We've compiled aluminum milling speed & feed charts from AB Tools, Korloy, Promax and Rushmore USA Tools, and created this PDF guide to put this invaluable reference readily at your fingertips. For additional recommendations, contact our technical advisors at **tech@travers.com** or via phone at **800.234.9985**

RUSHMORE USA TOOLS

Milling Applications

Milling Speed & Feed Recommendations For **Rushmore 3 Flute Solid Carbide 37° Helix ZrN Single End Mills For Aluminum** & **Rushmore 3 Flute Solid Carbide 37° Helix ZrN Ball End Mills For Aluminum**

Material		Axial ↓	Radial →	SFM	1/8		1/4		5/16		3/8		1/2		5/8		3/4	
					RPM	IPM	RPM	IPM	RPM	IPM	RPM	IPM	RPM	IPM	RPM	IPM	RPM	IPM
N	Aluminum, Brass, Copper 6061, 7050, 7075	.5 x D	1 x D	600	18336	66	9168	66	7334	79	6112	79	4584	83	3667	80	3056	80
		1.25 x D	.3 x D	720	22003	99	11002	96	8801	115	7334	115	5501	121	4401	116	3667	116
		1.5 X D	.1 x D	1200	36672	220	18336	193	14669	231	12224	231	9168	243	7334	233	6112	233
	High Silicon Aluminun 4% - 13% A242, A319, A356, A390	.5 x D	1 x D	600	18336	55	9168	55	7334	66	6112	66	4584	69	3667	67	3056	67
		1.25 x D	.3 x D	720	22003	79	11002	79	8801	95	7334	95	5501	100	4401	96	3667	96
		1.5 X D	.1 x D	1200	36672	176	18336	165	14669	198	12224	198	9168	208	7334	200	6112	200

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Milling Speed & Feed Recommendations For **Rushmore 2 Flute Solid Carbide 45° Helix Single End Mills For Aluminum**

Profiling

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group	SFM based on RDOC Cutting Diameter Engaged 10%	20%	30%	50%	IPT* (BASELINE) Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous N: Aluminum /Aluminum Alloys < 10% Si	2000	1800	1200	900									
Non-Ferrous N: Aluminum /Aluminum Alloys > 10% Si	1500	1200	1000	800									
Non-Ferrous N: Brass	900	800	600	500	0.0025	0.0037	0.0050	0.0062	0.0075	0.0100	0.0125	0.0150	0.0200
Non-Ferrous N: Cu/Cu Alloys / Magnesium	1000	800	600	500									
Non-Ferrous N: Plastics	900	800	600	500									

*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	2x
20%	3.1x
10%	3.8x

*1/4" AND SMALLER DIAMETERS: Use caution when Profiling more than 50% or Slotting more than 25%

Slotting

Surface Feet Per Minute (SFM)
Radial Depth of Cut (RDOC)
Inches Per Tooth (IPT)

Workpiece Material Group	SFM Cutting Diameter Engaged 25%	50%	100%	IPT Cutting Diameter 1/8†	3/16†	1/4†	5/16	3/8	1/2	5/8	3/4	1
Non-Ferrous N: Aluminum /Aluminum Alloys < 10% Si	2000	1500	1000	0.0012	0.0018	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100
Non-Ferrous N: Aluminum /Aluminum Alloys > 10% Si	1500	1200	800									
Non-Ferrous N: Brass	600	500	400	0.0018	0.0025	0.0032	0.0037	0.0050	0.0065	0.0075	0.0100	0.0120
Non-Ferrous N: Cu/Cu Alloys / Magnesium	500	400	300									
Non-Ferrous N: Plastics	1200	1000	800									

PROMAX
Premium

Milling Applications

Milling Speed & Feed Recommendations For **Promax Series 109 Single End Mills For Aluminum**

Series 109 - Aluminum Alloys & Non-Ferrous Materials

Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch] 1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	1230	0.05xø	1.4xø	0.0008	0.0016	0.002	0.0041	0.0048	0.0055
	Wrought Alloy Non-Hardened	1230	0.05xø	1.4xø	0.0008	0.0016	0.002	0.0041	0.0048	0.0055
	Wrought Alloy Hardened	1230	0.05xø	1.4xø	0.0008	0.0016	0.002	0.0041	0.0048	0.0055
	Casting Alloy < 6% Si	984	0.05xø	1.4xø	0.0008	0.0016	0.002	0.0041	0.0048	0.0055
	Casting Alloy 6-12% Si	738	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Casting Alloy > 6% Si	517	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
Magnesium	Wrought Alloy	492	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Casting Alloy	418	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
Copper	Non-Alloy	369	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Wrought Alloy Non-Hardened	344	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Wrought Alloy Hardened	271	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	CuNi-Alloy	320	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	CuNiZn-Alloy Long-Chipping	271	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	CuNiZn-Alloy Short-Chipping	320	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
CuZn (Brass)	Long-Chipping	369	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Short-Chipping	517	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
CuSn (Bronze)	Long-Chipping	320	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Short-Chipping	344	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
CuAlFe (Ampco)	Long-Chipping	148	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048
	Short-Chipping	172	0.05xø	1.4xø	0.0006	0.0008	0.0012	0.0034	0.0041	0.0048

Milling Speed & Feed Recommendations For **Promax Series 102 Single End Mills For Aluminum**
Milling Speed & Feed Recommendations For **Promax Series 119 Single End Mills For Aluminum**

Series 102 / 119 - Aluminum Alloys & Non-Ferrous Materials

Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch] 1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	1230	1xø	1xø	0.001	0.0017	0.0028	0.0035	0.0047	0.0055
	Wrought Alloy Non-Hardened	1230	1xø	1xø	0.001	0.0017	0.0028	0.0035	0.0047	0.0055
	Wrought Alloy Hardened	1230	1xø	1xø	0.001	0.0017	0.0028	0.0035	0.0047	0.0055
	Casting Alloy < 6% Si	984	1xø	1xø	0.001	0.0017	0.0028	0.0035	0.0047	0.0055
	Casting Alloy 6-12% Si	738	1xø	1xø	0.0008	0.0014	0.0028	0.0047	0.0067	0.0083
	Casting Alloy > 6% Si	517	1xø	1xø	0.0008	0.0014	0.0028	0.0047	0.0067	0.0083
Magnesium	Wrought Alloy	492	1xø	1xø	0.0008	0.0014	0.0028	0.0047	0.0067	0.0083
	Casting Alloy	418	1xø	1xø	0.0008	0.0014	0.0028	0.0047	0.0067	0.0083
Copper	Non-Alloy	369	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	Wrought Alloy Non-Hardened	344	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	Wrought Alloy Hardened	271	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	CuNi-Alloy	320	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	CuNiZn-Alloy Long-Chipping	271	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	CuNiZn-Alloy Short-Chipping	320	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
CuZn (Brass)	Long-Chipping	369	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	517	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
CuSn (Bronze)	Long-Chipping	320	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	344	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
CuAlFe (Ampco)	Long-Chipping	148	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	172	1xø	1xø	0.0006	0.0011	0.0024	0.0031	0.0047	0.0055

Series US376 - Aluminum Alloys & Non-Ferrous Materials

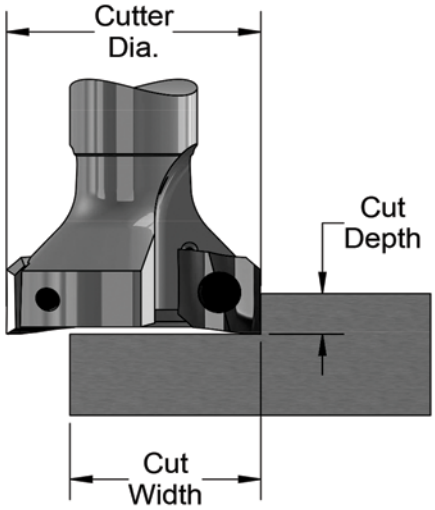
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [inch] 1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	1640	0.05xø	2xø	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Wrought Alloy Non-Hardened	1640	0.05xø	2xø	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Wrought Alloy Hardened	1640	0.05xø	2xø	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Casting Alloy < 6% Si	1312	0.05xø	2xø	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Casting Alloy 6-12% Si	984	0.05xø	2xø	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Casting Alloy > 6% Si	689	0.05xø	2xø	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028

* Feeds and speeds are starting points for overall lengths of 4" and shorter. For end mills with overal lengths of over 4", decrease the feeds and speeds

A.B. TOOLS, INC.

Aluminum Milling Tests

AB Tools is a US based tool manufacture out of Lincoln, CA. Their Indexable 'Shear-Hog' tool-line has built a name in the industry for their performance in aluminum and other non-ferrous materials. The tool's wide pocket design, unique cutting to shank diameter ratio, high shear insert design & multiple insert radii combine for maximum MRR (metal removal rate), even on smaller foot print machines.



You'll get higher CIM with smaller cutters, (assuming you're rough milling with cutters about one inch in diameter and larger). On tests 5, 6 and 8, with full diameter cuts, the one inch gets 46 CIM, the 1-1/4 gets 42 CIM and the two inch gets 37 CIM.

You'll get higher CIM with a cut width that is about 3/4 of the cutter diameter than with a full diameter cut width, (a long accepted machinist's rule).

Compare Tests 1 versus 3 and 6 versus 7. You can get the same CIM with fewer flutes, plus reduced insert costs; see Test 8.

All tests were run on a recent model Haas VF1 based on the highest inches per minute possible with the load meter showing 100%. Haas estimates 7.5 actual spindle HP at 6500 RPM.

Milling Speed & Feed Recommendations For **AB Tools End Mills**
Milling Speed & Feed Recommendations For **AB Tools Face Mills**

Test No.	Cutter	Cutter Dia.	RPM	Cut Width	Cut Depth	IPM Feed	No. Flutes	IPT Chip	CIM
1.	SH750	.750	7500	.750	.375	150	1	.020	42
2.	*below	.750	7500	.750	.375	130	2	.008	36
3.	SH750	.750	7500	.600	.250	315	1	.042	46
4.	*below	.750	7500	.600	.250	275	2	.018	41
5.	SH100	1.0	6500	1.0	.125	370	1	.057	46
6.	SH125	1.25	6500	1.25	.125	275	2	.027	42
7.	SH125	1.25	6500	1.0	.250	375	2	.037	47
8.	SH200	2.0	6500	2.0	.250	75	2 & 3	.006/.004	37

* A major brand solid carbide, 2 flute end mill, with High Rake for aluminum.

KORLOY

Pro-X Mill

Korloy Inc is a top worldwide tool manufacture that produces tooling solutions for many aluminum heavy industries such as the automobile, marine and aerospace industries. Their Pro-X Mill series is one of their most capable aluminum specific milling solutions. Some of the features of these tools include a long cutting edge, (< 0.700"), multiple radii, indents in the back of the insert to help secure the inserts during high speed machining and one of the hardest carbide grades (H01) on the market for extra-long tool life.

Max. RPM as per Cutting Diameter

Cutting diameter ØD(inch)	5000 type		6000 type	
	n(min^{-1})	vc(sfm)	n(min^{-1})	vc(sfm)
3/4	14,000	879	-	-
1	28,000	2,199	15,000	1,178
1 1/4	25,000	2,513	23,000	2,312
1 1/2	22,000	2,764	20,000	2,513
2	20,000	3,141	18,000	2,827
2 1/2	18,000	3,562	16,000	3,166
3	16,000	4,021	14,000	3,518
4	14,000	4,398	13,000	4,084
5	13,000	5,105	11,000	4,319

Recommended Cutting Conditions

Workpiece		Cutting Speed vc(sfm)	Feed fz(ipt)
Aluminum alloy	Rm280 < MPa	3,960	0.012
	Rm280 > MPa	3,300	0.010
Copper alloy	Long chipping	1,320	0.008
Thermo plastic	-	1,150	0.006
Aluminum alloy	Si <12%	3,300	0.010
	Si ≥12%	990	0.009
Copper alloy	Short chipping	1,650	0.008
Magnesium alloy	-	1,480	0.008
Duroplastics	-	680	0.006

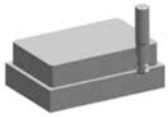
* In case of actual machining, accidental insert or tool breakage could happen even under the suggested RPM. A special cover or door is necessary to prevent damage from broken insert or broken tool.

KORLOY

Application Examples

Milling Speed & Feed Recommendations For **Korloy Pro-X End Mill Sets**
Milling Speed & Feed Recommendations For **Korloy Pro-X Face Mill Sets**

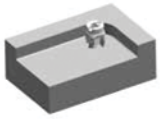
PAXSA5125HR-A



Workpiece	Cutting condition			
	vc(sfm)	fz(ipt)	ap(inch)	ae(inch)
A6061	4290	0.008	0.32	0.5D

Chip evacuation and good surface roughness

PAXCA5200HR-A

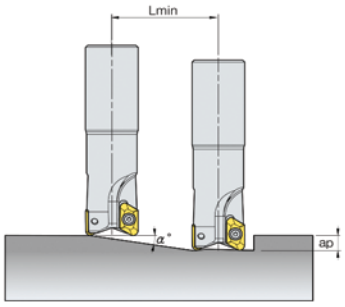


Workpiece	Cutting condition			
	vc(sfm)	fz(ipt)	ap(inch)	ae(inch)
A6061	4290	0.01	0.4	0.5D

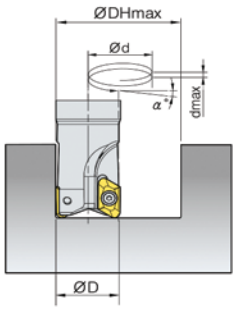
Long tool life and no built-up edge & chipping

Pro-X Mill Ramping & Helical Cutting Technical Data

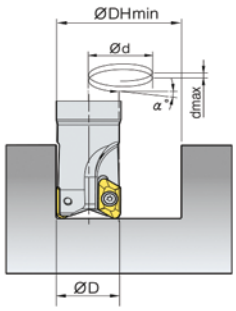
1. Ramping



2. Blind-hole helical cutting



3. Through-hole helical cutting



(inch)

Designation	ØD	Ramping		Blind-hole helical cutting				Through-hole helical cutting	
		α°(max)	Lmin	ØDHmax	dmax	ØDHmax	dmax	ØDHmax	dmax
PAXSA5075HR	0.75	9.1	2.47	1.264	0.008	1.185	0.007	0.988	0.006
PAXSA5100HR	1.00	11.9	1.86	1.764	0.015	1.685	0.014	1.488	0.012
PAXSA5125HR	1.25	9.0	2.49	2.264	0.014	2.185	0.014	1.988	0.012
PAXSA5150HR	1.50	7.2	3.11	2.764	0.014	2.685	0.013	2.488	0.012
PAXCA5200HR	2.00	5.2	4.36	3.764	0.013	3.685	0.013	3.488	0.012
PAXCA5250HR	2.50	4.0	5.61	4.764	0.013	4.685	0.013	4.488	0.012
PAXCA5300HR	3.00	3.3	6.86	5.764	0.013	5.685	0.013	5.488	0.012
PAXCA5400HR	4.00	2.4	9.36	7.764	0.013	7.685	0.013	7.488	0.012
PAXCA5500HR	5.00	1.9	11.86	9.764	0.013	9.685	0.013	9.488	0.012
PAXSA6100HR	1.00	9.0	2.48	1.764	0.011	1.685	0.011	1.488	0.009
PAXSA6125HR	1.25	6.8	3.31	2.264	0.011	2.185	0.010	1.988	0.009
PAXSA6150HR	1.50	10.8	2.07	2.764	0.021	2.685	0.020	2.488	0.019
PAXCA6200HR	2.00	7.7	2.91	3.764	0.020	3.685	0.020	3.488	0.019
PAXCA6250HR	2.50	6.0	3.74	4.764	0.020	4.685	0.019	4.488	0.019
PAXCA6300HR	3.00	4.9	4.57	5.764	0.020	5.685	0.019	5.488	0.019
PAXCA6400HR	4.00	3.6	6.24	7.764	0.019	7.685	0.019	7.488	0.019
PAXCA6500HR	5.00	2.9	7.91	9.764	0.019	9.685	0.019	9.488	0.019

- Lmin : when ap=0.394inch
- Lmin : Minimum inclination cutting length
  α° : Max. rampig angle
  ap : Depth of cut

$$Lmin = \frac{ap}{\tan \alpha^{\circ}} \text{ (inch)}$$