

**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
<b>Steels</b> 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
<b>Tool &amp; Die Steels</b> 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
<b>Stainless Steel</b> 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	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090
<b>Super Alloys</b> 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						
<b>Hardened Materials</b>	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
<b>Cast-Iron</b> 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						
<b>Non-Ferrous</b> Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N	1000	960	920	880	840	0.0027	0.0032	0.0045	0.0054	0.0063	0.0090

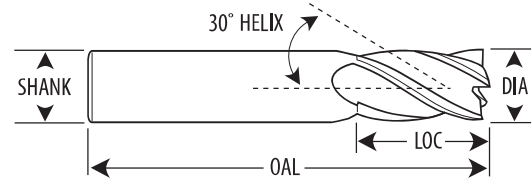
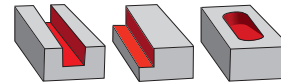
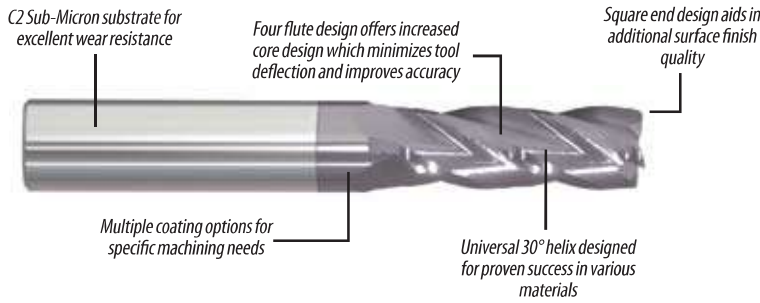
*CHIP THINNING Adjustments	
RDOC	Increase IPT
50%	None
30%	1.1 x
25%	1.2 x
20%	1.3 x
15%	1.4 x
10%	1.8 x
7%	2.0 x
5%	2.3 x
3%	3.0 x
2%	3.5 x
1%	5.0 x



**SLOTING**

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
<b>Steels</b> 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
<b>Tool &amp; Die Steels</b> A2, H13, L6, P20, S7	P 28-44 Rc	210	195	175	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050
<b>Stainless Steel</b> 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						
<b>Super Alloys</b> 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						
<b>Hardened Materials</b>	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
<b>Cast-Iron</b> 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						
<b>Non-Ferrous</b> Aluminum, Brass, Bronze, Copper, Plastics, Graphite	N	750	600	450	0.0016	0.0019	0.0025	0.0031	0.0038	0.0050

# 4 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	206-001000	206-000995	206-000996	206-000997
1/32	0.0313	1/16	1/8	1-1/2	Stub	203-001001	203-001002	203-001003	203-001004
		1/8	1/8	1-1/2	Regular	206-001001	206-001002	206-001003	206-001005
1.0mm	0.0394	4.0mm	3.0mm	39.0mm	Regular	206-001275	206-001275A	206-001270AA	206-001272
3/64	0.0469	3/32	1/8	1-1/2	Stub	203-001010	203-001011	203-001012	203-001013
		1/8	1/8	1-1/2	Regular	206-001010	206-001011	206-001013	206-001015
1.5mm	0.0591	5.0mm	3.0mm	39.0mm	Regular	206-001285	206-001285A	206-001285C	206-001287
1/16	0.0625	1/8	1/8	1-1/2	Stub	203-001020	203-001021	203-001022	203-001023
		1/4	1/8	1-1/2	Regular	206-001020	206-001021	206-001022	206-001027
5/64	0.0781	5/32	1/8	1-1/2	Stub	203-001030	203-001031	203-001032	203-001033
		1/4	1/8	1-1/2	Regular	206-001030	206-001031	206-001032	206-001036
2.0mm	0.0787	8.0mm	3.0mm	39.0mm	Regular	206-001295	206-001295A	206-001295C	206-001292
3/32	0.0938	3/16	1/8	1-1/2	Stub	203-001040	203-001041	203-001042	203-001043
		3/8	1/8	1-1/2	Regular	206-001040	206-001041	206-001042	206-001044
2.5mm	0.0984	9.5mm	3.0mm	39.0mm	Regular	206-001300	206-001300A	206-001300C	206-001302
7/64	0.1094	7/32	1/8	1-1/2	Stub	203-001050	203-001051	203-001052	203-001053
		3/8	1/8	1-1/2	Regular	206-001050	206-001051	206-001052	206-001053
3.0mm	0.1181	12.0mm	3.0mm	39.0mm	Regular	206-001313	—	206-001313C	206-001314
		1/4	1/8	1-1/2	Stub	203-001060	203-001061	203-001062	203-001063
1/8	0.1250	1/2	1/8	1-1/2	Regular	206-001060	206-001061	206-001063	206-001067
		3/4	1/8	2-1/4	Long	215-001001	215-001002	215-001003	215-001004
		1	1/8	3	X/Long	218-001001	218-001002	218-001003	218-001004
3.5mm	0.1378	12.0mm	4.0mm	51.0mm	Regular	206-001320	206-001320A	206-001320C	206-001322
9/64	0.1406	9/32	3/16	2	Stub	203-001070	203-001071	203-001072	203-001073
		9/16	3/16	2	Regular	206-001070	206-001071	206-001072	206-001073

4 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
5/32	0.1563	5/16	3/16	2	Stub	203-001080	203-001081	203-001082	203-001083
		9/16	3/16	2	Regular	206-001080	206-001081	206-001082	206-001083
		3/4	3/16	2-1/2	Long	215-001005	215-001006	215-001007	215-001008
		1-1/8	3/16	3	X/Long	218-001005	218-001006	218-001007	218-001008
4.0mm	0.1575	14.0mm	4.0mm	51.0mm	Regular	206-001330	206-001330A	206-001330C	206-001330B
11/64	0.1719	5/16	3/16	2	Stub	203-001090	203-001091	203-001092	203-001093
		9/16	3/16	2	Regular	206-001090	206-001091	206-021090	206-001093
4.5mm	0.1772	16.0mm	5.0mm	51.0mm	Regular	206-001340	206-001340A	206-001340C	206-001340B
3/16	0.1875	3/8	3/16	2	Stub	203-001100	203-001101	203-001105	203-001103
		5/8	3/16	2	Regular	206-001100	206-001101	206-001102	206-001107
		3/4	3/16	2-1/2	Long	215-001012	215-001013	215-001014	215-001015
		1	3/16	4	X/Long	218-001015	218-001015A	218-001015B	218-001015C
		1-1/8	3/16	3	X/Long	218-001010	218-001011	218-001012	218-001013
5.0mm	0.1969	16.0mm	5.0mm	51.0mm	Regular	206-001350	206-001350A	206-001350C	206-001350B
13/64	0.2031	3/8	1/4	2	Stub	203-001110	203-001111	203-001112	203-001113
		5/8	1/4	2-1/2	Regular	206-001110	206-001111	206-021110	206-001113
7/32	0.2188	7/16	1/4	2	Stub	203-001120	203-001121	203-001122	203-001123
		5/8	1/4	2-1/2	Regular	206-001120	206-001121	206-001122	206-001123
15/64	0.2344	7/16	1/4	2	Stub	203-001125	203-001126	203-001127	203-001128
		3/4	1/4	2-1/2	Regular	206-001125	206-001126	206-021125	206-001128
6.0mm	0.2362	19.0mm	6.0mm	63.0mm	Regular	206-001360	206-001360A	206-001360C	206-001360B
1/4	0.2500	1/2	1/4	2	Stub	203-001130	203-001131	203-001132	203-001133
		3/4	1/4	2-1/2	Regular	206-001130	206-001131	206-001132	206-001137
		1	1/4	4	Ext X/Long	218-001019	218-001019A	218-001019C	218-001019B
		1-1/8	1/4	3	Long	215-001020	215-001021	215-001022	215-001023
		1-1/2	1/4	4	X/Long	218-001020	218-001021	218-001024	218-001023
		1-1/2	1/4	6	Ext XX/Long	218-001025	218-001026	218-001027	218-001028
17/64	0.2656	3/4	5/16	2-1/2	Regular	206-001133	206-001135	206-021133	206-001136
7.0mm	0.2756	19.0mm	8.0mm	63.0mm	Regular	206-001370	206-001370A	206-001370C	206-001372
9/32	0.2813	1/2	5/16	2	Stub	203-001140	203-001141	203-001142	203-001143
		3/4	5/16	2-1/2	Regular	206-001140	206-001142	206-001143	206-001144
19/64	0.2969	13/16	5/16	2-1/2	Regular	206-001147	206-001145	206-021147	206-031147
5/16	0.3125	1/2	5/16	2	Stub	203-001150	203-001151	203-001152	203-001153
		13/16	5/16	2-1/2	Regular	206-001150	206-001151	206-001152	206-001153
		1-1/8	5/16	3	Long	215-001030	215-001033	215-001029	215-001028
		1-1/2	5/16	6	Ext XX/Long	218-001029	218-001029AA	218-001029B	218-001029A
		1-5/8	5/16	4	X/Long	218-001030	218-001031	218-001032	218-001033
8.0mm	0.3150	20.0mm	8.0mm	63.0mm	Regular	206-001380	206-001380A	206-001380C	206-001380B

4 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN		
21/64	0.3281	1	3/8	2-1/2	Regular	206-001154	206-001157	206-021154	206-031154		
11/32	0.3438	1	3/8	2-1/2	Regular	206-001160	206-001161	206-001162	206-001163		
9.0mm	0.3543	22.0mm	10.0mm	63.0mm	Regular	206-001390	206-001390A	206-001390C	206-001390B		
23/64	0.3594	1	3/8	2-1/2	Regular	206-001169	206-001165	206-021169	206-031169		
		5/8	3/8	2	Stub	203-001170	203-001171	203-001172	203-001173		
		1	3/8	2-1/2	Regular	206-001170	206-001171	206-001176	206-001177		
		1	3/8	4	X/Long	218-001035	218-001035A	218-001037C	218-001037		
		1-1/8	3/8	3	Long	215-001040	215-001041	215-001044	215-001043		
		1-1/2	3/8	6	Ext XX/Long	218-001045	218-001046	218-001048	218-001047		
3/8	0.3750	1-3/4	3/8	4	X/Long	218-001040	218-001039	218-001036	218-001038		
		25/64	0.3906	1	7/16	2-3/4	Regular	206-001175	206-001178	206-021175	206-031175
		10.0mm	0.3937	22.0mm	10.0mm	76.0mm	Regular	206-001400	—	206-001400C	206-001402
13/32	0.4063	1	7/16	2-3/4	Regular	206-001180	206-001181	206-001182	206-001183		
27/64	0.4219	1	7/16	2-3/4	Regular	206-001185	206-001187	206-021185	206-031185		
11.0mm	0.4331	25.0mm	12.0mm	76.0mm	Regular	206-001410	206-001410A	206-001410C	206-001412		
		5/8	7/16	2-1/2	Stub	203-001190	203-001191	203-001192	203-001193		
		1	7/16	2-3/4	Regular	206-001190	206-001191	206-001192	206-001193		
		2	7/16	4	Long	215-001050	215-001051	215-001052	215-001053		
7/16	0.4375	3	7/16	6	X/Long	218-001050	218-001051	218-001052	218-001053		
		29/64	0.4531	1	1/2	3	Regular	206-001195	206-001194	206-021195	206-031195
15/32	0.4688	1	1/2	3	Regular	206-001198	206-001196	206-021198	206-001206		
12.0mm	0.4724	25.0mm	12.0mm	76.0mm	Regular	206-001420	206-001420A	206-001420C	206-001420B		
31/64	0.4844	1	1/2	3	Regular	206-001199	206-001197	206-021199	206-031199		
		5/8	1/2	2-1/2	Stub	203-001200	203-001201	203-001202	203-001203		
		1	1/2	3	Regular	206-001200	206-001201	206-001204	206-001207		
		1	1/2	4	Small/Medium	215-001054	215-001054A	215-001054C	215-001054B		
		1-1/4	1/2	3	Regular	206-001203	206-001203B	206-001203C	206-001203A		
		1-1/2	1/2	4	Medium	215-001059	215-001058	215-001057	215-001056		
		1-1/2	1/2	6	Ext X/Long	218-001053A	218-001061	218-001062	218-001059		
		2	1/2	4	Long	215-001060	215-001063	215-001065	215-001067		
		3	1/2	6	X/Long	218-001053AA	218-001056	218-001057	218-001058		
1/2	0.5000	4	1/2	7	XXX/Long	218-001150	—	—	218-001150B		
		5	1/2	8	XXX/Long	218-001151	—	—	218-001151B		
		33/64	0.5156	1-1/4	9/16	3-1/2	Regular	206-001208	206-001208A	206-001208B	206-001218
17/32	0.5313	1-1/4	9/16	3-1/2	Regular	206-001209	206-001209A	206-001209C	206-001219		
14.0mm	0.5512	32.0mm	14.0mm	90.0mm	Regular	206-001430	206-001430A	206-001430C	206-001430B		
9/16	0.5625	1-1/4	9/16	3-1/2	Regular	206-001210	206-001211	206-001212	206-001213		
19/32	0.5938	1-1/4	5/8	3-1/2	Regular	206-001217	206-001217A	206-001217C	206-001217B		

4 FLUTE - SINGLE END - SQUARE CONTINUED

DIA	Dec In	LOC	Shank	OAL	Length	Bright	TiN	TiCN	AlTiN
5/8	0.6250	3/4	5/8	3	Stub	203-001220	203-001221	203-001222	203-001223
		1-1/4	5/8	3-1/2	Regular	206-001220	206-001221	206-001225	206-001226
		1-1/2	5/8	6	Ext X/Long	218-001074	218-001075	218-001076	218-001074A
		2-1/4	5/8	5	Long	215-001070	215-001071	215-001072	215-001073
		3	5/8	6	X/Long	218-001070	218-001071	218-001072	218-001073
		4	5/8	7	XXX/Long	218-001152	—	—	218-001152B
		5	5/8	8	XXX/Long	218-001153	—	—	218-001153B
		6	5/8	9	XXX/Long	218-001154	—	—	218-001154B
16.0mm	0.6299	32.0mm	16.0mm	102.0mm	Regular	206-001440	206-001440A	206-001440C	206-001442
41/64	0.6406	1-1/2	3/4	4	Regular	206-001236	206-001236A	206-001236C	206-001237
21/32	0.6563	1-1/2	3/4	4	Regular	206-001228	206-001228A	206-001228C	206-001228B
11/16	0.6875	1-1/2	3/4	4	Regular	206-001230	206-001231	206-001232	206-001233
18.0mm	0.7087	38.0mm	18.0mm	102.0mm	Regular	206-001450	206-001450A	206-001450C	206-001452
47/64	0.7344	1-1/2	3/4	4	Regular	206-001237F	206-001237FA	206-001237FC	206-001237FB
3/4	0.7500	1	3/4	3	Stub	203-001240	203-001241	203-001242	203-001243
		1	3/4	4	Regular	206-001238	—	—	206-001238B
		1-1/2	3/4	4	Regular	206-001239	206-001241	206-001243	206-001244
		1-1/2	3/4	6	Ext X/Long	218-001101	218-001101A	218-001101B	218-001102
		2-1/4	3/4	5	Long	215-001080	215-001081	215-001082	215-001083
		3	3/4	6	X/Long	218-001080	218-001082	218-001086	218-001079
		4	3/4	7	XX/Long	218-001081	218-001083	218-001087	218-001084
		5	3/4	8	XXX/Long	218-001155	—	—	218-001155B
		6	3/4	9	XXX/Long	218-001156	—	—	218-001156B
8	3/4	12	XXX/Long	218-001157	—	—	218-001157B		
20.0mm	0.7874	38.0mm	20.0mm	102.0mm	Regular	206-001460	206-001460A	206-001460C	206-001460B
13/16	0.8125	1-1/2	7/8	4	Regular	206-001245	206-001245A	206-001245C	206-001246
22.0mm	0.8661	38.0mm	22.0mm	102.0mm	Regular	206-001470	206-001470A	206-001470C	206-001470B
7/8	0.8750	1-1/2	7/8	4	Regular	206-001250	206-001251	206-001252	206-001254
15/16	0.9375	1-1/2	1	4	Regular	206-001255	206-001255A	206-001255C	206-001256
25.0mm	0.9843	38.0mm	25.0mm	102.0mm	Regular	206-001480	206-001480A	206-001480C	206-001480B
1	1.0000	1	1	3	Stub	203-001260	203-001261	203-001262	203-001263
		1	1	4	Regular	206-001259	—	—	206-001259B
		1-1/2	1	4	Regular	206-001260	206-001261	206-001263	206-001264
		1-1/2	1	6	Ext X/Long	218-001103	218-001105	218-001106	218-001104
		2-1/4	1	5	Long	215-001090	215-001091	215-001092	215-001093
		3	1	6	X/Long	218-001090	218-001088	218-001097	218-001094
		4	1	7	XX/Long	218-001091	218-001089	218-001098	218-001095
		5	1	8	XXX/Long	218-001158	—	—	218-001158B
		6	1	9	XXX/Long	218-001159	—	—	218-001159B
		7	1	10	XXX/Long	218-001160	—	—	218-001160B
8	1	12	XXX/Long	218-001161	—	—	218-001161B		
1-1/4	1.2500	2	1-1/4	4-1/2	Regular	206-001266	206-001266A	206-001266C	206-001266B