















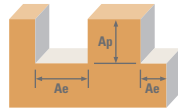


Series	Hardness	Ae x D ₁	Ap x D ₁	Vc (sfm)	Diameter (D ₁) (inch)								
					1/8	1/4	3/8	1/2	5/8	3/4	1		
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536 ≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ 0.5	≤ 1.5	555	RPM	16961	8480	5654	4240	3392	2827	2120
					(444-666)	Fz	0.00046	0.0012	0.0023	0.0031	0.0034	0.0037	0.0043
					Feed (ipm)	39.0	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	0.00046	0.0012	0.0023	0.0031	0.0034	0.0037	0.0043
					Feed (ipm)	30.9	40.3	51.5	52.1	45.7	41.5	36.1	
P	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100 ≤ 375 Bhn or ≤ 40 HRc	Profile 	≤ 0.5	≤ 1.5	315	RPM	9626	4813	3209	2407	1925	1604	1203
					(252-378)	Fz	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
					Feed (ipm)	16.4	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	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
					Feed (ipm)	13.0	17.2	21.6	22.0	19.9	17.8	15.3	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2 ≤ 375 Bhn or ≤ 40 HRc	Profile 	≤ 0.5	≤ 1.5	185	RPM	5654	2827	1885	1413	1131	942	707
					(148-222)	Fz	0.00028	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
					Feed (ipm)	7.9	9.9	13.2	12.7	11.3	10.4	9.2	
		Slot 	1	≤ 1	145	RPM	4431	2216	1477	1108	886	739	554
					(116-174)	Fz	0.00028	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
					Feed (ipm)	6.2	7.8	10.3	10.0	8.9	8.1	7.2	
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile ≤ 220 Bhn or ≤ 19 HRc	Profile 	≤ 0.5	≤ 1.5	445	RPM	13599	6800	4533	3400	2720	2267	1700
					(356-534)	Fz	0.00042	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	0.00042	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 ≤ 260 Bhn or ≤ 26 HRc	Profile 	≤ 0.5	≤ 1.5	340	RPM	10390	5195	3463	2598	2078	1732	1299
					(272-408)	Fz	0.00031	0.0008	0.0016	0.0021	0.0023	0.0025	0.0029
					Feed (ipm)	16.1	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	0.00031	0.0008	0.0016	0.0021	0.0023	0.0025	0.0029
					Feed (ipm)	12.8	17.3	22.0	21.7	19.0	17.2	15.0	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F ≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ 0.5	≤ 1.5	490	RPM	14974	7487	4991	3744	2995	2496	1872
					(392-588)	Fz	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
					Feed (ipm)	25.5	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	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
					Feed (ipm)	20.3	26.8	33.8	34.3	31.0	27.8	23.8	
M	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L ≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ 0.5	≤ 1.5	340	RPM	10390	5195	3463	2598	2078	1732	1299
					(272-408)	Fz	0.00027	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	0.00027	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 Bhn or ≤ 35 HRc	Profile 	≤ 0.5	≤ 1.5	310	RPM	9474	4737	3158	2368	1895	1579	1184
					(248-372)	Fz	0.00027	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	0.00027	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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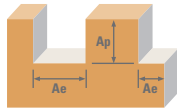




Series Z5, Z5CR Fractional	Hardness	Profile Ae x D ₁	Slot Ap x D ₁	Vc (sfm)	Diameter (D ₁) (inch)																				
					1/8	1/4	3/8	1/2	5/8	3/4	1														
					RPM	Fz	Feed (ipm)	RPM	Fz	Feed (ipm)	RPM	Fz	Feed (ipm)												
SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.5	≤ 1.5	80	2445	0.00025	3.1	1222	0.00068	4.2	815	0.00128	5.2	611	0.00170	4.6	489	0.00187	0.00204	4.2	306	0.00238	3.6	
		Slot	1	≤ 1	65	1986	0.00025	2.5	993	0.00068	3.4	497	0.00128	4.2	379	0.00170	3.7	316	0.00187	0.00204	3.4	248	0.00238	3.0	
	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.5	≤ 1.5	62	1895	0.00018	1.7	947	0.00048	2.3	632	0.00090	2.8	474	0.00120	2.5	379	0.00130	0.00140	2.2	316	0.00170	2.0	
		Slot	1	≤ 1	50	1528	0.00018	1.4	764	0.00048	1.8	382	0.00090	2.3	306	0.00120	2.0	255	0.00130	0.00140	1.8	191	0.00170	1.6	
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.5	≤ 1.5	215	6570	0.0003	9.9	3285	0.0008	13.1	2190	0.0015	16.4	1643	0.0020	14.5	1314	0.0022	0.0024	13.1	1095	0.0028	11.5
			Slot	1	≤ 1	170	5195	0.0003	7.8	2598	0.0008	10.4	1732	0.0015	13.0	1299	0.0020	11.4	1039	0.0022	0.0024	10.4	866	0.0028	9.1
≤ 440 Bhn or ≤ 47 HRc		Profile	≤ 0.5	≤ 1.5	75	2292	0.0003	3.4	1146	0.0008	4.6	764	0.0015	5.7	573	0.0020	5.0	458	0.0022	0.0024	4.6	382	0.0028	4.0	
		Slot	1	≤ 1	60	1834	0.0003	2.8	917	0.0008	3.7	611	0.0015	4.6	458	0.0020	4.0	367	0.0022	0.0024	3.7	229	0.0028	3.2	
TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile	≤ 0.5	≤ 1.5	60	1834	0.0003	3.4	917	0.0008	4.6	611	0.0015	5.7	458	0.0020	5.0	367	0.0022	0.0024	4.6	229	0.0028	4.0	
		Slot	1	≤ 1	48	1488	0.0003	2.8	732	0.0008	3.7	497	0.0015	4.6	382	0.0020	4.0	306	0.0022	0.0024	3.7	229	0.0028	3.2	

Note:

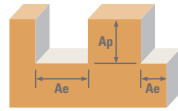
- Bhn (Brinell) HRc (Rockwell C)
- rpm = Vc x 3.82 / D₁
- ipm = Fz x 5 x rpm
- ramp at 5 degrees or less, using slotting speed and feed rates (do not plunge)
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D₁ maximum)
- refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)









TOOLWIZARD® 2.1
www.sgstoolwizard.com



Series Z5MCR Metric	Hardness	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 Bhn or ≤ 28 HRc	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)	1291	1650	1650	1668	1463	1327	1157
		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)	1024	1308	1308	1322	1160	1052	917
ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100 ≤ 375 Bhn or ≤ 40 HRc	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)	550	692	692	702	635	570	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)	436	549	549	557	504	452	388	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2 ≤ 375 Bhn or ≤ 40 HRc	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	0.065
						Feed (mm/min)	251	335	335	323	287	263	233
		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	0.065
						Feed (mm/min)	197	262	262	253	225	206	183
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile ≤ 220 Bhn or ≤ 19 HRc	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)	949	1208	1208	1208	1070	978	841
		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)	757	964	964	964	853	780	671
CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile ≤ 260 Bhn or ≤ 26 HRc	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)	554	703	703	692	606	549	478	
	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)	440	558	558	550	482	436	380	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F ≤ 275 Bhn or ≤ 28 HRc	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)	855	1077	1077	1092	988	887	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)	680	857	857	869	786	706	605
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L ≤ 275 Bhn or ≤ 28 HRc	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)	461	615	615	593	527	483	412
		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)	366	489	489	471	419	384	327
STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450 ≤ 325 Bhn or ≤ 35 HRc	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)	421	561	561	541	481	441	376	
	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)	339	452	452	436	388	355	303	

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Series Z5MCR Metric	Hardness	Ae x D ₁	Ap x D ₁	Vc (m/min)	Diameter (D ₁) (mm)												
					6	8	10	12	16	20	25						
SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile 	≤ 0.5	≤ 1.5	24 (20-29)	RPM	1293	969	776	646	485	388	310				
						Fz	0.0160	0.0272	0.0340	0.0409	0.0478	0.0531	0.0599				
					Slot 	1	≤ 1	20 (16-24)	RPM	1050	788	630	525	394	315	252	
									Fz	0.0160	0.0272	0.0340	0.0409	0.0478	0.0531	0.0599	
								Feed (mm/min)	103	132	132	132	116	103	93		
									84	107	107	107	94	84	75		
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile 	≤ 0.5	≤ 1.5	19 (15-23)	RPM	1002	751	601	501	376	301	240			
							Fz	0.0112	0.0192	0.0239	0.0284	0.0333	0.0371	0.0420			
						Slot 	1	≤ 1	15 (12-18)	RPM	808	606	485	404	303	242	194
										Fz	0.0112	0.0192	0.0239	0.0284	0.0333	0.0371	0.0420
									Feed (mm/min)	45	58	58	57	50	45	41	
										45	58	58	57	50	45	41	
TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si		≤ 350 Bhn or ≤ 38 HRc	Profile 	≤ 0.5	≤ 1.5	66 (52-79)	RPM	3474	2605	2084	1737	1303	1042	834			
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070			
						Slot 	1	≤ 1	52 (41-62)	RPM	2747	2060	1648	1373	1030	824	659
										Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
									Feed (mm/min)	333	417	417	417	367	333	292	
										264	330	330	330	290	264	231	
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile 	≤ 0.5	≤ 1.5	23 (18-27)	RPM	1212	909	727	606	454	364	291			
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.071			
						Slot 	1	≤ 1	18 (15-22)	RPM	969	727	582	485	364	291	233
										Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.071
									Feed (mm/min)	116	145	145	145	128	116	103	
										93	116	116	116	102	93	83	

Note:

- Bhn (Brinell) HRc (Rockwell C)
- rpm = (Vc x 1000) / (D₁ x 3.14)
- mm/min = Fz 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 KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)