

MILLING RECOMMENDATIONS - GENERAL PURPOSE ENDMILLS



PROFILING

Workpiece Material Group	Hardness	Surface Feet Per Minute (SFM) Radial Depth of Cut (RDOC)					Inches Per Tooth (IPT)					
		SFM based on RDOC					IPT *(BASELINE)					
		Cutting Diameter Engaged					Cutting Diameter					
		5%	10%	20%	30%	50%	5/16	3/8	1/2	5/8	3/4	1
Steels Free Machining & Low Carbon: 10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36 Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX, 51XX, 86XX, 93XX	P ≤ 28 Rc	1050	700	385	375	350						
	P 28-38 Rc	630	420	320	250	210	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Tool & Die Steels A2, H13, L6, P20, S7	P 28-44 Rc	525	350	300	275	250	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
Stainless Steel Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F Moderately Difficult to Machine, Nitronic 50, Nitronic 60, 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347 Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M ≤ 28 Rc	650	600	550	500	450						
	M ≤ 28 Rc	525	400	350	300	250	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
	M > 28 Rc	525	400	350	300	250						
Super Alloys High Temp, Nimonic, Inconel, Monel, Hastelloy Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S ≤ 42 Rc	265	200	175	150	100	0.0014	0.0016	0.0023	0.0027	0.0032	0.0045
	S ≤ 42 Rc	230	200	175	150	125						
Hardened Materials	H 45-55 Rc	250	240	230	210	200	0.0018	0.0021	0.0030	0.0036	0.0042	0.0060
	H 55-65 Rc	200	180	160	150	100	0.0013	0.0014	0.0021	0.0024	0.0029	0.0041
Cast-Iron Gray: SAE J431, ASTM A48 Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K ≤ 240 HB	425	400	375	350	300	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
	K > 240 HB	320	300	250	225	200						
Non-Ferrous Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N	1000	960	920	880	840	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090

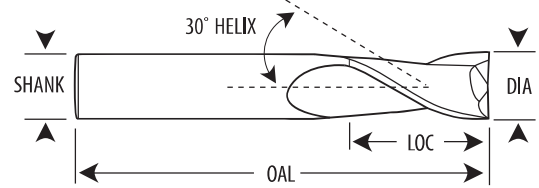
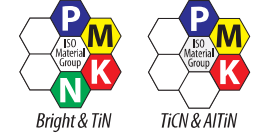
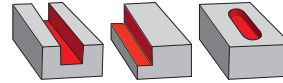
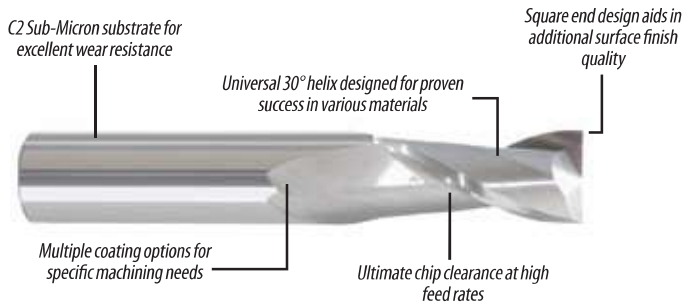
*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x



SLOTTING

Workpiece Material Group	Hardness	Surface Feet Per Minute (SFM) Radial Depth of Cut (RDOC)			Inches Per Tooth (IPT)					
		SFM			IPT *(BASELINE)					
		Cutting Diameter Engaged			Cutting Diameter					
		25%	50%	100%	5/16	3/8	1/2	5/8	3/4	1
Steels Free Machining & Low Carbon: 10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36 Medium Carbon, High Carbon Steels, Alloy Steels & Easy to Machine Tool: 13XX, 41XX, 43XX, 51XX, 86XX, 93XX	P ≤ 28 Rc	385	370	350						
	P 28-38 Rc	245	230	2210	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Tool & Die Steels A2, H13, L6, P20, S7	P 28-44 Rc	210	195	175	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
Stainless Steel Easy to Machine, 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F Moderately Difficult to Machine, Nitronic 50, Nitronic 60, 301, 303 304, 304L Incoloy 27-7MO, 316 316L, 321, 347 Difficult to Machine, 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8Mo, Nitronics	M ≤ 28 Rc	385	370	350						
	M ≤ 28 Rc	245	210	175	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
	M > 28 Rc	210	195	175						
Super Alloys High Temp, Nimonic, Inconel, Monel, Hastelloy Titanium: Ti 3Al-2.5V, Ti 6Al-4V Ti 10V-2Fe-3Al	S ≤ 42 Rc	125	105	90	0.0008	0.0010	0.0013	0.0016	0.0017	0.0026
	S ≤ 42 Rc	100	90	80						
Hardened Materials	H 34-45 Rc	245	230	210	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
	H 45-55 Rc	175	160	140	0.0008	0.0010	0.0013	0.0016	0.0020	0.0025
	H 55-65 Rc	150	125	100	0.0004	0.0005	0.0008	0.0008	0.0010	0.0012
Cast-Iron Gray: SAE J431, ASTM A48 Ductile & Malleable: ASTM A536, ASTM 897, ASTM A47, ASTM A220 ASTM A602	K ≤ 240 HB	450	400	350	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
	K > 240 HB	300	250	225						
Non-Ferrous Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N	750	600	450	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050

2 FLUTE - SINGLE END SQUARE



DIAMETER TOLERANCE: +0.000 / -0.002" SHANK TOLERANCE: +0.0000 / -0.0005"

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
1/64	0.0156	3/64	1/8	1-1/2	Regular	204-001000	204-000995	—	204-000997
1/32	0.0313	1/16	1/8	1-1/2	Stub	202-001001	202-001002	202-001003	202-001004
		1/8	1/8	1-1/2	Regular	204-001001	204-001002	204-001003	204-001005
1.0mm	0.0394	4.0mm	3.0mm	39.0mm	Regular	204-001275	204-001270A	204-001270C	204-001270B
3/64	0.0469	3/32	1/8	1-1/2	Stub	202-001010	202-001011	202-001012	202-001013
		1/8	1/8	1-1/2	Regular	204-001010	204-001011	204-021010	204-001013
1.5mm	0.0591	5.0mm	3.0mm	39.0mm	Regular	204-001285	204-001285A	204-001285C	204-001285B
1/16	0.0625	1/8	1/8	1-1/2	Stub	202-001020	202-001021	202-001022	202-001023
		1/4	1/8	1-1/2	Regular	204-001020	204-001021	204-001022	204-001023
5/64	0.0781	5/32	1/8	1-1/2	Stub	202-001030	202-001031	202-001032	202-001033
		1/4	1/8	1-1/2	Regular	204-001030	204-001032	204-001033	204-001036
2.0mm	0.0787	8.0mm	3.0mm	39.0mm	Regular	204-001295	—	—	204-001295B
3/32	0.0938	3/16	1/8	1-1/2	Stub	202-001040	202-001041	202-001042	202-001043
		3/8	1/8	1-1/2	Regular	204-001040	204-001041	204-001042	204-001043
2.5mm	0.0984	9.5mm	3.0mm	39.0mm	Regular	204-001301	204-001297A	204-001297C	204-001297B
7/64	0.1094	7/32	1/8	1-1/2	Stub	202-001050	202-001051	202-001052	202-001053
		3/8	1/8	1-1/2	Regular	204-001050	204-001052	204-021050	204-001055
3.0mm	0.1181	12.0mm	3.0mm	39.0mm	Regular	204-001313	204-001311A	204-001311C	204-001311B
		1/4	1/8	1-1/2	Stub	202-001060	202-001061	202-001062	202-001063
		1/2	1/8	1-1/2	Regular	204-001060	204-001061	204-001062	204-001063
		3/4	1/8	2-1/4	Long	213-001001	213-001002	213-001003	213-001004
1/8	0.1250	1	1/8	3	X/Long	216-001001	216-001002	216-001003	216-001004
		12.0mm	4.0mm	51.0mm	Regular	204-001321	204-001321A	204-001321C	204-001321B
9/64	0.1406	9/32	3/16	2	Stub	202-001070	202-001071	202-001072	202-001073
		9/16	3/16	2	Regular	204-001070	204-001072	204-021070	204-001074
5/32	0.1563	5/16	3/16	2	Stub	202-001080	202-001081	202-001082	202-001083
		9/16	3/16	2	Regular	204-001080	204-001081	204-001083	204-001084
		3/4	3/16	2-1/2	Long	213-001005	213-001006	213-001007	213-001008
		1-1/8	3/16	3	X/Long	216-001005	216-001006	216-001007	216-001008
4.0mm	0.1575	14.0mm	4.0mm	51.0mm	Regular	204-001330	204-001330A	204-001330C	204-001330B
11/64	0.1719	5/16	3/16	2	Stub	202-001090	202-001091	202-001092	202-001093
		9/16	3/16	2	Regular	204-001090	204-001092	204-021090	204-001094

2 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
4.5mm	0.1772	16.0mm	5.0mm	51.0mm	Regular	204-001341	204-001341A	204-001341C	204-001341B
3/16	0.1875	3/8	3/16	2	Stub	202-001100	202-001101	202-001102	202-001103
		5/8	3/16	2	Regular	204-001100	204-001101	204-001103	204-001104
		3/4	3/16	2-1/2	Long	213-001012	213-001013	213-001016	213-001014
		1-1/8	3/16	3	X/Long	216-001010	216-001011	216-001012	216-001013
5.0mm	0.1969	16.0mm	5.0mm	51.0mm	Regular	204-001351	204-001351A	204-001351C	204-001351B
13/64	0.2031	3/8	1/4	2	Stub	202-001110	202-001111	202-001112	202-001113
		5/8	1/4	2-1/2	Regular	204-001110	204-001112	204-021110	204-001114
7/32	0.2188	7/16	1/4	2	Stub	202-001120	202-001121	202-001122	202-001123
		5/8	1/4	2-1/2	Regular	204-001120	204-001121	204-001123	204-001124
15/64	0.2344	7/16	1/4	2	Stub	202-001125	202-001126	202-001127	202-001128
		3/4	1/4	2-1/2	Regular	204-001125	204-001127	204-021125	204-001129
6.0mm	0.2362	19.0mm	6.0mm	63.0mm	Regular	204-001361	204-001361A	204-001361C	204-001361B
1/4	0.2500	1/2	1/4	2	Stub	202-001130	202-001131	202-001132	202-001133
		3/4	1/4	2-1/2	Regular	204-001130	204-001131	204-001133	204-001134
		1-1/8	1/4	3	Long	213-001020	213-001021	213-001022	213-001023
		1-1/2	1/4	4	X/Long	216-001020	216-001021	216-001022	216-001023
		1-1/2	1/4	6	Ext XX/Long	216-001025	216-001027	216-001028	216-001029
17/64	0.2656	3/4	5/16	2-1/2	Regular	204-001135	204-001137	204-021181	204-001139
7.0mm	0.2756	19.0mm	8.0mm	63.0mm	Regular	204-001371	204-001371A	204-001371C	204-001371B
9/32	0.2813	1/2	5/16	2	Stub	202-001140	202-001141	202-001142	202-001143
		3/4	5/16	2-1/2	Regular	204-001140	204-001141	204-001143	204-001144
19/64	0.2969	13/16	5/16	2-1/2	Regular	204-001145	204-001148	204-021145	204-031145
		1/2	5/16	2	Stub	202-001150	202-001151	202-001152	202-001153
		13/16	5/16	2-1/2	Regular	204-001150	204-001151	204-001155	204-001153
		1-1/8	5/16	3	Long	213-001030	213-001031	213-001032	213-001033
		1-1/2	5/16	6	Ext XX/Long	216-001034	216-001035	216-001036	216-001034A
		1-5/8	5/16	4	X/Long	216-001030	216-001031	216-001032	216-001033
8.0mm	0.3150	20.0mm	8.0mm	63.0mm	Regular	204-001381	204-001381A	204-001381C	204-001381B
21/64	0.3281	1	3/8	2-1/2	Regular	204-001154	204-001157	204-021154	204-031154
11/32	0.3438	1	3/8	2-1/2	Regular	204-001160	204-001162	204-001163	204-001164
9.0mm	0.3543	22.0mm	10.0mm	63.0mm	Regular	204-001391	204-001391A	204-001391C	204-001391B
23/64	0.3594	1	3/8	2-1/2	Regular	204-001165	204-001166	204-021165	204-031165
		5/8	3/8	2	Stub	202-001170	202-001171	202-001172	202-001173
		1	3/8	2-1/2	Regular	204-001170	204-001171	204-001179	204-001173
		1-1/8	3/8	3	Long	213-001040	213-001009	213-001015	213-001010
3/8	0.3750	1-1/2	3/8	6	Ext XX/Long	216-001045	216-001046	216-001047	216-001048
		1-3/4	3/8	4	X/Long	216-001040	216-001041	216-001042	216-001043
		25/64	0.3906	1	7/16	2-3/4	Regular	204-001175	204-001178
10.0mm	0.3937	22.0mm	10.0mm	76.0mm	Regular	204-001400	204-001400A	204-001400C	204-001400B
13/32	0.4063	1	7/16	2-3/4	Regular	204-001180	204-001182	204-021180	204-001184
27/64	0.4219	1	7/16	2-3/4	Regular	204-001185	204-001187	204-021185	204-031185
11.0mm	0.4331	25.0mm	12.0mm	76.0mm	Regular	204-001410	204-001410A	204-001410C	204-001410B

2 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
7/16	0.4375	5/8	7/16	2-1/2	Stub	202-001190	202-001191	202-001192	202-001193
		1	7/16	2-3/4	Regular	204-001190	204-001191	204-001189	204-001198
		2	7/16	4	Long	213-001050	213-001051	213-001053	213-001052
		3	7/16	6	X/Long	216-001050	216-001051	216-001052	216-001053
29/64	0.4531	1	1/2	3	Regular	204-001192	204-001194	204-021192	204-031192
15/32	0.4688	1	1/2	3	Regular	204-001193	204-001197	204-021193	204-001196
12.0mm	0.4724	25.0mm	12.0mm	76.0mm	Regular	204-001420	204-001420A	204-001420C	204-001420B
31/64	0.4844	1	1/2	3	Regular	204-001195	204-001199	204-021195	204-031195
1/2	0.5000	5/8	1/2	2-1/2	Stub	202-001200	202-001201	202-001202	202-001203
		1	1/2	3	Regular	204-001200	204-001201	204-001202	204-001205
		1-1/4	1/2	3	Regular	204-001200A	204-001200AA	204-001200C	204-001205A
		1-1/2	1/2	4	Medium	213-001059	213-001056	213-001062	213-001063
		1-1/2	1/2	6	Ext X/Long	216-001053A	216-001057	216-001058	216-001059
		2	1/2	4	Long	213-001060	213-001061	213-001065	213-001064
		3	1/2	6	X/Long	216-001054	216-001061	216-001062	216-001063
33/64	0.5156	1-1/4	9/16	3-1/2	Regular	204-001206	204-001206A	204-001206C	204-001206B
17/32	0.5313	1-1/4	9/16	3-1/2	Regular	204-001207	204-001207A	204-001207C	204-001207B
14.0mm	0.5512	32.0mm	14.0mm	90.0mm	Regular	204-001430	204-001430A	204-001430C	204-001430B
5/8	0.6250	9/16	9/16	3-1/2	Regular	204-001210	204-001209	204-001211	204-001212
		3/4	5/8	3	Stub	202-001220	202-001221	202-001222	202-001223
		1-1/4	5/8	3-1/2	Regular	204-001220	204-001222	204-001225	204-001224
		1-1/2	5/8	6	Ext X/Long	216-001074	216-001076	216-001075	216-001074A
		2-1/4	5/8	5	Long	213-001070	213-001071	213-001072	213-001073
		3	5/8	6	X/Long	216-001070	216-001071	216-001072	216-001073
16.0mm	0.6299	38.0mm	16.0mm	102.0mm	Regular	204-001440	204-001440A	204-001440C	204-001440B
11/16	0.6875	1-1/2	3/4	4	Regular	204-001230	204-001231	204-001233	204-001232
3/4	0.7500	18.0mm	18.0mm	102.0mm	Regular	204-001450	204-001450A	204-001450C	204-001450B
		1	3/4	3	Stub	202-001240	202-001241	202-001242	202-001243
		1-1/2	3/4	4	Regular	204-001240	204-001241	204-001243	204-001242
		1-1/2	3/4	6	Ext X/Long	216-001084	216-001085	216-001086	216-001084A
		2-1/4	3/4	5	Long	213-001080	213-001081	213-001082	213-001083
		3	3/4	6	X/Long	216-001080	216-001081	216-001082	216-001083
		4	3/4	7	XX/Long	216-001087	216-001087A	216-001087C	216-001087B
20.0mm	0.7874	38.0mm	20.0mm	102.0mm	Regular	204-001460	204-001460A	204-001460C	204-001460B
22.0mm	0.8661	38.0mm	22.0mm	102.0mm	Regular	204-001470	—	—	204-001470B
7/8	0.8750	1-1/2	7/8	4	Regular	204-001250	204-001251	204-001252	204-001253
1	1.0000	25.0mm	25.0mm	102.0mm	Regular	204-001480	—	—	204-001480B
		1-1/2	1	4	Regular	204-001260	204-001261	204-001262	204-001263
		1-1/2	1	6	Ext X/Long	216-001095	216-001097	216-001098	216-001096
		2-1/4	1	5	Long	213-001090	213-001091	213-001092	213-001093
		3	1	6	X/Long	216-001090	216-001091	216-001092	216-001093
4	1	7	XX/Long	216-001099	216-001099A	216-001099C	216-001099B		