	—	MXF-602-16-030
20mm	2.0mm	20mm	38mm	104mm	—	MXF-802-20-020
20mm	2.5mm	20mm	38mm	104mm	—	MXF-802-20-025
20mm	3.0mm	20mm	38mm	104mm	—	MXF-802-20-030
25mm	2.0mm	25mm	38mm	104mm	—	MXF-802-25-020
25mm	2.5mm	25mm	38mm	104mm	—	MXF-802-25-025
25mm	3.0mm	25mm	38mm	104mm	—	MXF-802-25-030

NOTE: Metric tools do not have flats.

# XG/MXG Speed & Feed



## XG SERIES SPEED & FEED

Material	Surface Feet	1/4"		5/16"		3/8"		1/2"		5/8"		3/4"		1"	
		RPM	in/min	RPM	in/min	RPM	in/min	RPM	in/min	RPM	in/min	RPM	in/min	RPM	in/min
<b>CAST IRON</b>															
Ductile	400	6112	28	4890	34	4075	39	3056	43	2445	39	2037	34	1528	30
Gray	525	8022	42	6418	51	5348	58	4011	64	3209	58	2674	51	2006	45
<b>INCONEL</b>															
625/718	100	1528	4	1222	5	1019	6	764	7	611	6	509	5	382	5
<b>STEEL</b>															
1018/1020	500	7640	32	6112	39	5093	44	3820	49	3056	44	2547	39	1910	34
4130	400	6112	20	4890	24	4075	28	3056	31	2445	28	2037	24	1528	21
4140	400	6112	20	4890	24	4075	28	3056	31	2445	28	2037	24	1528	21
4340	415	6341	21	5073	25	4227	29	3171	32	2536	29	2114	25	1585	22
<b>STAINLESS STEEL</b>															
303	550	8404	31	6723	38	5603	43	4202	48	3362	43	2801	38	2101	34
304	400	6112	17	4890	22	4075	24	3056	27	2445	24	2037	22	1528	19
316	400	6112	17	4890	22	4075	24	3056	27	2445	24	2037	22	1528	19
15-5/17-4	300	4584	13	3667	16	3056	18	2292	20	1834	18	1528	16	1146	14
13-8	300	4584	13	3667	16	3056	18	2292	20	1834	18	1528	16	1146	14
440C	300	4584	13	3667	16	3056	18	2292	20	1834	18	1528	16	1146	14
<b>TOOL STEEL (ANNEALED)</b>															
A2	400	6112	17	4890	22	4075	24	3056	27	2445	24	2037	22	1528	19
D2	360	5501	16	4401	19	3667	22	2750	24	2200	22	1834	19	1375	17
H13	400	6112	17	4890	22	4075	24	3056	27	2445	24	2037	22	1528	19
P20	400	6112	23	4890	28	4075	31	3056	35	2445	31	2037	28	1528	24
<b>TITANIUM</b>															
Com. pure	300	4584	17	3667	21	3056	24	2292	26	1834	24	1528	21	1146	18
6AL-4V	200	3056	9	2445	11	2037	12	1528	13	1222	12	1019	11	764	9
6AL-6V	175	2674	8	2139	9	1783	11	1337	12	1070	11	891	9	669	8

## MXG SERIES SPEED & FEED METRIC

Material	Surface Meters	6 mm		8 mm		10 mm		12 mm		16 mm		20 mm	
		RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min
<b>CAST IRON</b>													
Ductile	122	6475	706	4851	869	3881	978	3235	1087	2426	978	1941	869
Gray	160	8498	1060	6367	1304	5094	1467	4245	1630	3184	1467	2547	1304
<b>INCONEL</b>													
625/718	30	1619	108	1213	134	970	150	809	167	606	150	485	134
<b>STEEL</b>													
1018/1020	152	8093	807	6063	994	4851	1118	4043	1242	3032	1118	2426	994
4130	122	6475	505	4851	621	3881	699	3235	776	2426	699	1941	621
4140	122	6475	505	4851	621	3881	699	3235	776	2426	699	1941	621
4340	126	6717	523	5033	644	4027	725	3356	805	2517	725	2013	644
<b>STAINLESS STEEL</b>													
303	168	8903	791	6670	973	5337	1095	4448	1217	3335	1095	2668	973
304	122	6475	444	4851	546	3881	615	3235	683	2426	615	1941	546
316	122	6475	444	4851	546	3881	615	3235	683	2426	615	1941	546
15-5/17-4	91	4856	333	3638	410	2911	461	2426	512	1819	461	1455	410
13-8	91	4856	333	3638	410	2911	461	2426	512	1819	461	1455	410
440C	91	4856	333	3638	410	2911	461	2426	512	1819	461	1455	410

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# Speed & Feed **MXG/XF**

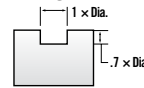
## MXG SERIES SPEED & FEED METRIC —CONTINUED FROM PREVIOUS

Material	Surface Meters	6 mm		8 mm		10 mm		12 mm		16 mm		20 mm	
		RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min
<b>TOOL STEEL (ANNEALED)</b>													
A2	122	6475	444	4851	546	3881	615	3235	683	2426	615	1941	546
D2	110	5827	400	4366	492	3493	553	2911	615	2183	553	1747	492
H13	122	6475	444	4851	546	3881	615	3235	683	2426	615	1941	546
P20	122	6475	575	4851	708	3881	796	3235	885	2426	796	1941	708
<b>TITANIUM</b>													
Com. pure	91	4856	431	3638	531	2911	597	2426	664	1819	597	1455	531
6AL-4V	61	3237	222	2425	273	1941	307	1617	342	1213	307	970	273
6AL-6V	53	2833	194	2122	239	1698	269	1415	299	1061	269	849	239

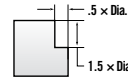
### General Guidelines

- Speed and feeds are based on applications with very rigid machine tools, toolholders, and fixturing. Speeds and feeds will vary dramatically depending on the application. Extreme forces can be generated and can cause damage, if not appropriate for the cutting conditions.
- Helical interpolation or ramping should be used to enter pockets.
- For the highest material removal rates and longest tool life profile milling is preferred over slotting (See diagrams at right).
- Use shrink fit or equivalent tool holder. If not, use flats to eliminate slippage in the tool holder!
- Climb milling is recommended.
- For ball end tools reduce feed rate by 10%.

#### Slotting



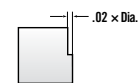
#### Profiling



## XF SERIES SPEED & FEED

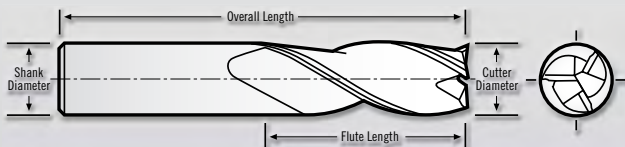
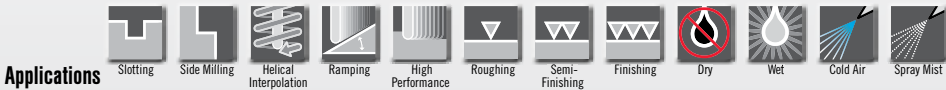
Material	Surface Feet	3/8"		1/2"		5/8"		3/4"		1"	
		RPM	in/min	RPM	in/min	RPM	in/min	RPM	in/min	RPM	in/min
<b>CAST IRON</b>											
Ductile	400	4075	58	3056	64	2445	58	2037	68	1528	60
Gray	525	5348	86	4011	96	3209	86	2674	102	2006	90
<b>INCONEL</b>											
625/718	150	1528	12	1146	14	917	12	764	16	573	14
<b>STEEL</b>											
1018/1020	500	5093	62	3820	68	3056	62	2547	74	1910	32
4130	400	4075	42	3056	46	2445	42	2037	48	1528	42
4140	400	4075	42	3056	46	2445	42	2037	48	1528	42
4340	415	4227	42	3171	48	2536	42	2114	50	1585	44
<b>STAINLESS STEEL</b>											
303	550	5603	62	4202	68	3362	62	2801	72	2101	64
304	400	4075	36	3056	40	2445	36	2037	44	1528	38
316	400	4075	36	3056	40	2445	36	2037	44	1528	38
15-5/17-4	300	3056	28	2292	30	1834	28	1528	32	1146	28
13-8	300	3056	28	2292	30	1834	28	1528	32	1146	28
440C	300	3056	28	2292	30	1834	28	1528	32	1146	28
<b>TOOL STEEL (ANNEALED)</b>											
A2	400	4075	36	3056	40	2445	36	2037	44	1528	38
D2	360	3667	32	2750	36	2200	32	1834	38	1375	34
H13	400	4075	36	3056	40	2445	36	2037	44	1528	38
P20	400	4075	44	3056	50	2445	44	2037	52	1528	46
<b>TITANIUM</b>											
Com. pure	300	3056	34	2292	38	1834	34	1528	40	1146	34
6AL-4V	380	3871	42	2903	48	2323	42	1935	50	1452	44
6AL-6V	175	1783	20	1337	22	1070	20	891	24	669	20

#### Finish Profiling



# ST/MST Super Tuffy Grade Carbide End Mills

Steel & Hi-Temp Alloys



**ST-341 and ST-343 Tolerances**  
 Cutting Dia. (1/8" to 1/4") = +.000/- .002"  
 (5/16" to 3/4") = +.000/- .003"  
 LOC (1/8" to 5/16") = +.030/- .000"  
 (3/8" to 3/4") = +.060/- .000"  
 Shank Dia. = -.0001/- .0002"  
 OAL = ±.060"

**MST-341 Tolerances**  
 Cutting Dia. = +.000/- .075mm  
 Shank Dia. = -.002/- .005mm  
 OAL = ±1.000mm  
 LOC = +0.500/+1.500mm



## ST-341 3 Flute Super Tuffy Carbide Stub Length

Cutting Diameter	Shank Diameter	Flute Length	Corner Break Size	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/4"	.003"/.005"	1-1/2"	ST-341-04	ST-341-04 T	ST-341-04 C	ST-341-04 A
3/16"	3/16"	3/8"	.003"/.005"	2"	ST-341-06	ST-341-06 T	ST-341-06 C	ST-341-06 A
1/4"	1/4"	1/2"	.003"/.005"	2-1/2"	ST-341-08	ST-341-08 T	ST-341-08 C	ST-341-08 A
5/16"	5/16"	1/2"	.004"/.006"	2-1/2"	ST-341-10	ST-341-10 T	ST-341-10 C	ST-341-10 A
3/8"	3/8"	5/8"	.005"/.007"	2-1/2"	ST-341-12	ST-341-12 T	ST-341-12 C	ST-341-12 A
1/2"	1/2"	5/8"	.006"/.009"	3"	ST-341-16	ST-341-16 T	ST-341-16 C	ST-341-16 A
5/8"	5/8"	3/4"	.009"/.011"	3-1/2"	ST-341-20	ST-341-20 T	ST-341-20 C	ST-341-20 A
3/4"	3/4"	1"	.011"/.014"	4"	ST-341-24	ST-341-24 T	ST-341-24 C	ST-341-24 A

## MST-341 Metric 3 Flute Super Tuffy Carbide Stub Length METRIC

Cutting Diameter	Shank Diameter	Flute Length	Corner Break Size	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3mm	3mm	6mm	.075/.125mm	38mm	MST-341-03	MST-341-03 T	MST-341-03 C	MST-341-03 A
4mm	4mm	8mm	.075/.125mm	50mm	MST-341-04	MST-341-04 T	MST-341-04 C	MST-341-04 A
5mm	5mm	8mm	.075/.125mm	50mm	MST-341-05	MST-341-05 T	MST-341-05 C	MST-341-05 A
6mm	6mm	8mm	.075/.125mm	57mm	MST-341-06	MST-341-06 T	MST-341-06 C	MST-341-06 A
8mm	8mm	12mm	.100/.150mm	63mm	MST-341-08	MST-341-08 T	MST-341-08 C	MST-341-08 A
10mm	10mm	14mm	.125/.175mm	72mm	MST-341-10	MST-341-10 T	MST-341-10 C	MST-341-10 A
12mm	12mm	16mm	.150/.130mm	83mm	MST-341-12	MST-341-12 T	MST-341-12 C	MST-341-12 A
16mm	16mm	20mm	.230/.280mm	92mm	MST-341-16	MST-341-16 T	MST-341-16 C	MST-341-16 A
20mm	20mm	25mm	.280/.360mm	104mm	MST-341-20	MST-341-20 T	MST-341-20 C	MST-341-20 A



# Super Tuffy Grade Carbide End Mills **ST**

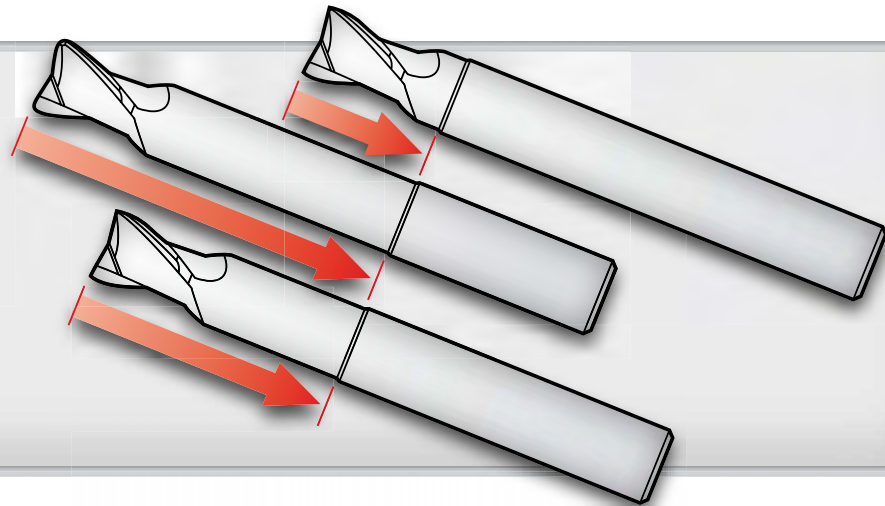


## ST-343 3 Flute Super Tuffy Carbide Standard Length

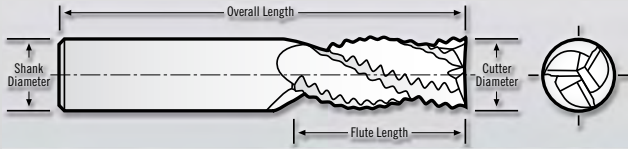
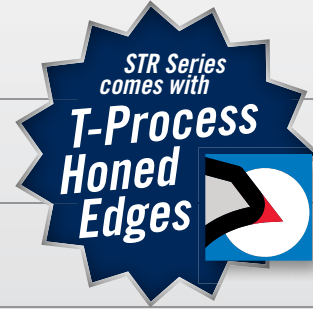
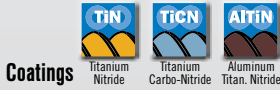
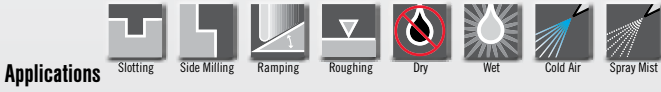
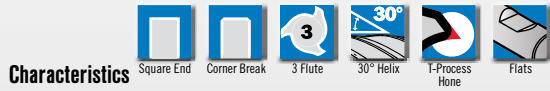
Cutting Diameter	Shank Diameter	Flute Length	Corner Break Size	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/2"	.003"/.005"	1-1/2"	ST-343-04	ST-343-04 T	ST-343-04 C	ST-343-04 A
3/16"	3/16"	5/8"	.003"/.005"	2"	ST-343-06	ST-343-06 T	ST-343-06 C	ST-343-06 A
1/4"	1/4"	3/4"	.003"/.005"	2-1/2"	ST-343-08	ST-343-08 T	ST-343-08 C	ST-343-08 A
5/16"	5/16"	13/16"	.004"/.006"	2-1/2"	ST-343-10	ST-343-10 T	ST-343-10 C	ST-343-10 A
3/8"	3/8"	7/8"	.005"/.007"	2-1/2"	ST-343-12	ST-343-12 T	ST-343-12 C	ST-343-12 A
1/2"	1/2"	1"	.006"/.009"	3"	ST-343-16	ST-343-16 T	ST-343-16 C	ST-343-16 A
5/8"	5/8"	1-1/4"	.009"/.011"	3-1/2"	ST-343-20	ST-343-20 T	ST-343-20 C	ST-343-20 A
3/4"	3/4"	1-1/2"	.011"/.014"	4"	ST-343-24	ST-343-24 T	ST-343-24 C	ST-343-24 A

## Need Reach?

See End Mill Modifications (page 7)



# STR/MSTR 3 Flute Super Tuffy Grade Carbide Ruffers



**STR Series Tolerances**  
 Cutting Dia. =  $-.003/-0.007$ "  
 LOC (1/4" to 5/16") =  $+0.030/-0.000$ "  
 (3/8" to 3/4") =  $+0.060/-0.000$ "  
 Shank Dia. =  $-.0001/-0.0002$ "  
 OAL =  $\pm 0.060$ "

**MSTR Tolerances**  
 Cutting Dia. =  $-.075/-0.180$ mm  
 Shank Dia. =  $-.002/-0.005$ mm  
 OAL =  $\pm 1.000$ mm  
 LOC =  $+0.500/+1.500$ mm



## STR-301 3 Flute Super Tuffy Carbide Ruffer Stub Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/4"	1/4"	1/2"	2-1/2"	STR-301-08*	STR-301-08 T*	STR-301-08 C*	STR-301-08 A*
5/16"	5/16"	1/2"	2-1/2"	STR-301-10*	STR-301-10 T*	STR-301-10 C*	STR-301-10 A*
3/8"	3/8"	5/8"	2-1/2"	STR-301-12	STR-301-12 T	STR-301-12 C	STR-301-12 A
7/16"	7/16"	5/8"	2-3/4"	STR-301-14*	STR-301-14 T*	STR-301-14 C*	STR-301-14 A*
1/2"	1/2"	5/8"	3"	STR-301-16	STR-301-16 T	STR-301-16 C	STR-301-16 A
5/8"	5/8"	7/8"	3-1/2"	STR-301-20	STR-301-20 T	STR-301-20 C	STR-301-20 A
3/4"	3/4"	1"	4"	STR-301-24	STR-301-24 T	STR-301-24 C	STR-301-24 A

\*Does not come with flats.

## MSTR-301 Metric 3 Flute Super Tuffy Carbide Ruffer Stub Length **METRIC**

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
6mm	6mm	8mm	57mm	MSTR-301-06	MSTR-301-06 T	MSTR-301-06 C	MSTR-301-06 A
8mm	8mm	12mm	63mm	MSTR-301-08	MSTR-301-08 T	MSTR-301-08 C	MSTR-301-08 A
10mm	10mm	14mm	72mm	MSTR-301-10	MSTR-301-10 T	MSTR-301-10 C	MSTR-301-10 A
12mm	12mm	16mm	83mm	MSTR-301-12	MSTR-301-12 T	MSTR-301-12 C	MSTR-301-12 A
16mm	16mm	20mm	92mm	MSTR-301-16	MSTR-301-16 T	MSTR-301-16 C	MSTR-301-16 A
20mm	20mm	25mm	104mm	MSTR-301-20	MSTR-301-20 T	MSTR-301-20 C	MSTR-301-20 A

NOTE: Metric tools do not have flats.

# 3 Flute Super Tuff Grade Carbide Ruffers **STR/MSTR**



## STR-303 3 Flute Super Tuff Carbide Ruffer Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/4"	1/4"	3/4"	2-1/2"	STR-303-08*	STR-303-08 T*	STR-303-08 C*	STR-303-08 A*
9/32"	5/16"	3/4"	2-1/2"	STR-303-09*	STR-303-09 T*	STR-303-09 C*	STR-303-09 A*
5/16"	5/16"	13/16"	2-1/2"	STR-303-10*	STR-303-10 T*	STR-303-10 C*	STR-303-10 A*
3/8"	3/8"	7/8"	2-1/2"	STR-303-12	STR-303-12 T	STR-303-12 C	STR-303-12 A
7/16"	7/16"	1"	2-3/4"	STR-303-14*	STR-303-14 T*	STR-303-14 C*	STR-303-14 A*
1/2"	1/2"	1"	3"	STR-303-16	STR-303-16 T	STR-303-16 C	STR-303-16 A
9/16"	9/16"	1-1/4"	3-1/2"	STR-303-18*	STR-303-18 T*	STR-303-18 C*	STR-303-18 A*
5/8"	5/8"	1-1/4"	3-1/2"	STR-303-20	STR-303-20 T	STR-303-20 C	STR-303-20 A
3/4"	3/4"	1-1/2"	4"	STR-303-24	STR-303-24 T	STR-303-24 C	STR-303-24 A
1"	1"	2-1/2"	5"	STR-303-32	STR-303-32 T	STR-303-32 C	STR-303-32 A

\*Does not come with flats.

## MSTR-303 Metric 3 Flute Super Tuff Carbide Ruffer Standard Length **METRIC**

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
6mm	6mm	14mm	57mm	MSTR-303-06	MSTR-303-06 T	MSTR-303-06 C	MSTR-303-06 A
8mm	8mm	16mm	63mm	MSTR-303-08	MSTR-303-08 T	MSTR-303-08 C	MSTR-303-08 A
10mm	10mm	20mm	72mm	MSTR-303-10	MSTR-303-10 T	MSTR-303-10 C	MSTR-303-10 A
12mm	12mm	25mm	83mm	MSTR-303-12	MSTR-303-12 T	MSTR-303-12 C	MSTR-303-12 A
16mm	16mm	32mm	92mm	MSTR-303-16	MSTR-303-16 T	MSTR-303-16 C	MSTR-303-16 A
20mm	20mm	38mm	104mm	MSTR-303-20	MSTR-303-20 T	MSTR-303-20 C	MSTR-303-20 A

NOTE: Metric tools do not have flats.

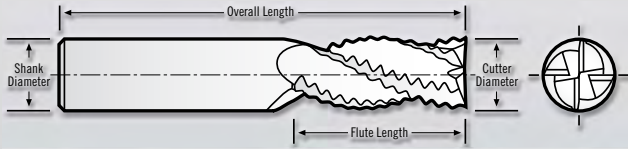
## Need Without Flats?

Order any tool without flats by adding "NF" to end of Tool Number!

NOTE: Metric sizes do not come with flats.



# STR/MSTR 4 Flute Super Tuffy Grade Carbide Ruffers



**STR Series Tolerances**  
 Cutting Dia. =  $-.003/-0.007$   
 LOC (1/4" to 5/16") =  $+.030/-0.000$   
 (3/8" to 3/4") =  $+.060/-0.000$   
 Shank Dia. =  $-.0001/-0.0002$   
 OAL =  $\pm 0.060$ "

**MSTR Tolerances**  
 Cutting Dia. =  $-.075/-0.180$ mm  
 Shank Dia. =  $-.002/-0.005$ mm  
 OAL =  $\pm 1.000$ mm  
 LOC =  $+0.500/+1.500$ mm



## STR-401 4 Flute Super Tuffy Carbide Ruffer Stub Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/4"	1/4"	1/2"	2-1/2"	STR-401-08*	STR-401-08 T*	STR-401-08 C*	STR-401-08 A*
5/16"	5/16"	1/2"	2-1/2"	STR-401-10*	STR-401-10 T*	STR-401-10 C*	STR-401-10 A*
3/8"	3/8"	5/8"	2-1/2"	STR-401-12	STR-401-12 T	STR-401-12 C	STR-401-12 A
7/16"	7/16"	5/8"	2-3/4"	STR-401-14*	STR-401-14 T*	STR-401-14 C*	STR-401-14 A*
1/2"	1/2"	5/8"	3"	STR-401-16	STR-401-16 T	STR-401-16 C	STR-401-16 A
5/8"	5/8"	7/8"	3-1/2"	STR-401-20	STR-401-20 T	STR-401-20 C	STR-401-20 A
3/4"	3/4"	1"	4"	STR-401-24	STR-401-24 T	STR-401-24 C	STR-401-24 A
1"	1"	1-1/2"	5"	STR-401-32	STR-401-32 T	STR-401-32 C	STR-401-32 A

\*Does not come with flats.

## MSTR-401 Metric 4 Flute Super Tuffy Carbide Ruffer Stub Length METRIC

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
6mm	6mm	8mm	57mm	MSTR-401-06	MSTR-401-06 T	MSTR-401-06 C	MSTR-401-06 A
8mm	8mm	12mm	63mm	MSTR-401-08	MSTR-401-08 T	MSTR-401-08 C	MSTR-401-08 A
10mm	10mm	14mm	72mm	MSTR-401-10	MSTR-401-10 T	MSTR-401-10 C	MSTR-401-10 A
12mm	12mm	16mm	83mm	MSTR-401-12	MSTR-401-12 T	MSTR-401-12 C	MSTR-401-12 A
16mm	16mm	20mm	92mm	MSTR-401-16	MSTR-401-16 T	MSTR-401-16 C	MSTR-401-16 A
20mm	20mm	25mm	104mm	MSTR-401-20	MSTR-401-16 T	MSTR-401-16 C	MSTR-401-16 A

NOTE: Metric tools do not have flats.

# 4 Flute Super Tuffy Grade Carbide Ruffers **STR/MSTR**



## STR-404 4 Flute Super Tuffy Carbide Ruffer Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/4"	1/4"	3/4"	2-1/2"	STR-404-08*	STR-404-08 T*	STR-404-08 C*	STR-404-08 A*
9/32"	5/16"	3/4"	2-1/2"	STR-404-09*	STR-404-09 T*	STR-404-09 C*	STR-404-09 A*
5/16"	5/16"	13/16"	2-1/2"	STR-404-10*	STR-404-10 T*	STR-404-10 C*	STR-404-10 A*
3/8"	3/8"	7/8"	2-1/2"	STR-404-12	STR-404-12 T	STR-404-12 C	STR-404-12 A
7/16"	7/16"	1"	2-3/4"	STR-404-14*	STR-404-14 T*	STR-404-14 C*	STR-404-14 A*
1/2"	1/2"	1"	3"	STR-404-16	STR-404-16 T	STR-404-16 C	STR-404-16 A
9/16"	9/16"	1-1/4"	3-1/2"	STR-404-18*	STR-404-18 T*	STR-404-18 C*	STR-404-18 A*
5/8"	5/8"	1-1/4"	3-1/2"	STR-404-20	STR-404-20 T	STR-404-20 C	STR-404-20 A
3/4"	3/4"	1-1/2"	4"	STR-404-24	STR-404-24 T	STR-404-24 C	STR-404-24 A
1"	1"	2-1/2"	5"	STR-404-32	STR-404-32 T	STR-404-32 C	STR-404-32 A

\*Does not come with flats.

## MSTR-404 Metric 4 Flute Super Tuffy Carbide Ruffer Standard Length **METRIC**

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
6mm	6mm	14mm	57mm	MSTR-404-06	MSTR-404-06 T	MSTR-404-06 C	MSTR-404-06 A
8mm	8mm	16mm	63mm	MSTR-404-08	MSTR-404-08 T	MSTR-404-08 C	MSTR-404-08 A
10mm	10mm	20mm	72mm	MSTR-404-10	MSTR-404-10 T	MSTR-404-10 C	MSTR-404-10 A
12mm	12mm	25mm	83mm	MSTR-404-12	MSTR-404-12 T	MSTR-404-12 C	MSTR-404-12 A
16mm	16mm	32mm	92mm	MSTR-404-16	MSTR-404-16 T	MSTR-404-16 C	MSTR-404-16 A
20mm	20mm	38mm	104mm	MSTR-404-20	MSTR-404-20 T	MSTR-404-20 C	MSTR-404-20 A

NOTE: Metric tools do not have flats.

## Need Without Flats?

Order any tool without flats by adding "NF" to end of Tool Number!

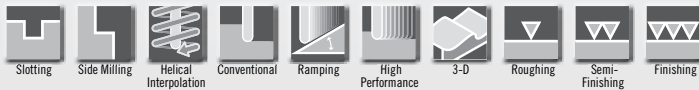
NOTE: Metric sizes do not come with flats.



# B 3 Flute Tuffy Grade Carbide Ball End Mills



Characteristics



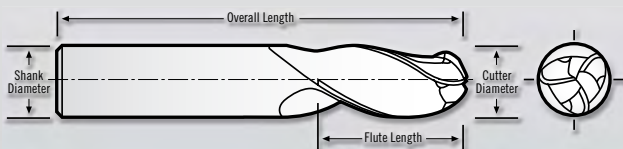
Applications



Materials



Coatings



### B Series Tolerances

Cutting Dia. (1/16" to 1/4") =  $+0.00/-0.002$ "  
 (9/32" to 3/4") =  $+0.00/-0.003$ "  
 Shank Dia. =  $-0.0001/-0.0002$ "  
 LOC (1/16" to 5/16") =  $+0.030/-0.000$ "  
 (3/8" to 1") =  $+0.060/-0.000$ "  
 OAL =  $\pm 0.060$ "

Steel & Hi-Temp Alloys



## B-300 3 Flute Tuffy Ball End Stub Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/4"	1-1/2"	B-300-04	B-300-04T	B-300-04C	B-300-04A
3/16"	3/16"	5/16"	2"	B-300-06	B-300-06T	B-300-06C	B-300-06A
1/4"	1/4"	5/16"	2-1/2"	B-300-08	B-300-08T	B-300-08C	B-300-08A
5/16"	5/16"	7/16"	2-1/2"	B-300-10	B-300-10T	B-300-10C	B-300-10A
3/8"	3/8"	1/2"	2-1/2"	B-300-12	B-300-12T	B-300-12C	B-300-12A
1/2"	1/2"	5/8"	3"	B-300-16	B-300-16T	B-300-16C	B-300-16A
5/8"	5/8"	7/8"	3-1/2"	B-300-20	B-300-20T	B-300-20C	B-300-20A
3/4"	3/4"	1"	4"	B-300-24	B-300-24T	B-300-24C	B-300-24A

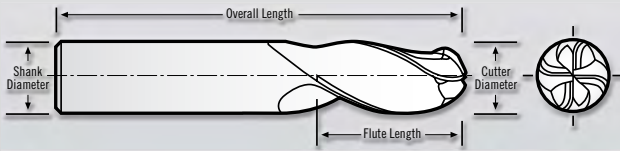
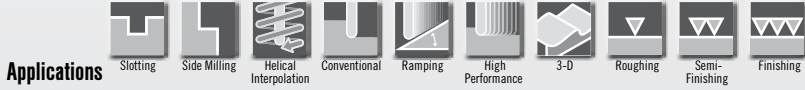


## B-330 3 Flute Tuffy Ball End Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/2"	1-1/2"	B-330-04	B-330-04T	B-330-04C	B-330-04A
3/16"	3/16"	5/8"	2"	B-330-06	B-330-06T	B-330-06C	B-330-06A
1/4"	1/4"	3/4"	2-1/2"	B-330-08	B-330-08T	B-330-08C	B-330-08A
5/16"	5/16"	13/16"	2-1/2"	B-330-10	B-330-10T	B-330-10C	B-330-10A
3/8"	3/8"	7/8"	2-1/2"	B-330-12	B-330-12T	B-330-12C	B-330-12A
1/2"	1/2"	1"	3"	B-330-16	B-330-16T	B-330-16C	B-330-16A
5/8"	5/8"	1-1/4"	3-1/2"	B-330-20	B-330-20T	B-330-20C	B-330-20A
3/4"	3/4"	1-1/2"	4"	B-330-24	B-330-24T	B-330-24C	B-330-24A



# 4 Flute Tuffy Grade Carbide Ball End Mills **B/MB**



### B Series Tolerances

Cutting Dia. (1/16" to 1/4") = +.000/- .002"  
 (9/32" to 3/4") = +.000/- .003"  
 LOC (1/16" to 5/16") = +.030/- .000"  
 (3/8" to 1") = +.060/- .000"  
 Shank Dia. = -.0001/- .0002"  
 OAL = ±.060"

### MB Tolerances

Cutting Dia. = +.000/- .075mm  
 Shank Dia. = -.002/- .005mm  
 OAL = ±1.000mm  
 LOC = +0.500/+1.500mm



## B-440 4 Flute Tuffy Ball End Standard Length 40° Helix

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/2"	1-1/2"	B-440-04	B-440-04T	B-440-04C	B-440-04A
3/16"	3/16"	5/8"	2"	B-440-06	B-440-06T	B-440-06C	B-440-06A
1/4"	1/4"	3/4"	2-1/2"	B-440-08	B-440-08T	B-440-08C	B-440-08A
5/16"	5/16"	13/16"	2-1/2"	B-440-10	B-440-10T	B-440-10C	B-440-10A
3/8"	3/8"	7/8"	2-1/2"	B-440-12	B-440-12T	B-440-12C	B-440-12A
1/2"	1/2"	1"	3"	B-440-16	B-440-16T	B-440-16C	B-440-16A
5/8"	5/8"	1-1/4"	3-1/2"	B-440-20	B-440-20T	B-440-20C	B-440-20A
3/4"	3/4"	1-1/2"	4"	B-440-24	B-440-24T	B-440-24C	B-440-24A

## MB-440 Metric 4 Flute Tuffy Ball End Standard Length 40° Helix METRIC

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3mm	3mm	12mm	38mm	MB-440-03	MB-440-03 T	MB-440-03 C	MB-440-03 A
4mm	4mm	12mm	50mm	MB-440-04	MB-440-04 T	MB-440-04 C	MB-440-04 A
5mm	5mm	14mm	50mm	MB-440-05	MB-440-05 T	MB-440-05 C	MB-440-05 A
6mm	6mm	14mm	57mm	MB-440-06	MB-440-06 T	MB-440-06 C	MB-440-06 A
8mm	8mm	16mm	63mm	MB-440-08	MB-440-08 T	MB-440-08 C	MB-440-08 A
10mm	10mm	20mm	72mm	MB-440-10	MB-440-10 T	MB-440-10 C	MB-440-10 A
12mm	12mm	25mm	83mm	MB-440-12	MB-440-12 T	MB-440-12 C	MB-440-12 A
16mm	16mm	32mm	92mm	MB-440-16	MB-440-16 T	MB-440-16 C	MB-440-16 A
20mm	20mm	38mm	104mm	MB-440-20	MB-440-20 T	MB-440-20 C	MB-440-20 A

# ST/MST 3 Flute Super Tuffy Grade Carbide End Mills



Characteristics



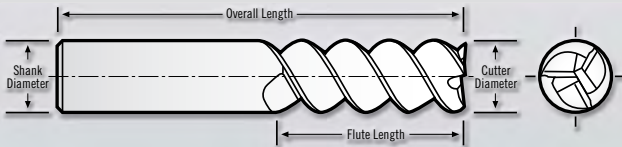
Applications



Materials



Coatings



### ST-360 Tolerances

Cutting Dia. =  $+0.000/-0.003$ "  
 Shank Dia. =  $-0.0001/-0.0002$ "  
 LOC (1/8" to 1/4") =  $+0.030/-0.002$ "  
 (5/16" to 3/4") =  $+0.060/-0.003$ "  
 OAL =  $\pm 0.060$ "

### MST-360 Tolerances

Cutting Dia. =  $+0.000/-0.075$ mm  
 Shank Dia. =  $-0.002/-0.005$ mm  
 LOC =  $+0.500/+1.500$ mm  
 OAL =  $\pm 1.000$ mm



## ST-360 3 Flute Super Tuffy Carbide Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/2"	1-1/2"	ST-360-04	ST-360-04 T	ST-360-04 C	ST-360-04 A
3/16"	3/16"	5/8"	2"	ST-360-06	ST-360-06 T	ST-360-06 C	ST-360-06 A
1/4"	1/4"	3/4"	2-1/2"	ST-360-08	ST-360-08 T	ST-360-08 C	ST-360-08 A
5/16"	5/16"	13/16"	2-1/2"	ST-360-10	ST-360-10 T	ST-360-10 C	ST-360-10 A
3/8"	3/8"	7/8"	2-1/2"	ST-360-12	ST-360-12 T	ST-360-12 C	ST-360-12 A
7/16"	7/16"	1"	2-3/4"	ST-360-14	ST-360-14 T	ST-360-14 C	ST-360-14 A
1/2"	1/2"	1"	3"	ST-360-16	ST-360-16 T	ST-360-16 C	ST-360-16 A
9/16"	9/16"	1-1/4"	3-1/2"	ST-360-18	ST-360-18 T	ST-360-18 C	ST-360-18 A
5/8"	5/8"	1-1/4"	3-1/2"	ST-360-20	ST-360-20 T	ST-360-20 C	ST-360-20 A
3/4"	3/4"	1-1/2"	4"	ST-360-24	ST-360-24 T	ST-360-24 C	ST-360-24 A

## MST-360 Metric 3 Flute Super Tuffy Carbide Standard Length METRIC

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3mm	3mm	12mm	38mm	MST-360-03	MST-360-03 T	MST-360-03 C	MST-360-03 A
4mm	4mm	12mm	50mm	MST-360-04	MST-360-04 T	MST-360-04 C	MST-360-04 A
5mm	5mm	14mm	50mm	MST-360-05	MST-360-05 T	MST-360-05 C	MST-360-05 A
6mm	6mm	14mm	57mm	MST-360-06	MST-360-06 T	MST-360-06 C	MST-360-06 A
8mm	8mm	16mm	63mm	MST-360-08	MST-360-08 T	MST-360-08 C	MST-360-08 A
10mm	10mm	20mm	72mm	MST-360-10	MST-360-10 T	MST-360-10 C	MST-360-10 A
12mm	12mm	25mm	83mm	MST-360-12	MST-360-12 T	MST-360-12 C	MST-360-12 A
16mm	16mm	32mm	92mm	MST-360-16	MST-360-16 T	MST-360-16 C	MST-360-16 A
20mm	20mm	38mm	104mm	MST-360-20	MST-360-20 T	MST-360-20 C	MST-360-20 A

# 6 Flute Super Tuffy Grade Carbide End Mills **ST/MST**



**Characteristics**



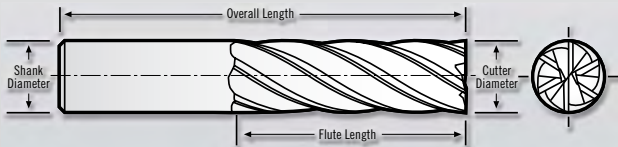
**Applications**



**Materials**



**Coatings**



**ST-630/ST-646 Tolerances**  
 Cutting Dia. = +.001/- .000"  
 Shank Dia. = -.0001/- .0002"  
 LOC = +.060/- .000"  
 OAL = ±.060"

**MST-646 Tolerances**  
 Cutting Dia. = +.025/- .000mm  
 Shank Dia. = -.002/- .005mm  
 LOC = +0.500/+1.500mm  
 OAL = ±1.000mm



## ST-646 6 Flute Super Tuffy Carbide Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Corner Radius	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3/8"	3/8"	7/8"	.005"/.007"	2-1/2"	ST-646-12	ST-646-12 T	ST-646-12 C	ST-646-12 A
1/2"	1/2"	1"	.006"/.009"	3"	ST-646-16	ST-646-16 T	ST-646-16 C	ST-646-16 A
5/8"	5/8"	1-1/4"	.009"/.011"	3-1/2"	ST-646-20	ST-646-20 T	ST-646-20 C	ST-646-20 A
3/4"	3/4"	1-1/2"	.011"/.014"	4"	ST-646-24	ST-646-24 T	ST-646-24 C	ST-646-24 A
1"	1"	2-1/2"	.012"/.015"	5"	ST-646-32	ST-646-32 T	ST-646-32 C	ST-646-32 A

## MST-646 Metric 6 Flute Super Tuffy Carbide Standard Length **METRIC**

Cutting Diameter	Shank Diameter	Flute Length	Corner Radius	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
10mm	10mm	20mm	.125/.180mm	72mm	MST-646-10	MST-646-10 T	MST-646-10 C	MST-646-10 A
12mm	12mm	25mm	.150/.230mm	83mm	MST-646-12	MST-646-12 T	MST-646-12 C	MST-646-12 A
16mm	16mm	32mm	.230/.280mm	92mm	MST-646-16	MST-646-16 T	MST-646-16 C	MST-646-16 A
20mm	20mm	38mm	.280/.355mm	104mm	MST-646-20	MST-646-20 T	MST-646-20 C	MST-646-20 A



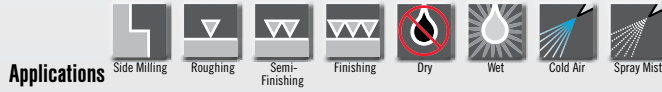
## ST-630 6 Flute Super Tuffy Carbide Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3/8"	3/8"	7/8"	2-1/2"	ST-630-12	ST-630-12 T	ST-630-12 C	ST-630-12 A
1/2"	1/2"	1"	3"	ST-630-16	ST-630-16 T	ST-630-16 C	ST-630-16 A
5/8"	5/8"	1-1/4"	3-1/2"	ST-630-20	ST-630-20 T	ST-630-20 C	ST-630-20 A
3/4"	3/4"	1-1/2"	4"	ST-630-24	ST-630-24 T	ST-630-24 C	ST-630-24 A
1"	1"	2-1/2"	5"	ST-630-32	ST-630-32 T	ST-630-32 C	ST-630-32 A

# ST/MST 4 Flute Super Tuffy Grade Carbide End Mills



Characteristics



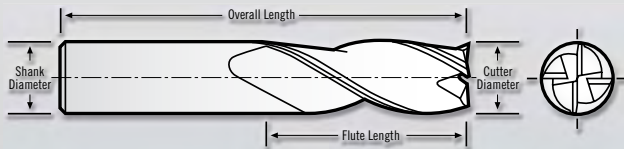
Applications



Materials



Coatings



### ST-430/434 Tolerances

Cutting Dia. =  $+0.001/-0.000$ "  
 Shank Dia. =  $-0.0001/-0.0002$ "  
 LOC (1/8" to 5/16") =  $+0.030/-0.000$ "  
 (3/8" to 1") =  $+0.060/-0.000$ "  
 OAL =  $\pm 0.060$ "

### MST-430 and MST-434 Tolerances

Cutting Dia. =  $+0.025/-0.000$ mm  
 Shank Dia. =  $-0.002/-0.005$ mm  
 LOC =  $+0.500/+1.500$ mm  
 OAL =  $\pm 1.000$ mm



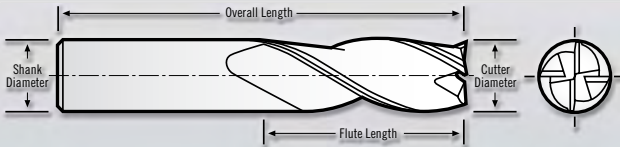
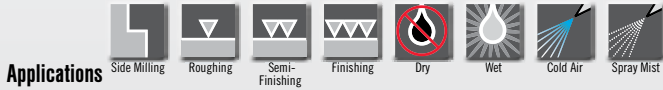
## ST-430 4 Flute Super Tuffy Carbide Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/2"	1-1/2"	ST-430-04	ST-430-04 T	ST-430-04 C	ST-430-04 A
5/32"	3/16"	9/16"	2"	ST-430-05	ST-430-05 T	ST-430-05 C	ST-430-05 A
3/16"	3/16"	5/8"	2"	ST-430-06	ST-430-06 T	ST-430-06 C	ST-430-06 A
7/32"	1/4"	5/8"	2-1/2"	ST-430-07	ST-430-07 T	ST-430-07 C	ST-430-07 A
1/4"	1/4"	3/4"	2-1/2"	ST-430-08	ST-430-08 T	ST-430-08 C	ST-430-08 A
9/32"	5/16"	3/4"	2-1/2"	ST-430-09	ST-430-09 T	ST-430-09 C	ST-430-09 A
5/16"	5/16"	13/16"	2-1/2"	ST-430-10	ST-430-10 T	ST-430-10 C	ST-430-10 A
3/8"	3/8"	7/8"	2-1/2"	ST-430-12	ST-430-12 T	ST-430-12 C	ST-430-12 A
7/16"	7/16"	1"	2-3/4"	ST-430-14	ST-430-14 T	ST-430-14 C	ST-430-14 A
1/2"	1/2"	1"	3"	ST-430-16	ST-430-16 T	ST-430-16 C	ST-430-16 A
9/16"	9/16"	1-1/4"	3-1/2"	ST-430-18	ST-430-18 T	ST-430-18 C	ST-430-18 A
5/8"	5/8"	1-1/4"	3-1/2"	ST-430-20	ST-430-20 T	ST-430-20 C	ST-430-20 A
3/4"	3/4"	1-1/2"	4"	ST-430-24	ST-430-24 T	ST-430-24 C	ST-430-24 A

## MST-430 Metric 4 Flute Super Tuffy Carbide Standard Length METRIC

Cutting Diameter	Shank Diameter	Flute Length	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3mm	3mm	12mm	38mm	MST-430-03	MST-430-03 T	MST-430-03 C	MST-430-03 A
4mm	4mm	12mm	50mm	MST-430-04	MST-430-04 T	MST-430-04 C	MST-430-04 A
5mm	5mm	14mm	50mm	MST-430-05	MST-430-05 T	MST-430-05 C	MST-430-05 A
6mm	6mm	14mm	57mm	MST-430-06	MST-430-06 T	MST-430-06 C	MST-430-06 A
8mm	8mm	16mm	63mm	MST-430-08	MST-430-08 T	MST-430-08 C	MST-430-08 A
10mm	10mm	20mm	72mm	MST-430-10	MST-430-10 T	MST-430-10 C	MST-430-10 A
12mm	12mm	25mm	83mm	MST-430-12	MST-430-12 T	MST-430-12 C	MST-430-12 A
16mm	16mm	32mm	92mm	MST-430-16	MST-430-16 T	MST-430-16 C	MST-430-16 A
20mm	20mm	38mm	104mm	MST-430-20	MST-430-20 T	MST-430-20 C	MST-430-20 A

# 4 Flute Super Tuffy Grade Carbide End Mills **ST/MST**



**ST-430/434 Tolerances**

Cutting Dia. =  $+0.001/-0.000$ "  
 Shank Dia. =  $-0.0001/-0.0002$ "  
 LOC (1/8" to 5/16") =  $+0.030/-0.000$ "  
 (3/8" to 1") =  $+0.060/-0.000$ "  
 OAL =  $\pm 0.060$ "

**MST-430 and MST-434 Tolerances**

Cutting Dia. =  $+0.025/-0.000$ mm  
 Shank Dia. =  $-0.002/-0.005$ mm  
 LOC =  $+0.500/+1.500$ mm  
 OAL =  $\pm 1.000$ mm



## ST-434 4 Flute Super Tuffy Carbide Standard Length

Cutting Diameter	Shank Diameter	Flute Length	Corner Break Size	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
1/8"	1/8"	1/2"	.003"/.005"	1-1/2"	ST-434-04	ST-434-04 T	ST-434-04 C	ST-434-04 A
3/16"	3/16"	5/8"	.003"/.005"	2"	ST-434-06	ST-434-06 T	ST-434-06 C	ST-434-06 A
1/4"	1/4"	3/4"	.003"/.005"	2-1/2"	ST-434-08	ST-434-08 T	ST-434-08 C	ST-434-08 A
5/16"	5/16"	13/16"	.004"/.006"	2-1/2"	ST-434-10	ST-434-10 T	ST-434-10 C	ST-434-10 A
3/8"	3/8"	7/8"	.005"/.007"	2-1/2"	ST-434-12	ST-434-12 T	ST-434-12 C	ST-434-12 A
1/2"	1/2"	1"	.006"/.009"	3"	ST-434-16	ST-434-16 T	ST-434-16 C	ST-434-16 A
5/8"	5/8"	1-1/4"	.009"/.011"	3-1/2"	ST-434-20	ST-434-20 T	ST-434-20 C	ST-434-20 A
3/4"	3/4"	1-1/2"	.011"/.014"	4"	ST-434-24	ST-434-24 T	ST-434-24 C	ST-434-24 A

## MST-434 Metric 4 Flute Super Tuffy Carbide Standard Length **METRIC**

Cutting Diameter	Shank Diameter	Flute Length	Corner Break Size	Overall Length	Tool Number Uncoated	Tool Number TiN Coated	Tool Number TiCN Coated	Tool Number AlTiN Coated
3mm	3mm	12mm	.075/.125mm	38mm	MST-434-03	MST-434-03 T	MST-434-03 C	MST-434-03 A
4mm	4mm	12mm	.075/.125mm	50mm	MST-434-04	MST-434-04 T	MST-434-04 C	MST-434-04 A
5mm	5mm	14mm	.075/.125mm	50mm	MST-434-05	MST-434-05 T	MST-434-05 C	MST-434-05 A
6mm	6mm	14mm	.075/.125mm	57mm	MST-434-06	MST-434-06 T	MST-434-06 C	MST-434-06 A
8mm	8mm	16mm	.100/.150mm	63mm	MST-434-08	MST-434-08 T	MST-434-08 C	MST-434-08 A
10mm	10mm	20mm	.125/.175mm	72mm	MST-434-10	MST-434-10 T	MST-434-10 C	MST-434-10 A
12mm	12mm	25mm	.150/.130mm	83mm	MST-434-12	MST-434-12 T	MST-434-12 C	MST-434-12 A
16mm	16mm	32mm	.230/.280mm	92mm	MST-434-16	MST-434-16 T	MST-434-16 C	MST-434-16 A
20mm	20mm	38mm	.280/.360mm	104mm	MST-434-20	MST-434-20 T	MST-434-20 C	MST-434-20 A

# Hi-Temp Alloys Tools in Other Sections

## **TS / MTS** **201/301/401**

(See Multiple Applications)



**94**

## **TR** **303/404/606**

(See Multiple Applications)



**96**

## **MINIATURES**

(See Miniatures Applications)



**77**

## **SAWS**

(See Saws Applications)



**108**



TOOLS FOR

# Composites & Plastics