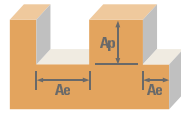


Series 77M, 77MCR Metric	Hardness	Ae x D <sub>1</sub>	Ap x D <sub>1</sub>	Vc (m/min)	D <sub>1</sub> • mm							
					6	8	10	12	16	20	25	
<b>P</b>  <b>CARBON STEELS</b> 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	HSM	2.5xD	284 (227-341)	RPM	12208	9156	7325	6104	4578	3662	2930
			≤ 0.2 ≤ APMX		Fz	0.0413	0.0411	0.0640	0.0711	0.0889	0.1013	0.1050
		HSM	3xD	257 (206-308)	Feed (ipm)	3529	2634	3282	3038	2849	2597	2154
			≤ 0.15 ≤ APMX		Fz	0.0347	0.0461	0.0717	0.0797	0.0996	0.1135	0.1176
		HSM	4xD	230 (184-276)	Feed (ipm)	2965	2955	3676	3405	3192	2910	2412
			≤ 0.1 ≤ APMX		Fz	0.0362	0.0480	0.0747	0.0830	0.1037	0.1182	0.0919
	≤ 375 Bhn or ≤ 40 HRc	HSM	2.5xD	132 (106-159)	RPM	8068	6051	4841	4034	3025	2420	1936
			≤ 0.2 ≤ APMX		Fz	0.0213	0.0285	0.0512	0.0610	0.0711	0.0827	0.0875
		HSM	3xD	138 (111-166)	Feed (ipm)	1203	1207	1735	1723	1506	1401	1186
			≤ 0.15 ≤ APMX		Fz	0.0239	0.0319	0.0574	0.0683	0.0797	0.0926	0.0980
		HSM	4xD	152 (122-182)	Feed (ipm)	1350	1351	1945	1929	1688	1569	1328
			≤ 0.1 ≤ APMX		Fz	0.0249	0.0332	0.0597	0.0711	0.0830	0.0964	0.1021
<b>M</b>  <b>STAINLESS STEELS (FREE MACHINING)</b> 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	HSM	2.5xD	197 (158-236)	RPM	9660	7245	5796	4830	3623	2898	2318
			≤ 0.2 ≤ APMX		Fz	0.0216	0.0285	0.0448	0.0533	0.0635	0.0747	0.0800
		HSM	3xD	204 (163-245)	Feed (ipm)	1461	1445	1818	1803	1610	1515	1298
			≤ 0.15 ≤ APMX		Fz	0.0242	0.0319	0.0502	0.0598	0.0711	0.0837	0.0896
		HSM	4xD	182 (146-218)	Feed (ipm)	1636	1618	2037	2022	1803	1698	1454
			≤ 0.1 ≤ APMX		Fz	0.0252	0.0332	0.0523	0.0622	0.0741	0.0871	0.0933
	≤ 275 Bhn or ≤ 28 HRc	HSM	2.5xD	130 (104-156)	RPM	6369	4777	3822	3185	2389	1911	1529
			≤ 0.2 ≤ APMX		Fz	0.0168	0.0221	0.0371	0.0432	0.0584	0.0693	0.0750
		HSM	3xD	134 (107-161)	Feed (ipm)	749	739	993	963	976	927	803
			≤ 0.15 ≤ APMX		Fz	0.0188	0.0248	0.0416	0.0484	0.0655	0.0777	0.0840
		HSM	4xD	120 (96-144)	Feed (ipm)	838	829	1113	1079	1095	1039	899
			≤ 0.1 ≤ APMX		Fz	0.0196	0.0258	0.0433	0.0504	0.0682	0.0809	0.0875
≤ 325 Bhn or ≤ 35 HRc	HSM	2.5xD	124 (99-149)	RPM	6104	4578	3662	3052	2289	1831	1465	
		≤ 0.2 ≤ APMX		Fz	0.0168	0.0221	0.0371	0.0432	0.0584	0.0693	0.0750	
	HSM	3xD	129 (103-155)	Feed (ipm)	718	708	952	923	936	888	769	
		≤ 0.15 ≤ APMX		Fz	0.0188	0.0248	0.0416	0.0484	0.0655	0.0777	0.0840	
	HSM	4xD	115 (92-138)	Feed (ipm)	803	795	1066	1034	1050	996	861	
		≤ 0.1 ≤ APMX		Fz	0.0196	0.0258	0.0433	0.0504	0.0682	0.0809	0.0875	
<b>P</b>  <b>CAST IRONS (LOW &amp; MEDIUM ALLOY)</b> Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	HSM	2.5xD	218 (174-262)	RPM	10722	8041	6433	5361	4021	3217	2573
			≤ 0.2 ≤ APMX		Fz	0.0239	0.0315	0.0474	0.0559	0.0762	0.0880	0.0925
		HSM	3xD	225 (180-270)	Feed (ipm)	1794	1773	2135	2098	2145	1981	1666
			≤ 0.15 ≤ APMX		Fz	0.0268	0.0353	0.0531	0.0626	0.0854	0.0986	0.1036
		HSM	4xD	202 (162-242)	Feed (ipm)	2011	1987	2391	2349	2404	2220	1866
			≤ 0.1 ≤ APMX		Fz	0.0279	0.0368	0.0553	0.0652	0.0889	0.1027	0.1079
	≤ 260 Bhn or ≤ 26 HRc	HSM	2.5xD	130 (104-156)	RPM	6369	4777	3822	3185	2389	1911	1529
			≤ 0.2 ≤ APMX		Fz	0.0168	0.0221	0.0371	0.0432	0.0584	0.0693	0.0750
		HSM	3xD	134 (107-161)	Feed (ipm)	749	739	993	963	976	927	803
			≤ 0.15 ≤ APMX		Fz	0.0188	0.0248	0.0416	0.0484	0.0655	0.0777	0.0840
		HSM	4xD	120 (96-144)	Feed (ipm)	838	829	1113	1079	1095	1039	899
			≤ 0.1 ≤ APMX		Fz	0.0196	0.0258	0.0433	0.0504	0.0682	0.0809	0.0875
<b>N</b>  <b>NON-FERROUS MATERIALS</b>	Not Recommended for this Material Group											

continued on next page



Series 77M, 77MCR Metric	Hardness	Ae x D <sub>1</sub>	Ap x D <sub>1</sub>	Vc (m/min)	D <sub>1</sub> • mm								
					6	8	10	12	16	20	25		
<b>SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400</b>	≤ 300 Bhn or ≤ 32 HRc	HSM 2.5xD	≤ 0.2 ≤ APMX	41 (33-49)	RPM	2017	1513	1210	1008	756	605	484	
					Fz	0.0140	0.0183	0.0294	0.0356	0.0457	0.0560	0.0625	
		Feed (ipm)	198	194	249	251	242	237	212				
		HSM 3xD	≤ 0.15 ≤ APMX	43 (34-52)	Fz	0.0157	0.0205	0.0330	0.0398	0.0512	0.0627	0.0700	
					Feed (ipm)	222	217	280	281	271	266	237	
		HSM 4xD	≤ 0.1 ≤ APMX	38 (30-46)	Fz	0.0163	0.0213	0.0344	0.0415	0.0533	0.0653	0.0729	
	Feed (ipm)				230	226	291	293	282	277	247		
						RPM	1274	955	764	637	478	382	306
	<b>SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene</b>	≤ 400 Bhn or ≤ 43 HRc	HSM 2.5xD	≤ 0.2 ≤ APMX	26 (21-31)	Fz	0.0114	0.0152	0.0243	0.0305	0.0381	0.0480	0.0550
						Feed (ipm)	102	102	130	136	127	128	118
			HSM 3xD	≤ 0.15 ≤ APMX	27 (22-32)	Fz	0.0128	0.0171	0.0273	0.0342	0.0427	0.0538	0.0616
						Feed (ipm)	114	114	146	152	143	144	132
HSM 4xD			≤ 0.1 ≤ APMX	24 (19-29)	Fz	0.0133	0.0178	0.0284	0.0356	0.0445	0.0560	0.0642	
					Feed (ipm)	119	119	152	159	149	150	137	
					RPM	4352	3264	2611	2176	1632	1306	1045	
<b>TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si</b>	≤ 350 Bhn or ≤ 38 HRc	HSM 2.5xD	≤ 0.2 ≤ APMX	88 (70-106)	Fz	0.0191	0.0254	0.0397	0.0483	0.0635	0.0747	0.0800	
					Feed (ipm)	582	580	726	736	725	683	585	
		HSM 3xD	≤ 0.15 ≤ APMX	91 (73-109)	Fz	0.0213	0.0285	0.0445	0.0541	0.0711	0.0837	0.0896	
					Feed (ipm)	649	651	813	824	812	765	655	
		HSM 4xD	≤ 0.1 ≤ APMX	82 (66-98)	Fz	0.0222	0.0296	0.0463	0.0563	0.0741	0.0871	0.0933	
					Feed (ipm)	676	676	846	858	847	796	682	
					RPM	2548	1911	1529	1274	955	764	611	
<b>TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al</b>	≤ 440 Bhn or ≤ 47 HRc	HSM 2.5xD	≤ 0.2 ≤ APMX	52 (42-62)	Fz	0.0163	0.0254	0.0397	0.0483	0.0635	0.0747	0.0800	
					Feed (ipm)	291	340	425	431	425	400	342	
		HSM 3xD	≤ 0.15 ≤ APMX	54 (43-65)	Fz	0.0182	0.0285	0.0445	0.0541	0.0711	0.0837	0.0896	
					Feed (ipm)	325	381	476	482	476	448	384	
		HSM 4xD	≤ 0.1 ≤ APMX	48 (38-58)	Fz	0.0190	0.0296	0.0463	0.0563	0.0741	0.0871	0.0933	
					Feed (ipm)	339	396	495	502	496	466	399	
					RPM	4087	3065	2452	2044	1533	1226	981	
<b>TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2</b>	≤ 375 Bhn or ≤ 40 HRc	HSM 2.5xD	≤ 0.2 ≤ APMX	83 (66-100)	Fz	0.0140	0.0183	0.0294	0.0356	0.0457	0.0560	0.0625	
					Feed (ipm)	401	393	505	509	490	481	429	
		HSM 3xD	≤ 0.15 ≤ APMX	86 (69-103)	Fz	0.0157	0.0205	0.0330	0.0398	0.0512	0.0627	0.0700	
					Feed (ipm)	449	440	566	569	549	538	481	
		HSM 4xD	≤ 0.1 ≤ APMX	77 (62-92)	Fz	0.0163	0.0213	0.0344	0.0415	0.0533	0.0653	0.0729	
					Feed (ipm)	466	457	590	594	572	560	501	
					RPM	4087	3065	2452	2044	1533	1226	981	

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)  
 $rpm = (Vc \times 1000) / (DC \times 3.14)$   
 $mm/min = Fz \times 7 \times rpm$   
 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-sgstoool.com](http://www.kyocera-sgstoool.com))