

PREMIUM ROTARY CUTTING TOOLS

RobbJack



Applications Guide – 2014

ALUMINUM

TITANIUM, STEEL &
HIGH-TEMP ALLOYS

COMPOSITES

DIE/MOLD & HARDENED
MATERIALS

MINIATURES

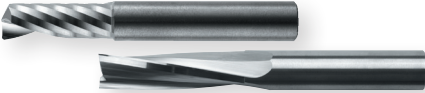
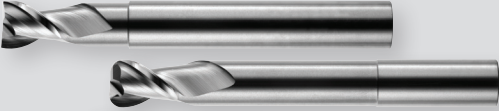
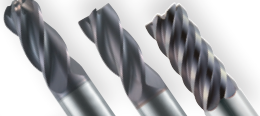
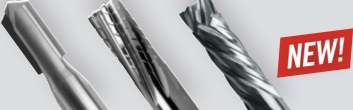
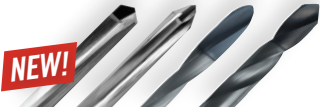
MULTIPLE APPLICATIONS

SAWS

WOOD & PLASTICS



RobbJack's got the **Solution** for Your Next Machining Project

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	= Steel and High-Temp Alloys		= Multiple Applications
	= Die Mold		= Saws
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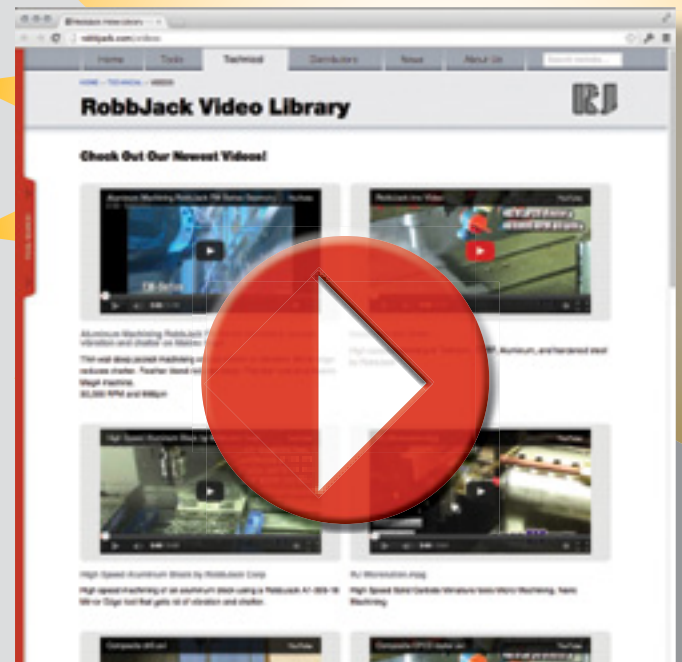
End Mill General Speeds & Feeds/Formulas

Material	SFM Surface Feet/Minute	SMM Surface Meters/Minute	Chip Load per Tooth
Aluminum / Non-Ferrous			
Ferrous			
2024	Max RPM	Max RPM	tool diameter x .0256
6061 (T1-T3)	Max RPM	Max RPM	tool diameter x .0128
6061 (T4-T6)	Max RPM	Max RPM	tool diameter x .0256
7075	Max RPM	Max RPM	tool diameter x .0256
Non-Ferrous			
Brass	750	230	tool diameter x .0128
Copper	600	190	tool diameter x .0128
Magnesium	Max RPM	Max RPM	tool diameter x .0256
Titanium, Steel and High-Temp Alloys			
Titanium			
Commercially Pure	350	100	tool diameter x .0048
6AL-4V	230	55	tool diameter x .0048
6AL-6V	180	35	tool diameter x .004
Steel			
1018-1020	350	110	tool diameter x .0064
4130	260	80	tool diameter x .0032
4140	220	70	tool diameter x .0032
4340	280	90	tool diameter x .0032
Tool Steel Annealed			
A2	350	110	tool diameter x .0032
D2	260	80	tool diameter x .0032
H13	230	70	tool diameter x .0032
P20	350	110	tool diameter x .00496
Stainless Steel			
303	500	150	tool diameter x .0048
304	225	70	tool diameter x .0032
316	240	75	tool diameter x .0032
15-5/17-4 PH	200	60	tool diameter x .0032
440C	200	60	tool diameter x .0032
Inconel			
625 / 718	100	30	tool diameter x .0036
Composites			
G10 Fiberglass/Polyester	1000	300	tool diameter x .0136
Graphite	1000	300	tool diameter x .0256
Graphite Fiber/Epoxy	800	250	tool diameter x .008
Plastics	1300	400	tool diameter x .0256
Die/Mold			
See Die/Mold section			
Other Material Applications			
Cast Iron			
Ductile Iron	350	110	tool diameter x .0096
Gray Cast Iron	500	150	tool diameter x .0128

INCH SIZES		
Surface Feet per Minute	=	$RPM \times .262 \times \text{Tool Diameter}$
RPM	=	$\frac{\text{Surface Feet per Minute} \times 3.82}{\text{Tool Diameter}}$
Feedrate (in/min.)	=	$RPM \times \text{Chip Load per Tooth} \times \text{Number of Flutes}$
in ³ /min	=	$\text{Width} \times \text{Depth} \times \text{Inches per Minute}$
Horsepower	=	$1.341 \times \text{kW}$
kW	=	$.7457 \times \text{Horsepower}$
METRIC SIZES		
Surface Meters per Minute	=	$RPM \times .00314 \times \text{Tool Diameter}$
RPM	=	$\frac{\text{Surface Meters per Minute} \times 318.057}{\text{Tool Diameter}}$
Feedrate (mm/min.)	=	$RPM \times \text{Chip Load per Tooth} \times \text{Number of Flutes}$
cm ³ /min	=	$\frac{\text{Width (mm)} \times \text{Depth (mm)} \times \text{Feedrate (mm/min)}}{1000}$
Horsepower	=	$1.341 \times \text{kW}$
kW	=	$.7457 \times \text{Horsepower}$



See RobbJack Videos at
www.robjack.com/videos





Specific End Mill Speeds & Feeds

A1-201 SPEEDS & FEEDS

Tool Diameter	Aluminum 6061-T6, 7075, 2024		Brass		Copper		Plastic		Magnesium	
	RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT
1/8"	Max	0.0032"	22900	0.0016"	18300	0.0016"	39700	0.0032"	Max	0.0032"
3/16"	Max	0.0048"	15300	0.0024"	12200	0.0024"	26500	0.0048"	Max	0.0048"
1/4"	Max	0.0064"	11500	0.0032"	9200	0.0032"	19900	0.0064"	Max	0.0064"
5/16"	Max	0.0080"	9200	0.0040"	7300	0.0040"	15900	0.0080"	Max	0.0080"
3/8"	Max	0.0096"	7600	0.0048"	6100	0.0048"	13200	0.0096"	Max	0.0096"
1/2"	Max	0.0128"	5700	0.0064"	4600	0.0064"	9900	0.0128"	Max	0.0128"
5/8"	Max	0.0160"	4600	0.0080"	3700	0.0080"	7900	0.0160"	Max	0.0160"
3/4"	Max	0.0192"	3800	0.0096"	3100	0.0096"	6600	0.0192"	Max	0.0192"
1"	Max	0.0256"	2900	0.0128"	2300	0.0128"	5000	0.0256"	Max	0.0256"

Axial depth of cut up to $1 \times$ diameter of the tool

MA1-201 SPEEDS & FEEDS METRIC

Tool Diameter	Aluminum 6061-T6, 7075, 2024		Brass		Copper		Plastic		Magnesium	
	RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT
3mm	Max	0.077mm	24300	0.038mm	19400	0.038mm	42000	0.077mm	Max	0.077mm
4mm	Max	0.102mm	18200	0.051mm	14600	0.051mm	31500	0.102mm	Max	0.102mm
5mm	Max	0.128mm	14600	0.064mm	11600	0.064mm	25200	0.128mm	Max	0.128mm
6mm	Max	0.154mm	12100	0.077mm	9700	0.077mm	21000	0.154mm	Max	0.154mm
8mm	Max	0.205mm	9100	0.102mm	7300	0.102mm	15800	0.205mm	Max	0.205mm
10mm	Max	0.256mm	7300	0.128mm	5800	0.128mm	12600	0.256mm	Max	0.256mm
12mm	Max	0.307mm	6100	0.154mm	4900	0.154mm	10500	0.307mm	Max	0.307mm
16mm	Max	0.410mm	4500	0.205mm	3600	0.205mm	7900	0.410mm	Max	0.410mm
20mm	Max	0.512mm	3600	0.256mm	2900	0.256mm	6300	0.512mm	Max	0.512mm

Axial depth of cut up to $1 \times$ diameter of the tool



A1-303 SPEEDS & FEEDS

Tool Diameter	Aluminum 6061-T6		Aluminum 6061-T3		Aluminum 7075		Aluminum 2024	
	RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT
1/8"	Max	0.0020"	Max	0.0018"	Max	0.0020"	Max	0.0020"
3/16"	Max	0.0030"	Max	0.0026"	Max	0.0030"	Max	0.0030"
1/4"	Max	0.0040"	Max	0.0035"	Max	0.0040"	Max	0.0040"
5/16"	Max	0.0050"	Max	0.0044"	Max	0.0050"	Max	0.0050"
3/8"	Max	0.0060"	Max	0.0053"	Max	0.0060"	Max	0.0060"
1/2"	Max	0.0080"	Max	0.0070"	Max	0.0080"	Max	0.0080"
5/8"	Max	0.0100"	Max	0.0088"	Max	0.0100"	Max	0.0100"
3/4"	Max	0.0120"	Max	0.0105"	Max	0.0120"	Max	0.0120"
1"	Max	0.0160"	Max	0.0140"	Max	0.0160"	Max	0.0160"

Axial depth of cut up to $1.5 \times$ diameter of the tool with 50% radial step over.

MA1-303 SPEEDS & FEEDS METRIC

Tool Diameter	Aluminum 6061-T6		Aluminum 6061-T3		Aluminum 7075		Aluminum 2024	
	RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT
3mm	Max	0.048mm	Max	0.042mm	Max	0.048mm	Max	0.048mm
4mm	Max	0.064mm	Max	0.056mm	Max	0.064mm	Max	0.064mm
5mm	Max	0.080mm	Max	0.070mm	Max	0.080mm	Max	0.080mm
6mm	Max	0.096mm	Max	0.084mm	Max	0.096mm	Max	0.096mm
8mm	Max	0.128mm	Max	0.112mm	Max	0.128mm	Max	0.128mm
10mm	Max	0.160mm	Max	0.140mm	Max	0.160mm	Max	0.160mm
12mm	Max	0.192mm	Max	0.168mm	Max	0.192mm	Max	0.192mm
16mm	Max	0.256mm	Max	0.224mm	Max	0.256mm	Max	0.256mm
20mm	Max	0.320mm	Max	0.280mm	Max	0.320mm	Max	0.320mm

Axial depth of cut up to $1.5 \times$ diameter of the tool with 50% radial step over.

Specific End Mill Speeds & Feeds



FM SERIES SPEEDS & FEEDS

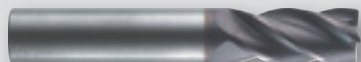
Tool Dia.	Typical Z-Depth	Aluminum 6061-T6		Aluminum 6061-T3		Aluminum 7075		Aluminum 2024	
		RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT
1/4"	0.1500"	Max	0.0040"	Max	0.0035"	Max	0.0040"	Max	0.0040"
5/16"	0.1500"	Max	0.0050"	Max	0.0044"	Max	0.0050"	Max	0.0050"
3/8"	0.1875"	Max	0.0060"	Max	0.0053"	Max	0.0060"	Max	0.0060"
1/2"	0.2000"	Max	0.0080"	Max	0.0070"	Max	0.0080"	Max	0.0080"
5/8"	0.2000"	Max	0.0100"	Max	0.0088"	Max	0.0100"	Max	0.0100"
3/4"	0.2500"	Max	0.0120"	Max	0.0105"	Max	0.0120"	Max	0.0120"
1"	0.2500"	Max	0.0160"	Max	0.0140"	Max	0.0160"	Max	0.0160"

Z-Depth of cut per pass should be deeper than the corner radius to help reduce chatter

MFM SERIES SPEEDS & FEEDS **METRIC**

Tool Dia.	Typical Z-Depth	Aluminum 6061-T6		Aluminum 6061-T3		Aluminum 7075		Aluminum 2024	
		RPM	CLPT	RPM	CLPT	RPM	CLPT	RPM	CLPT
6mm	4mm	Max	0.096mm	Max	0.084mm	Max	0.096mm	Max	0.096mm
8mm	4mm	Max	0.128mm	Max	0.112mm	Max	0.128mm	Max	0.128mm
10mm	5mm	Max	0.16mm	Max	0.14mm	Max	0.16mm	Max	0.16mm
12mm	5mm	Max	0.192mm	Max	0.168mm	Max	0.192mm	Max	0.192mm
16mm	5mm	Max	0.256mm	Max	0.224mm	Max	0.256mm	Max	0.256mm
20mm	6.5mm	Max	0.32mm	Max	0.28mm	Max	0.32mm	Max	0.32mm
25mm	6.5mm	Max	0.4mm	Max	0.35mm	Max	0.4mm	Max	0.4mm

Z-Depth of cut per pass should be deeper than the corner radius to help reduce chatter



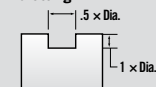
NS SERIES SPEEDS & FEEDS

Material	Surface Footage	3/16"		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	RPM	in/min
CAST IRON																	
Ductile	400	8149	20	6112	20	4890	24	4075	28	3056	31	2445	28	2037	24	1528	21
Gray	525	10696	42	8022	42	6418	51	5348	58	4011	64	3209	58	2674	51	2006	45
STEEL																	
1018/1020	500	10187	32	7640	32	6112	39	5093	44	3820	49	3056	44	2547	39	1910	34
4130	400	8149	20	6112	20	4890	24	4075	28	3056	31	2445	28	2037	24	1528	21
4140	400	8149	20	6112	20	4890	24	4075	28	3056	31	2445	28	2037	24	1528	21
4340	415	8455	21	6341	21	5073	25	4227	29	3171	32	2536	29	2114	25	1585	22
TOOL STEEL (ANNEALED)																	
A2	400	8149	17	6112	17	4890	22	4075	24	3056	27	2445	24	2037	22	1528	19
D2	360	7334	16	5501	16	4401	19	3667	22	2750	24	2200	22	1834	19	1375	17
H13	400	8149	17	6112	17	4890	22	4075	24	3056	27	2445	24	2037	22	1528	19
P20	400	8149	23	6112	23	4890	28	4075	31	3056	35	2445	31	2037	28	1528	24

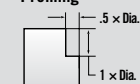
Speeds and feeds are based on applications with very rigid machine tools, toolholders, and fixturing. Speeds and feeds will vary dramatically depending on the application. Extreme forces can be generated and can cause damage, if not appropriate for the cutting conditions.

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 below)

Slotting



Profiling



MNS SERIES SPEEDS & FEEDS **METRIC**

Material	Surface Meters/min	6mm		8mm		10mm		12mm		16mm		20mm		25mm	
		RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min	RPM	mm/min
CAST IRON															
Ductile	400	6475	505	4851	505	3881	621	3234	699	2426	776	1941	699	1552	543
Gray	525	8498	1060	6367	1060	5094	1304	4245	1467	3184	1630	2547	1467	2038	1141
STEEL															
1018/1020	500	8093	807	6064	807	4851	994	4043	1118	3032	1242	2426	1118	1941	869
4130	400	6475	505	4851	505	3881	621	3234	699	2426	776	1941	699	1552	543
4140	400	6475	505	4851	505	3881	621	3234	699	2426	776	1941	699	1552	543
4340	415	6717	523	5033	523	4027	644	3356	725	2517	805	2013	725	1611	564
TOOL STEEL (ANNEALED)															
A2	400	6475	444	4851	444	3881	546	3234	615	2426	683	1941	615	1552	478
D2	360	5827	400	4366	400	3493	492	2911	553	2183	615	1747	553	1397	430
H13	400	6475	444	4851	444	3881	546	3234	615	2426	683	1941	615	1552	478
P20	400	6475	575	4851	575	3881	708	3234	796	2426	885	1941	796	1552	619



XG-402 SPEEDS & FEEDS

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
CAST IRON															
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
INCONEL															
625/718	100	1528	4	1222	5	1019	6	764	7	611	6	509	5	382	5
STEEL															
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

CONTINUED ON NEXT PAGE—

Specific End Mill Speeds & Feeds

—CONTINUED FROM PREVIOUS PAGE



XG-402 SPEEDS & FEEDS

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
STAINLESS STEEL															
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
TOOL STEEL (ANNEALED)															
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
TITANIUM															
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-402 SPEEDS & FEEDS 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
CAST IRON													
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
INCONEL													
625/718	30	1619	108	1213	134	970	150	809	167	606	150	485	134
STEEL													
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
STAINLESS STEEL													
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
TOOL STEEL (ANNEALED)													
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
TITANIUM													
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

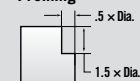
General Guidelines for XG-402 and MXG-402

- Speeds 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.

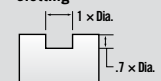
- Helical interpolation or ramping should be used to enter pockets.
- For the highest material removal rates and longest tool life profile milling is preferred over slotting (See diagrams at right).

- 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%.

Profiling



Slotting



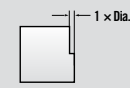
Specific End Mill Speeds & Feeds



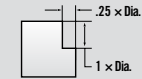
XG-502 AND XF SERIES SPEEDS & FEEDS

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
CAST IRON											
Ductile	400	4075	58	3056	64	2445	58	2037	68	1528	60
Gray	525	5348	86	4011	96	3209	86	2674	102	2006	90
INCONEL											
625/718	150	1528	12	1146	14	917	12	764	16	573	14
STEEL											
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
STAINLESS STEEL											
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
TOOL STEEL (ANNEALED)											
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
TITANIUM											
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

XF Finish Profiling



XG-502 Profiling



DM SERIES SPEEDS & FEEDS (Chipload per Tooth)

Tool Number	Cutter Diameter	Steels 30-40 HRc		Steels 40-50 HRc		Steels 50-60 HRc	
		ROUGHING	FINISHING	ROUGHING	FINISHING	ROUGHING	FINISHING
DM-201-01	1/32"	0.0006-0.0008	0.0005-0.0006	0.0005-0.0006	0.0004-0.0005	0.0004-0.0005	0.0003-0.0004
DM-201-02	1/16"	0.0013-0.0015	0.0010-0.0013	0.0010-0.0013	0.0008-0.0010	0.0008-0.0010	0.0005-0.0008
DM-201-03	3/32"	0.0019-0.0023	0.0015-0.0019	0.0015-0.0019	0.0011-0.0015	0.0011-0.0015	0.0008-0.0011
DM-201-04	1/8"	0.0025-0.0030	0.0020-0.0025	0.0020-0.0025	0.0015-0.0020	0.0015-0.0020	0.0010-0.0015
DM-201-06	3/16"	0.0038-0.0045	0.0030-0.0038	0.0030-0.0038	0.0023-0.0030	0.0023-0.0030	0.0015-0.0023
DM-201-08	1/4"	0.0050-0.0060	0.0040-0.0050	0.0040-0.0050	0.0030-0.0040	0.0030-0.0040	0.0020-0.0030
DM-201-10	5/16"	0.0063-0.0075	0.0050-0.0063	0.0050-0.0063	0.0038-0.0050	0.0038-0.0050	0.0025-0.0038
DM-201-12	3/8"	0.0075-0.0090	0.0060-0.0075	0.0060-0.0075	0.0045-0.0060	0.0045-0.0060	0.0030-0.0045
DM-201-14	7/16"	0.0088-0.0105	0.0070-0.0088	0.0070-0.0088	0.0053-0.0070	0.0053-0.0070	0.0035-0.0053
DM-201-16	1/2"	0.0100-0.0120	0.0080-0.0100	0.0080-0.0100	0.0060-0.0080	0.0060-0.0080	0.0040-0.0060



DM SERIES SPEEDS & FEEDS (Roughing & Semi-Finishing)

Tool Number	Cutter Diameter	Rotations Per Minute (RPM)		
		STEELS 30-40HRc	STEELS 40-50HRc	STEELS 50-60HRc
DM-201-01	1/32"	20,000-40,000	20,000-40,000	20,000-40,000
DM-201-02	1/16"	20,000-40,000	20,000-40,000	20,000-36,000
DM-201-03	3/32"	20,000-32,000	20,000-32,000	16,000-24,000
DM-201-04	1/8"	15,000-24,000	18,000-24,000	12,000-18,000
DM-201-06	3/16"	10,000-16,000	12,000-16,000	8,100-12,000
DM-201-08	1/4"	7,600-12,000	9,100-12,000	6,100-9,100
DM-201-10	5/16"	6,000-9,700	7,300-9,700	4,800-7,300
DM-201-12	3/8"	5,000-8,100	6,100-8,100	4,000-6,100
DM-201-14	7/16"	4,300-6,900	5,200-6,900	3,400-5,200
DM-201-16	1/2"	3,800-6,100	4,500-6,100	3,000-4,500

DM Series Guidelines

- Special diameters and lengths are available on a make-to-order basis.
- Air or mist coolant on materials greater than 40 HRc.

Radial Step Over



Roughing or Semi-Finishing
25%-40% of tool diameter

Radial Step Over for finishing depends on finish requirements.

Specific End Mill Speeds & Feeds



DM SERIES SPEEDS & FEEDS (Finishing)

Tool Number	Cutter Diameter	Rotations Per Minute (RPM)		
		STEELS 30–40HRc	STEELS 40–50HRc	STEELS 50–60HRc
DM-201-01	1/32"	20,000–40,000	20,000–40,000	20,000–40,000
DM-201-02	1/16"	20,000–40,000	20,000–40,000	20,000–36,000
DM-201-03	3/32"	20,000–32,000	20,000–32,000	16,000–24,000
DM-201-04	1/8"	15,000–24,000	18,000–24,000	12,000–18,000
DM-201-06	3/16"	10,000–16,000	12,000–16,000	8,100–12,000
DM-201-08	1/4"	7,600–12,000	9,100–12,000	6,100–9,100
DM-201-10	5/16"	6,000–9,700	7,300–9,700	4,800–7,300
DM-201-12	3/8"	5,000–8,100	6,100–8,100	4,000–6,100
DM-201-14	7/16"	4,300–6,900	5,200–6,900	3,400–5,200
DM-201-16	1/2"	3,800–6,100	4,500–6,100	3,000–4,500

Axial Depth



30–40 HRc Axial depth = 10% of tool diameter
 40–50 HRc Axial depth = 5% of tool diameter
 50–60 HRc Axial depth = 4% of tool diameter



TM SERIES SPEEDS & FEEDS (Semi-Finishing & Finishing)

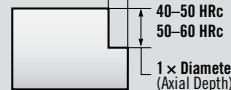
Tool Number	Cutter Diameter	Steels 30–40 HRc		Steels 40–50 HRc		Steels 50–60 HRc	
		ROUGHING	FINISHING	ROUGHING	FINISHING	ROUGHING	FINISHING
TM-201-01	1/32"	34,000–40,000	0.0001–0.00025	26,000–30,000	0.0001–0.0002	16,000–18,000	0.0001–0.0002
TM-201-02	1/16"	34,000–40,000	0.0003–0.0005	25,000–30,000	0.0003–0.0005	16,000–18,000	0.0002–0.0004
TM-201-03	3/32"	22,000–26,000	0.0006–0.00075	16,000–19,000	0.0005–0.0007	10,000–12,000	0.0005–0.0006
TM-201-04	1/8"	17,000–20,000	0.0008–0.001	13,000–17,000	0.0007–0.0009	8,000–13,000	0.0006–0.0008
TM-201-06	3/16"	12,000–14,000	0.0011–0.0015	9,000–12,000	0.0001–0.0014	5,300–9,000	0.0009–0.0012
TM-201-08	1/4"	9,000–10,400	0.0015–0.002	7,000–9,000	0.0014–0.0018	4,000–6,600	0.0012–0.0016
TM-201-10	5/16"	7,200–8,300	0.0019–0.0025	5,500–7,200	0.0017–0.0023	3,200–5,400	0.0015–0.0020
TM-201-12	3/8"	6,000–6,900	0.0020–0.003	4,600–6,000	0.0018–0.0027	2,700–4,500	0.0016–0.0024
TM-201-14	7/16"	5,200–6,000	0.0023–0.0035	4,000–5,200	0.0021–0.0032	2,300–3,900	0.0019–0.0028
TM-201-16	1/2"	4,500–5,200	0.0025–0.004	3,500–4,500	0.0023–0.0036	2,100–3,500	0.0020–0.0032

(Use maximum RPM if suggested RPM is higher than the machine's capabilities)

TM Series Guidelines

- Speeds and feeds are only general starting points and may vary depending on specific applications.
- Use Climb Milling for better finish and longer tool life.
- Air or mist coolant on materials greater than 40 HRc.
- Good machines, tool holders, and programming methods all help in extending tool life.
- The best way to engage into the material is by helical interpolation or entering from off the part.
- Use for tight areas like helical bores or tight corners. For large open areas use HM/MTM Series.

Profiling



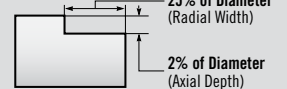
30–40 HRc Profiling Radial Width = 5% of Diameter
 40–50 HRc Profiling Radial Width = 5% of Diameter
 50–60 HRc Profiling Radial Width = 2% of Diameter

1 x Diameter (Axial Depth)

Additional Notes

- Special diameters, lengths, and corner radii are available on a make-to-order basis.
- Special draft angles (blend angle) or necked shanks for part clearance are available upon request and usually ship within the next business day.

Facing/Floor Finishing



25% of Diameter (Radial Width)

2% of Diameter (Axial Depth)



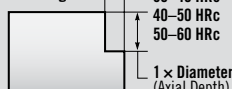
HM SERIES SPEEDS & FEEDS (Semi-Finishing & Finishing)

Tool Number	Cutter Diameter	Steels 30–40 HRc		Steels 40–50 HRc		Steels 50–60 HRc	
		RPM	CLPT	RPM	CLPT	RPM	CLPT
HM-402-04	1/8"	17,000–20,000	0.0008–0.001	13,000–17,000	0.0007–0.0009	8,000–13,000	0.0006–0.0008
HM-402-06	3/16"	12,000–14,000	0.0011–0.0015	9,000–12,000	0.0010–0.0014	5,300–9,000	0.0009–0.0012
HM-602-08	1/4"	9,000–10,400	0.0015–0.002	7,000–9,000	0.0014–0.0018	4,000–6,600	0.0012–0.0016
HM-602-10	5/16"	7,200–8,300	0.0019–0.0025	5,500–7,200	0.0017–0.0023	3,200–5,400	0.0015–0.0020
HM-602-12	3/8"	6,000–6,900	0.0020–0.003	4,600–6,000	0.0018–0.0027	2,700–4,500	0.0016–0.0024
HM-602-14	7/16"	5,200–6,000	0.0023–0.0035	4,000–5,200	0.0021–0.0032	2,300–3,900	0.0019–0.0028
HM-602-16	1/2"	4,500–5,200	0.0025–0.004	3,500–4,500	0.0023–0.0036	2,100–3,500	0.0020–0.0032
HM-602-20	5/8"	3,600–4,150	0.0026–0.0042	2,800–3,600	0.0023–0.0038	1,600–2,750	0.0021–0.0034
HM-802-24	3/4"	3,000–3,500	0.0028–0.005	2,300–3,000	0.0025–0.0045	1,350–2,250	0.0023–0.0041
HM-102-32	1"	2,200–2,600	0.0030–0.006	1,700–2,200	0.0027–0.0054	1,000–1,700	0.0024–0.0049

HM Series Guidelines

- Speeds and feeds are only general starting points and may vary depending on specific applications.
- Use Climb Milling for better finish and longer tool life.
- Air or mist coolant on materials greater than 40 HRc.
- Good machines, tool holders, and programming methods all help in extending tool life.
- The best way to engage into the material is by helical interpolation or entering from off the part.
- Use for open areas of floors or walls. For tight areas like helical bores or tight corners use TM/MTM Series.

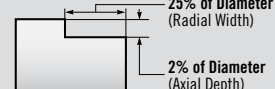
Profiling



30–40 HRc Profiling Radial Width = 5% of Diameter
 40–50 HRc Profiling Radial Width = 5% of Diameter
 50–60 HRc Profiling Radial Width = 2% of Diameter

1 x Diameter (Axial Depth)

Facing/Floor Finishing



25% of Diameter (Radial Width)

2% of Diameter (Axial Depth)

Speeds & Feeds

SAWS

Material	Max Axial Depth/Pass <i>(Times Thickness)</i>	Teeth	Inch				Metric			
			SFM <i>Surface Feet/Minute</i>	Chip Load per Tooth – Standard			SMM <i>Surface Meters/Minute</i>	Chip Load per Tooth – Metric		
				<i>Saw Thickness</i> .002"-.031"	<i>Saw Thickness</i> .031"-.100"	<i>Saw Thickness</i> >.100"		<i>Saw Thickness</i> .05mm-1.0mm	<i>Saw Thickness</i> 1.0mm-3.0mm	<i>Saw Thickness</i> >3.0mm
Aluminum / Non-Ferrous										
Ferrous										
2024	4	Coarse	3600	.000234"/.000273"	.000273"/.00052"	0.00052"	1100	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
6061 (T1–T3)	4	Coarse	3600	.000234"/.000273"	.000273"/.00052"	0.00052"	1100	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
6061 (T4–T6)	4	Coarse	3600	.000234"/.000273"	.000273"/.00052"	0.00052"	1100	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
7075	4	Coarse	3600	.000234"/.000273"	.000273"/.00052"	0.00052"	1100	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Non-Ferrous										
Brass	4	Coarse	750	.000234"/.000273"	.000273"/.00052"	0.00052"	230	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Copper	4	Coarse	600	.000234"/.000273"	.000273"/.00052"	0.00052"	190	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Magnesium	4	Coarse	3600	.000234"/.000273"	.000273"/.00052"	0.00052"	1100	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Titanium, Steel and High-Temp Alloys										
Titanium										
Commercially Pure	2	Fine	700	.00018"/.00021"	.00021"/.0004"	0.0004"	210	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
6AL-4V	2	Fine	350	.00018"/.00021"	.00021"/.0004"	0.0004"	105	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
6AL-6V	2	Fine	230	.00018"/.00021"	.00021"/.0004"	0.0004"	70	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Steel										
1018–1020	4	Fine	350	.00018"/.00021"	.00021"/.0004"	0.0004"	110	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
4130	2	Fine	260	.00018"/.00021"	.00021"/.0004"	0.0004"	80	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
4140	2	Fine	220	.00018"/.00021"	.00021"/.0004"	0.0004"	70	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
4340	2	Fine	280	.00018"/.00021"	.00021"/.0004"	0.0004"	90	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Tool Steel Annealed										
A2	2	Fine	350	.00018"/.00021"	.00021"/.0004"	0.0004"	110	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
D2	2	Fine	260	.00018"/.00021"	.00021"/.0004"	0.0004"	80	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
H13	2	Fine	230	.00018"/.00021"	.00021"/.0004"	0.0004"	70	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
P20	2	Fine	350	.00018"/.00021"	.00021"/.0004"	0.0004"	110	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Stainless Steel										
303	2	Fine	500	.00018"/.00021"	.00021"/.0004"	0.0004"	150	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
304	2	Fine	200	.00018"/.00021"	.00021"/.0004"	0.0004"	70	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
316	2	Fine	240	.00018"/.00021"	.00021"/.0004"	0.0004"	75	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
15-5/17-4 PH	2	Fine	200	.00018"/.00021"	.00021"/.0004"	0.0004"	60	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
440C	2	Fine	200	.00018"/.00021"	.00021"/.0004"	0.0004"	60	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Inconel										
625 / 718	2	Fine	100	.00018"/.00021"	.00021"/.0004"	0.0004"	30	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Composites										
G10 Fiberglass/Polyester	4	Coarse	1000	.000234"/.000273"	.000273"/.00052"	0.00052"	300	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Graphite	4	Coarse	1000	.000234"/.000273"	.000273"/.00052"	0.00052"	300	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Graphite Fiber/Epoxy	4	Coarse	800	.000234"/.000273"	.000273"/.00052"	0.00052"	250	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Other Material Applications										
Cast Iron										
Ductile Iron	2	Fine	350	.00018"/.00021"	.00021"/.0004"	0.0004"	110	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Gray Cast Iron	2	Fine	500	.00018"/.00021"	.00021"/.0004"	0.0004"	150	.0046mm/.0053mm	.0053mm/.010mm	0.010mm
Wood & Plastics										
Wood	4	Coarse	3600	.000234"/.000273"	.000273"/.00052"	0.00052"	1100	.0059mm/.0069mm	.0069mm/.013mm	0.013mm
Plastics	4	Coarse	1600	.000234"/.000273"	.000273"/.00052"	0.00052"	400	.0059mm/.0069mm	.0069mm/.013mm	0.013mm

Speeds & Feeds



ET SPEEDS & FEEDS

Material	5000 RPM	7500 RPM	10,000 RPM
	in/min	in/min	in/min
NON-FERROUS METALS			
Aluminum/Aluminum Alloys	10 ipm	15 ipm	20 ipm
Brass/Bronze	10 ipm	15 ipm	20 ipm
Copper/Copper Alloys	10 ipm	15 ipm	20 ipm
Magnesium	10 ipm	15 ipm	20 ipm
COMPOSITES			
G10 Fiberglass	15 ipm	22.5 ipm	30 ipm
Graphite	15 ipm	22.5 ipm	30 ipm
Carbon Fiber	15 ipm	22.5 ipm	30 ipm
Plastics	15 ipm	22.5 ipm	30 ipm
FERROUS METALS			
Cast Iron	5 ipm	7.5 ipm	10 ipm
Steel, Low Carbon	5 ipm	7.5 ipm	10 ipm
Steel, Medium Carbon	7.5 ipm	11.25 ipm	15 ipm
Steel, Hardened	2.5 ipm	3.75 ipm	5 ipm
Stainless Steel, Soft	5 ipm	7.5 ipm	10 ipm
Stainless Steel, Hard	2.5 ipm	3.75 ipm	5 ipm
Inconel	4 ipm	6 ipm	8 ipm
Titanium, Soft	5 ipm	7.5 ipm	10 ipm
Titanium, Hard	2.5 ipm	3.75 ipm	5 ipm



WOOD SERIES SPEEDS & FEEDS

Material	RPM (1/4")	Feed Inches/Minute
Wood		
Hardwoods	18,000	180–250
Softwoods	18,000	180–250
MDF	18,000	150–250
Laminated Materials	18,000	150–250
Plastics, Others		
Solid Surface	15,300	70–130
Fiberglass	15,300	80–150
Phenolic	15,300	80–150
Aluminum (Soft)	18,000	90–120
Aluminum (Aircraft Grade)	18,000	180–230
Copper	9,200	45–60
Foam	18,000	150–300
Plastics (Soft)	18,000	180–250
Plastics (Hard)	18,000	150–200

General Guidelines

- Select the shortest flute length possible for the application. Shorter flute length router tools offer better stability and increased feed rates.
- Select the largest diameter tool for the job. Increasing diameter by 10% provides 25% more strength.
- Adjust RPM and feed rate to reduce vibration. Vibration will cause poor finish and chip tools. Feed rates that are too slow can also cause vibration and poor tool life.
- Regular cleaning of tool holders and collets help ensure the tool's performance and life.
- Securing the part as rigidly as possible will improve finishes and tool life.

Visit RobbJack's New Website!



Dynamic Tool Search at www.robjack.com

TOOL SEARCH

- 1**

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Your Specifications
Tool Characteristics
Materials
Application
- 3**

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- 4**

Click on a Tool Number
- 5**

Complete Tool Description

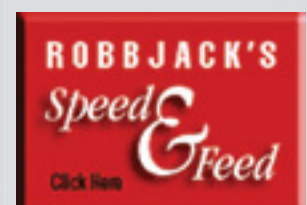
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- ▶ Quick, easy calculations, both metric and standard
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- ▶ Simultaneous tool recommendations



End Mill Modifications

Coolant Grooves



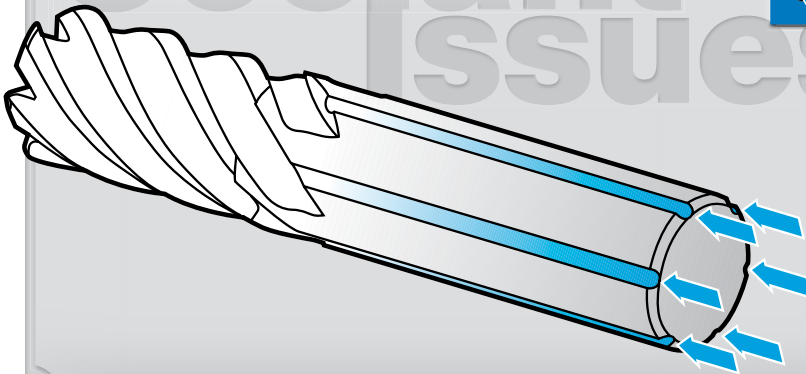
Coolant Grooves allow coolant to flow around the outside of the tool for through-spindle coolant applications. It is a lower-cost option to through-the-tool coolant holes.

To order a RobbJack tool with a **Coolant Grooves**, use the existing standard *Part Number*, and add **-CG**.

Example:

An A1-201-12 with coolant grooves is Part Number:

▶ **A1-201-12-CG**
See price sheet for pricing



Mirror Edge™

Our edge preparation dampens vibration to help eliminate chatter.



Mirror Edge



Non-Mirror Edge

Applications

- Deep pocket and thin wall aluminum
- Long reaches more than 3:1 length-to-diameter ratio
- Plunging corners in titanium, steels, stainless, aluminum, etc.
- High end valves used with Feather Blend and T-Process

Must Use Coolant



Our patented Mirror Edge geometry helps to eliminate chatter. This geometry can be used in any application where chatter is a problem, usually for thin walls, valves, deep pockets or where the tool sticks out more than 3:1 length to diameter ratio.

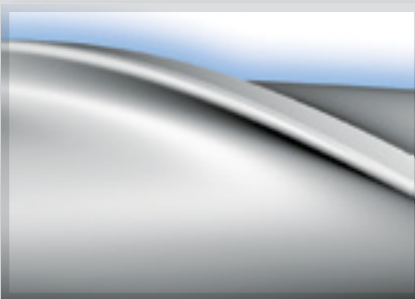
To order RobbJack tools with **Mirror Edge**, use the existing standard *Part Number*, and add **-ME**.

Example:

An A1-201-12 with Mirror Edge is Part Number:

▶ **A1-201-12-ME**
See price sheet for pricing

T-Process



T-Process is a honed edge we put on an end mill to help eliminate chipping.



Pros: T-Process strengthens the edge, helps eliminate chipping and gives a smooth edge.

Cons: T-Process will bring up a burr in certain materials, and it is not for materials that like a sharp edge, such as aluminum and plastics.

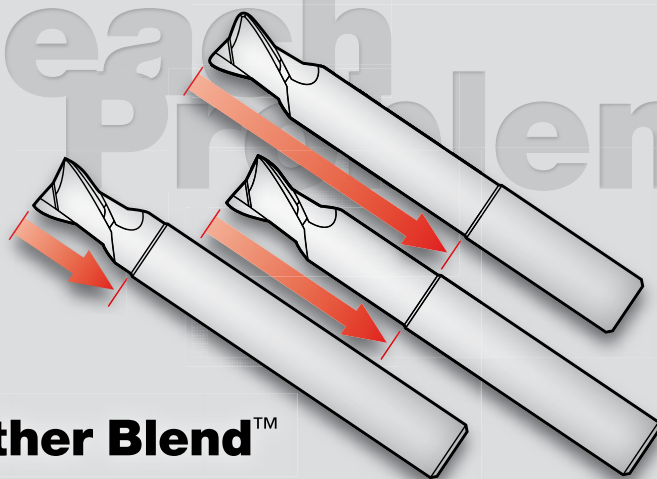
To order a RobbJack tool with a **T-Process**, use the existing standard *Part Number*, and add **-TP**.

Example:

An XG-402-16 with a T-Process is Part Number:

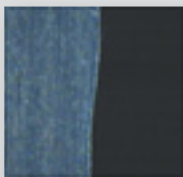
▶ **XG-402-16-TP**
See price sheet for pricing

End Mill Modifications

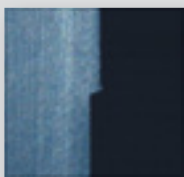


Feather Blend™

A smooth transition from the cutting diameter to the neck diameter.



Feather Blend



Standard Neck

Applications

- Any necked tool
- Eliminates swirl lines during plunging
- Eliminates stress risers in parts



Reach

Modify any standard tool with a neck to get the job done quickly.

A neck will increase rigidity, reduce tool deflection and last longer than a long length of cut tool. Necking can be added to most standard tools in 1–2 days.

To order a RobbJack tool with a **Reach**, use the existing standard *Part Number*, and add **-N** and the desired length from the end of the tool.

Example:

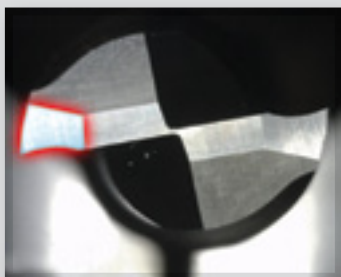
An A1-201-12 necked with 1.0" Reach is Part Number:

► **A1-201-12-N 1.0"**

See price sheet for pricing

A tool necked with Feather Blend has a reduction in the tool diameter after the cutting length so the tool can cut deeper than its cutting length. It features a smooth transition from the cutting diameter to the neck diameter. Feather Blend reduces staircase marks and stress risers in parts and helps maintain the strongest tool possible.

Wiper Flats



A Wiper Flat is a small flat on the end of the tool where there is no concavity. It is used to minimize swirl marks on the floor of parts.



Pros: A Wiper Flat gives better floor finishes.

Cons: Wiper Flats will increase surface contact, not for use on thin floors.

To order a RobbJack tool with a **Wiper Flats**, use the existing standard *Part Number*, and add **-WF**.

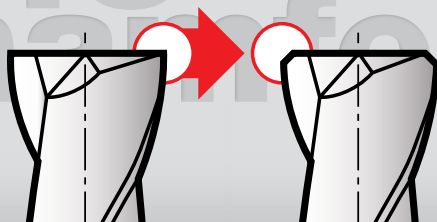
Example:

An A1-201-12 with wiper flats is Part Number:

► **A1-201-12-WF**

See price sheet for pricing

45° Chamfer



To order a RobbJack tool with a **45° Chamfer**, use the existing standard *Part Number*, add **-CH** and amount of *Chamfer*.

Example:

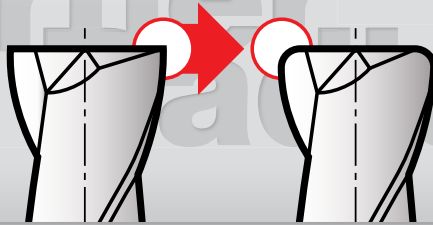
A1-201-12 with a .040" 45° chamfer is Part Number:

► **A1-201-12-CH .040"**

See price sheet for pricing

End Mill Modifications

Corner Radius



To order a RobbJack tool with a **Corner Radius**, use the existing standard *Part Number*, add **-CR** and desired *Radius Size*.

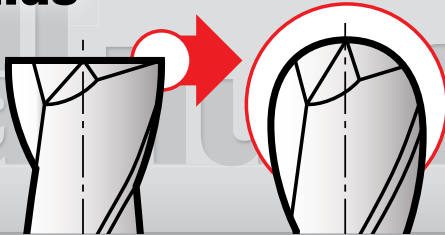
Example: An A1-201-12 with a .005 corner radius is Part Number:

▶ **A1-201-12-CR .005**

See price sheet for pricing

SPECIAL NOTE: 2 flutes under .050" call for pricing.
3 or more flutes under .080" call for pricing.

Full Radius



To order a RobbJack tool with a **Full Radius** (or Ball End), use the existing standard *Part Number*, and add **-BN**.

Example: An A1-201-12 with a Full Radius (Ball End) is Part Number:

▶ **A1-201-12-BN**

See price sheet for pricing

Weldon Flats



To order RobbJack tools with **Weldon Flats**, use the existing standard *Part Number*, and add **-FL**.

Example: An A1-201-12 with a Weldon Flat is Part Number:

▶ **A1-201-12-FL**

No Charge

Regrinding

Let RobbJack recondition your used cutting tools and get RobbJack quality grinds and specifications on tools with any brand name!

Wouldn't it be nice if resharpened tools performed as well as new? Let us regrind yours the way we do ours and it can happen. We will add our grinds and finishes to any tools, regardless of manufacturer. Our prices are competitive, our delivery is the best in the industry, and we do our own, in-house PVD coatings and re-coatings.

GO GREEN

Try RobbJack's in-house carbide recycling program.

Many times the tools we receive for regrinding are too badly damaged to justify reconditioning. For all tools that we determine fall into this category, **we will either:**

▶ *Return the tools to you marked "No Work Done" (NWD)*

OR...

▶ *Put the tools, as scrap, into our recycling program and send you a certificate for a 10% discount on your next regrinding order.*

We will offer you this choice every time we receive tools that we determine are NWD. We recycle scrap tools to carbide re-manufacturers, who crush the tools and use the recycled shards and powder to make shredders or non-critical carbide grades.

YOUR OWN COATING

Get state-of-the art coating technology without delivery hassles.

RobbJack owns and operates their PVD coating facility in Lincoln, CA under the tenets of ISO9000 certification. Our factory-trained technicians take the same special care with your tools as with ours, assuring you of the best PVD coatings available. We do this as part of our process, reducing or eliminating delays in delivery.

Download our **Regrinding Order Form** at www.robjack.com/technical/regrindform to get started. Or email or call us!

Phone: (916) 645-6045
Toll-Free: (800) 527-8883
Fax: (916) 645-0146



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sherry@robjack.com