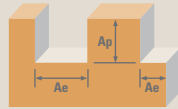
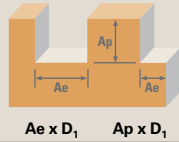


Fractional Speed & Feed Recommendations



Series	Hardness (Brinell)	Profile	Ae x D ₁	Ap x D ₁	Vc (SFM)	Diameter (D,) (inch)							
						1/8	1/4	3/8	1/2	5/8	3/4	1	
P CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275	Profile	≤ 0.5	≤ 1.5	555	RPM	16961	8480	5654	4240	3392	2827	2120
					(444-666)	Fz	0.0005	0.0012	0.0023	0.0031	0.0034	0.0037	0.0043
						Feed (IPM)	39.9	50.9	65.0	65.7	57.7	52.3	45.6
		Slot	1	≤ 1	440	RPM	13446	6723	4482	3362	2689	2241	1681
					(352-528)	Fz	0.0005	0.0012	0.0023	0.0031	0.0034	0.0037	0.0043
						Feed (IPM)	31.6	40.3	51.5	52.1	45.7	41.5	36.1
P ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375	Profile	≤ 0.5	≤ 1.5	315	RPM	9626	4813	3209	2407	1925	1604	1203
					(252-378)	Fz	0.0004	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (IPM)	16.8	21.7	27.3	27.7	25.0	22.5	19.3
		Slot	1	≤ 1	250	RPM	7640	3820	2547	1910	1528	1273	955
					(200-300)	Fz	0.0004	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (IPM)	13.4	17.2	21.6	22.0	19.9	17.8	15.3
P TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375	Profile	≤ 0.5	≤ 1.5	185	RPM	5654	2827	1885	1413	1131	942	707
					(148-222)	Fz	0.0003	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (IPM)	7.6	9.9	13.2	12.7	11.3	10.4	8.8
		Slot	1	≤ 1	145	RPM	4431	2216	1477	1108	886	739	554
					(116-174)	Fz	0.0003	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (IPM)	6.0	7.8	10.3	10.0	8.9	8.1	6.9
K CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220	Profile	≤ 0.5	≤ 1.5	445	RPM	13599	6800	4533	3400	2720	2267	1700
					(356-534)	Fz	0.0004	0.0011	0.0021	0.0028	0.0031	0.0034	0.0039
						Feed (IPM)	28.6	37.4	47.6	47.6	42.2	38.5	33.1
		Slot	1	≤ 1	355	RPM	10849	5424	3616	2712	2170	1808	1356
					(284-426)	Fz	0.0004	0.0011	0.0021	0.0028	0.0031	0.0034	0.0039
						Feed (IPM)	22.8	29.8	38.0	38.0	33.6	30.7	26.4
K CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	> 220 ≤ 260	Profile	≤ 0.5	≤ 1.5	340	RPM	10390	5195	3463	2598	2078	1732	1299
					(272-408)	Fz	0.0003	0.0008	0.0016	0.0021	0.0023	0.0025	0.0029
						Feed (IPM)	15.6	21.8	27.7	27.3	23.9	21.6	18.8
		Slot	1	≤ 1	270	RPM	8251	4126	2750	2063	1650	1375	1031
					(216-324)	Fz	0.0003	0.0008	0.0016	0.0021	0.0023	0.0025	0.0029
						Feed (IPM)	12.4	17.3	22.0	21.7	19.0	17.2	15.0
M STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275	Profile	≤ 0.5	≤ 1.5	490	RPM	14974	7487	4991	3744	2995	2496	1872
					(392-588)	Fz	0.0004	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (IPM)	26.2	33.7	42.4	43.1	38.9	34.9	29.9
		Slot	1	≤ 1	390	RPM	11918	5959	3973	2980	2384	1986	1490
					(312-468)	Fz	0.0004	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (IPM)	20.9	26.8	33.8	34.3	31.0	27.8	23.8
M STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275	Profile	≤ 0.5	≤ 1.5	340	RPM	10390	5195	3463	2598	2078	1732	1299
					(272-408)	Fz	0.0003	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (IPM)	14.0	18.2	24.2	23.4	20.8	19.0	16.2
		Slot	1	≤ 1	270	RPM	8251	4126	2750	2063	1650	1375	1031
					(216-324)	Fz	0.0003	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (IPM)	11.1	14.4	19.3	18.6	16.5	15.1	12.9
M STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325	Profile	≤ 0.5	≤ 1.5	310	RPM	9474	4737	3158	2368	1895	1579	1184
					(248-372)	Fz	0.0003	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (IPM)	12.8	16.6	22.1	21.3	18.9	17.4	14.8
		Slot	1	≤ 1	250	RPM	7640	3820	2547	1910	1528	1273	955
					(200-300)	Fz	0.0003	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (IPM)	10.3	13.4	17.8	17.2	15.3	14.0	11.9

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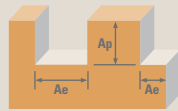


Series	Hardness (Brinell)	Profile	Ae x D ₁	Ap x D ₁	Vc (SFM)	Diameter (D ₁) (inch)							
						1/8	1/4	3/8	1/2	5/8	3/4	1	
S Z5, Z5CR Fractional	≤ 300	Profile 	≤ 0.5	≤ 1.5	80	RPM	2445	1222	815	611	489	407	306
					(64-96)	Fz	0.0002	0.0006	0.0011	0.0015	0.0017	0.0018	0.0021
						Feed (IPM)	2.8	3.7	4.5	4.6	4.2	3.7	3.2
		Slot 	1	≤ 1	65	RPM	1986	993	662	497	397	331	248
					(52-78)	Fz	0.0002	0.0006	0.0011	0.0015	0.0017	0.0018	0.0021
						Feed (IPM)	2.3	3.0	3.6	3.7	3.4	3.0	2.6
S SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300	Profile 	≤ 0.5	≤ 1.5	62	RPM	1895	947	632	474	379	316	237
					(50-74)	Fz	0.0002	0.0005	0.0009	0.0012	0.0013	0.0014	0.0017
						Feed (IPM)	1.7	2.3	2.8	2.8	2.5	2.2	2.0
		Slot 	1	≤ 1	50	RPM	1528	764	509	382	306	255	191
					(40-60)	Fz	0.0002	0.0005	0.0009	0.0012	0.0013	0.0014	0.0017
						Feed (IPM)	1.4	1.8	2.3	2.3	2.0	1.8	1.6
S TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350	Profile 	≤ 0.5	≤ 1.5	215	RPM	6570	3285	2190	1643	1314	1095	821
					(172-258)	Fz	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (IPM)	9.9	13.1	16.4	16.4	14.5	13.1	11.5
		Slot 	1	≤ 1	170	RPM	5195	2598	1732	1299	1039	866	649
					(136-204)	Fz	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (IPM)	7.8	10.4	13.0	13.0	11.4	10.4	9.1
S TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	> 350 ≤ 440	Profile 	≤ 0.5	≤ 1.5	75	RPM	2292	1146	764	573	458	382	287
					(60-90)	Fz	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (IPM)	3.4	4.6	5.7	5.7	5.0	4.6	4.0
		Slot 	1	≤ 1	60	RPM	1834	917	611	458	367	306	229
					(48-72)	Fz	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (IPM)	2.8	3.7	4.6	4.6	4.0	3.7	3.2

- Note:**
- rpm = sfm x 3.82 / D₁
 - ipm = (inch / flute) x 5 x rpm
 - ramp at 5 degrees or less, using slotting speed and feed rates (do not plunge)
 - reduce speed and feed for materials harder than listed
 - reduce feed and Ae when finish milling (.02 x D₁ maximum)
 - refer to the SGS Tool Wizard for complete technical information (www.sgstool.com)

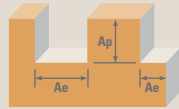


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Series	Metric	Hardness (Brinell)	Ae x D ₁	Ap x D ₁	Vc (m/min)	Diameter (D ₁) (mm)								
						6	8	10	12	16	20	25		
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275	Profile 	≤ 0.5	≤ 1.5	169	RPM	8967	6725	5380	4484	3363	2690	2152
						(135-203)	Fz	0.029	0.049	0.061	0.074	0.087	0.099	0.108
							Feed (mm/min)	1300	1648	1641	1659	1463	1332	1162
			Slot 	1	≤ 1	134	RPM	7109	5332	4265	3555	2666	2133	1706
						(107-161)	Fz	0.029	0.049	0.061	0.074	0.087	0.099	0.108
							Feed (mm/min)	1031	1306	1301	1315	1160	1056	921
P	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375	Profile 	≤ 0.5	≤ 1.5	96	RPM	5089	3817	3054	2545	1909	1527	1221
						(77-115)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	560	687	687	700	639	573	489
			Slot 	1	≤ 1	76	RPM	4039	3029	2424	2020	1515	1212	969
						(61-91)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	444	545	545	555	507	454	388
P	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375	Profile 	≤ 0.5	≤ 1.5	56	RPM	2989	2242	1793	1495	1121	897	717
						(45-68)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	254	336	332	321	286	265	226
			Slot 	1	≤ 1	44	RPM	2343	1757	1406	1171	879	703	562
						(35-53)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	199	264	260	252	224	207	177
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220	Profile 	≤ 0.5	≤ 1.5	136	RPM	7190	5392	4314	3595	2696	2157	1726
						(109-163)	Fz	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	935	1213	1208	1204	1065	981	846
			Slot 	1	≤ 1	108	RPM	5736	4302	3441	2868	2151	1721	1377
						(87-130)	Fz	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	746	968	964	961	850	783	675
K	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	> 220 ≤ 260	Profile 	≤ 0.5	≤ 1.5	104	RPM	5493	4120	3296	2747	2060	1648	1318
						(83-124)	Fz	0.020	0.034	0.043	0.050	0.059	0.067	0.073
							Feed (mm/min)	549	700	709	687	608	552	481
			Slot 	1	≤ 1	82	RPM	4362	3272	2617	2181	1636	1309	1047
						(66-99)	Fz	0.020	0.034	0.043	0.050	0.059	0.067	0.073
							Feed (mm/min)	436	556	563	545	483	438	382
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275	Profile 	≤ 0.5	≤ 1.5	149	RPM	7917	5938	4750	3958	2969	2375	1900
						(119-179)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	871	1069	1069	1089	995	891	760
			Slot 	1	≤ 1	119	RPM	6301	4726	3781	3151	2363	1890	1512
						(95-143)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	693	851	851	866	792	709	605
M	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275	Profile 	≤ 0.5	≤ 1.5	104	RPM	5493	4120	3296	2747	2060	1648	1318
						(83-124)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	467	618	610	591	525	486	415
			Slot 	1	≤ 1	82	RPM	4362	3272	2617	2181	1636	1309	1047
						(66-99)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	371	491	484	469	417	386	330
M	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325	Profile 	≤ 0.5	≤ 1.5	94	RPM	5009	3756	3005	2504	1878	1503	1202
						(76-113)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	426	563	556	538	479	443	379
			Slot 	1	≤ 1	76	RPM	4039	3029	2424	2020	1515	1212	969
						(61-91)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	343	454	448	434	386	357	305

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Series Z5MCR Metric	Hardness (Brinell)	Profile Ae x D ₁	Slot Ap x D ₁	Vc (m/min)	Diameter (D ₁) (mm)							
					6	8	10	12	16	20	25	
S SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300	Profile ≤ 0.5	≤ 1.5	24	RPM	1293	969	776	646	485	388	310
				(20-29)	Fz	0.014	0.023	0.029	0.036	0.044	0.048	0.053
					Feed (mm/min)	90	111	112	116	107	93	82
		Slot 1	≤ 1	20	RPM	1050	788	630	525	394	315	252
				(16-24)	Fz	0.014	0.023	0.029	0.036	0.044	0.048	0.053
					Feed (mm/min)	74	91	91	95	87	76	67
S SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	> 300	Profile ≤ 0.5	≤ 1.5	19	RPM	1002	751	601	501	376	301	240
				(15-23)	Fz	0.012	0.019	0.024	0.029	0.033	0.037	0.043
					Feed (mm/min)	60	71	72	73	62	56	52
		Slot 1	≤ 1	15	RPM	808	606	485	404	303	242	194
				(12-18)	Fz	0.012	0.019	0.024	0.029	0.033	0.037	0.043
					Feed (mm/min)	48	58	58	59	50	45	42
S TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350	Profile ≤ 0.5	≤ 1.5	66	RPM	3474	2605	2084	1737	1303	1042	834
				(52-79)	Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
					Feed (mm/min)	330	417	417	417	365	333	292
		Slot 1	≤ 1	52	RPM	2747	2060	1648	1373	1030	824	659
				(41-62)	Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
					Feed (mm/min)	261	330	330	330	288	264	231
S TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	> 350 ≤ 440	Profile ≤ 0.5	≤ 1.5	23	RPM	1212	909	727	606	454	364	291
				(18-27)	Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
					Feed (mm/min)	115	145	145	145	127	116	102
		Slot 1	≤ 1	18	RPM	969	727	582	485	364	291	233
				(15-22)	Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
					Feed (mm/min)	92	116	116	116	102	93	81

Note:

- rpm = (1000 x m/min) / (3.14 x D₁)
- mm / min = (mm / flute) x 5 x rpm
- ramp at 5 degrees or less, using slotting speed and feed rates (do not plunge)
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D₁ maximum)
- refer to the SGS Tool Wizard for complete technical information (www.sgstool.com)



Tool Wizard
CALCULATE APPLICATION PARAMETERS

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