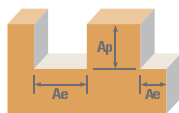
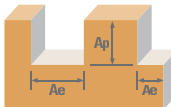


Series 33



Series 33MCR Metric		Hardness			Vc (m/min)	Diameter (D ₁) (mm)								
			Ae x D ₁	Ap x D ₁		3	6	8	10	12	16	20		
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRC	 Profile	≤ 0.5	≤ 1.5	168	RPM	17773	8886	6665	5332	4443	3332	2666
						(134-201)	Fz	0.012	0.029	0.049	0.061	0.074	0.100	0.107
						Feed (mm/min)	640	768	981	981	992	998	853	
			 Slot	1	≤ 1	134	RPM	14218	7109	5332	4265	3555	2666	2133
						(107-161)	Fz	0.012	0.029	0.049	0.061	0.074	0.100	0.107
						Feed (mm/min)	512	614	785	785	793	798	682	
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRC	 Profile	≤ 0.5	≤ 1.5	96	RPM	10179	5089	3817	3054	2545	1909	1527
						(77-115)	Fz	0.010	0.022	0.036	0.045	0.055	0.074	0.080
						Feed (mm/min)	293	330	415	415	421	425	366	
			 Slot	1	≤ 1	76	RPM	8078	4039	3029	2424	2020	1515	1212
						(61-91)	Fz	0.010	0.022	0.036	0.045	0.055	0.074	0.080
						Feed (mm/min)	233	262	330	330	334	337	291	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRC	 Profile	≤ 0.5	≤ 1.5	56	RPM	5978	2989	2242	1793	1495	1121	897
						(45-68)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064
						Feed (mm/min)	129	151	201	201	194	198	172	
			 Slot	1	≤ 1	44	RPM	4686	2343	1757	1406	1171	879	703
						(35-53)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064
						Feed (mm/min)	101	118	157	157	152	155	135	
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRC	 Profile	≤ 0.5	≤ 1.5	136	RPM	14380	7190	5392	4314	3595	2696	2157
						(109-163)	Fz	0.008	0.026	0.045	0.056	0.067	0.090	0.096
						Feed (mm/min)	362	569	725	725	725	725	621	
			 Slot	1	≤ 1	108	RPM	11471	5736	4302	3441	2868	2151	1721
						(87-130)	Fz	0.008	0.026	0.045	0.056	0.067	0.090	0.096
						Feed (mm/min)	289	454	578	578	578	578	496	
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRC	 Profile	≤ 0.5	≤ 1.5	104	RPM	10987	5493	4120	3296	2747	2060	1648
						(83-124)	Fz	0.007	0.019	0.034	0.043	0.050	0.067	0.072
						Feed (mm/min)	237	316	422	422	415	411	356	
			 Slot	1	≤ 1	82	RPM	8725	4362	3272	2617	2181	1636	1309
						(66-99)	Fz	0.007	0.019	0.034	0.043	0.050	0.067	0.072
						Feed (mm/min)	188	251	335	335	330	327	283	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRC	 Profile	≤ 0.5	≤ 1.5	149	RPM	15834	7917	5938	4750	3958	2969	2375
						(119-179)	Fz	0.009	0.024	0.041	0.051	0.060	0.079	0.085
						Feed (mm/min)	433	570	722	722	712	707	608	
			 Slot	1	≤ 1	119	RPM	12602	6301	4726	3781	3151	2363	1890
						(95-143)	Fz	0.009	0.024	0.041	0.051	0.060	0.079	0.085
						Feed (mm/min)	345	454	575	575	567	563	484	

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Series 33MCR Metric	Hardness			Vc (m/min)	Diameter (D ₁) (mm)								
		Ae x D ₁	Ap x D ₁		3	6	8	10	12	16	20		
M	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L ≤ 275 Bhn or ≤ 28 HRc		≤ 0.5	≤ 1.5	104	RPM	10987	5493	4120	3296	2747	2060	1648
					(83-124)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	237	316	396	396	395	396	343	
			1	≤ 1	82	RPM	8725	4362	3272	2617	2181	1636	1309
					(66-99)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	188	251	314	314	314	314	272	
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450 ≤ 325 Bhn or ≤ 35 HRc		≤ 0.5	≤ 1.5	94	RPM	10017	5009	3756	3005	2504	1878	1503
					(76-113)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	216	288	361	361	361	361	313	
			1	≤ 1	76	RPM	8078	4039	3029	2424	2020	1515	1212
					(61-91)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	174	233	291	291	291	291	252	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400 ≤ 300 Bhn or ≤ 32 HRc		≤ 0.5	≤ 1.5	24	RPM	2585	1293	969	776	646	485	388
					(20-29)	Fz	0.006	0.017	0.028	0.035	0.041	0.054	0.059
					Feed (mm/min)	48	65	81	65	79	78	68	
			1	≤ 1	20	RPM	2100	1050	788	630	525	394	315
					(16-24)	Fz	0.006	0.017	0.028	0.035	0.041	0.054	0.059
					Feed (mm/min)	39	53	66	66	64	64	55	
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene ≤ 400 Bhn or ≤ 43 HRc		≤ 0.5	≤ 1.5	19	RPM	2003	1002	751	601	501	376	301
					(15-23)	Fz	0.005	0.012	0.019	0.024	0.029	0.038	0.043
					Feed (mm/min)	29	36	43	43	43	43	38	
			1	≤ 1	15	RPM	1583	792	594	475	396	297	238
					(12-18)	Fz	0.005	0.012	0.019	0.024	0.029	0.038	0.043
					Feed (mm/min)	23	28	34	34	34	34	30	
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si ≤ 350 Bhn or ≤ 38 HRc		≤ 0.5	≤ 1.5	66	RPM	6947	3474	2605	2084	1737	1303	1042
					(52-79)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	150	200	250	250	250	250	217	
			1	≤ 1	52	RPM	5493	2747	2060	1648	1373	1030	824
					(41-62)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	119	158	198	198	198	198	171	
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al ≤ 440 Bhn or ≤ 47 HRc		≤ 0.5	≤ 1.5	23	RPM	2424	1212	909	727	606	454	364
					(18-27)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	52	70	87	87	87	87	76	
			1	≤ 1	18	RPM	1939	969	727	582	485	364	291
					(15-22)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
					Feed (mm/min)	42	56	70	70	70	70	60	

Bhn (Brinell) HRc (Rockwell C)

rpm = (Vc x 1000) / (D₁ x 3.14)

mm/min = Fz x 3 x rpm

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)