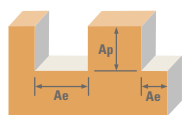








Series Z1M, Z1MPCR, Z1MPIC, Z1MPLC Metric	Hardness	Ae x DC	Ap x DC	Vc (m/min)	DC • mm										
					1	3	6	8	10	12	16	20	25		
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	Profile	≤ 0.5	≤ 1.5	169	RPM	53803	17934	8967	6725	5380	4484	3363	2690	2152
					(135-203)	Fz	0.0030	0.0109	0.029	0.049	0.061	0.074	0.087	0.099	0.108
					Feed (mm/min)	646	782	1040	1318	1313	1327	1170	1065	930	
		Slot	1	≤ 1	134	RPM	42654	14218	7109	5332	4265	3555	2666	2133	1706
					(107-161)	Fz	0.0030	0.0109	0.029	0.049	0.061	0.074	0.087	0.099	0.108
					Feed (mm/min)	512	620	825	1045	1041	1052	928	845	737	
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	Profile	≤ 0.5	≤ 1.5	96	RPM	30537	10179	5089	3817	3054	2545	1909	1527	1221
					(77-115)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	281	330	448	550	550	560	511	458	391	
		Slot	1	≤ 1	76	RPM	24235	8078	4039	3029	2424	2020	1515	1212	969
					(61-91)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	223	262	355	436	436	444	406	364	310	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	Profile	≤ 0.5	≤ 1.5	149	RPM	47501	15834	7917	5938	4750	3958	2969	2375	1900
					(119-179)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	437	513	697	855	855	871	796	713	608	
		Slot	1	≤ 1	119	RPM	37807	12602	6301	4726	3781	3151	2363	1890	1512
					(95-143)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	348	408	555	681	681	693	633	567	484	
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	Profile	≤ 0.5	≤ 1.5	104	RPM	32960	10987	5493	4120	3296	2747	2060	1648	1318
					(83-124)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
					Feed (mm/min)	237	281	374	494	488	472	420	389	332	
		Slot	1	≤ 1	82	RPM	26174	8725	4362	3272	2617	2181	1636	1309	1047
					(66-99)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
					Feed (mm/min)	188	223	297	393	387	375	334	309	264	
STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	Profile	≤ 0.5	≤ 1.5	94	RPM	30052	10017	5009	3756	3005	2504	1878	1503	1202	
				(76-113)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063	
				Feed (mm/min)	216	256	341	451	445	431	383	355	303		
	Slot	1	≤ 1	76	RPM	24235	8078	4039	3029	2424	2020	1515	1212	969	
				(61-91)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063	
				Feed (mm/min)	174	207	275	364	359	347	309	286	244		
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	Profile	≤ 0.5	≤ 1.5	136	RPM	43139	14380	7190	5392	4314	3595	2696	2157	1726
					(109-163)	Fz	0.0028	0.0099	0.026	0.045	0.056	0.067	0.079	0.091	0.098
					Feed (mm/min)	483	569	748	971	966	963	852	785	676	
		Slot	1	≤ 1	108	RPM	34414	11471	5736	4302	3441	2868	2151	1721	1377
					(87-130)	Fz	0.0028	0.0099	0.026	0.045	0.056	0.067	0.079	0.091	0.098
					Feed (mm/min)	385	454	597	774	771	769	680	626	540	

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METRIC Z-Carb-AP



Series
Z1M, Z1MPCR,
Z1MPIC, Z1MPLC
Metric

Metric	Hardness	Ae x DC	Ap x DC	Vc (m/min)	DC • mm											
					1	3	6	8	10	12	16	20	25			
K	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile 	≤ 0.5	≤ 1.5	104	RPM	32960	10987	5493	4120	3296	2747	2060	1648	1318
						(83-124)	Fz	0.0020	0.0074	0.020	0.034	0.043	0.050	0.059	0.067	0.074
						Feed (mm/min)	264	325	439	560	567	549	486	442	390	
						82	RPM	26174	8725	4362	3272	2617	2181	1636	1309	1047
						(66-99)	Fz	0.0020	0.0074	0.020	0.034	0.043	0.050	0.059	0.067	0.074
						Feed (mm/min)	209	258	349	445	450	436	386	351	310	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile 	≤ 0.5	≤ 1.5	24	RPM	7755	2585	1293	969	776	646	485	388	310
						(20-29)	Fz	0.0018	0.0061	0.016	0.027	0.034	0.041	0.048	0.053	0.060
						Feed (mm/min)	56	63	83	105	105	106	93	82	74	
						20	RPM	6301	2100	1050	788	630	525	394	315	252
						(16-24)	Fz	0.0018	0.0061	0.016	0.027	0.034	0.041	0.048	0.053	0.060
						Feed (mm/min)	45	51	67	85	86	86	76	67	60	
S	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	RPM	6010	2003	1002	751	601	501	376	301	240
						(15-23)	Fz	0.0013	0.0043	0.011	0.019	0.024	0.028	0.033	0.037	0.042
						Feed (mm/min)	31	34	44	57	58	56	50	44	40	
						15	RPM	4847	1616	808	606	485	404	303	242	194
						(12-18)	Fz	0.0013	0.0043	0.011	0.019	0.024	0.028	0.033	0.037	0.042
						Feed (mm/min)	25	28	36	46	47	45	40	36	33	
S	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile 	≤ 0.5	≤ 1.5	66	RPM	20842	6947	3474	2605	2084	1737	1303	1042	834
						(52-79)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	167	197	264	333	333	333	292	267	233	
						52	RPM	16480	5493	2747	2060	1648	1373	1030	824	659
						(41-62)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	132	156	209	264	264	264	231	211	185	
H	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile 	≤ 0.5	≤ 1.5	23	RPM	7271	2424	1212	909	727	606	454	364	291
						(18-27)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	58	69	92	116	116	116	102	93	81	
						18	RPM	5816	1939	969	727	582	485	364	291	233
						(15-22)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	47	55	74	93	93	93	81	74	65	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile 	≤ 0.5	≤ 1.5	56	RPM	17934	5978	2989	2242	1793	1495	1121	897	717
						(45-68)	Fz	0.0018	0.0066	0.017	0.030	0.037	0.043	0.051	0.059	0.065
						Feed (mm/min)	129	158	203	269	265	257	229	212	187	
						44	RPM	14057	4686	2343	1757	1406	1171	879	703	562
						(35-53)	Fz	0.0018	0.0066	0.017	0.030	0.037	0.043	0.051	0.059	0.065
						Feed (mm/min)	101	124	159	211	208	201	179	166	146	

Bhn (Brinell) HRc (Rockwell C)

$\text{rpm} = (\text{Vc} \times 1000) / (\text{DC} \times 3.14)$

$\text{mm/min} = \text{Fz} \times 4 \times \text{rpm}$

maximum Slotting Ap for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .25 x DC

maximum Profile Ae for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .20 x DC

reduce speed and feed for materials harder than listed

reduce feed and Ae when finish milling (.02 x DC maximum)

feed rates listed have chip thinning adjustments included where applicable

refer to the SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)