

METRIC  
**ICe-Carb®**

Series 140M 5D Metric	Hardness	Vc (m/min)	DC • mm								
			3	6	8	10	12	14	16		
<b>P</b>  <b>CARBON STEELS</b> 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	130	RPM	13733	6867	5150	4120	3433	2943	2575	
		(104-155)	Fr	0.095	0.189	0.252	0.316	0.379	0.442	0.505	
			Feed (mm/min)	1300	1300	1300	1300	1300	1300	1300	
	≤ 275 Bhn or ≤ 28 HRc	116	RPM	12279	6140	4605	3684	3070	2631	2302	
		(93-139)	Fr	0.086	0.171	0.228	0.285	0.342	0.399	0.456	
			Feed (mm/min)	1050	1050	1050	1050	1050	1050	1050	
	≤ 425 Bhn or ≤ 45 HRc	67	RPM	7109	3555	2666	2133	1777	1523	1333	
		(54-80)	Fr	0.071	0.142	0.189	0.237	0.284	0.332	0.379	
			Feed (mm/min)	505	505	505	505	505	505	505	
	<b>M</b>  <b>ALLOY STEELS</b> 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	101	RPM	10664	5332	3999	3199	2666	2285	1999
			(80-121)	Fr	0.071	0.143	0.190	0.238	0.285	0.333	0.380
				Feed (mm/min)	760	760	760	760	760	760	760
≤ 375 Bhn or ≤ 40 HRc		61	RPM	6463	3231	2424	1939	1616	1385	1212	
		(49-73)	Fr	0.062	0.124	0.165	0.206	0.248	0.289	0.330	
			Feed (mm/min)	400	400	400	400	400	400	400	
≤ 450 Bhn or ≤ 48 HRc		43	RPM	4524	2262	1696	1357	1131	969	848	
		(34-51)	Fr	0.043	0.086	0.115	0.144	0.172	0.201	0.230	
			Feed (mm/min)	195	195	195	195	195	195	195	
<b>K</b>  <b>STAINLESS STEELS (FREE MACHINING)</b> 303, 416, 420F, 430F, 440F		≤ 185 Bhn or ≤ 9 HRc	93	RPM	9856	4928	3696	2957	2464	2112	1848
			(74-112)	Fr	0.061	0.123	0.164	0.205	0.246	0.286	0.327
				Feed (mm/min)	605	605	605	605	605	605	605
	≤ 275 Bhn or ≤ 28 HRc	59	RPM	6301	3151	2363	1890	1575	1350	1181	
		(48-71)	Fr	0.048	0.095	0.127	0.159	0.190	0.222	0.254	
			Feed (mm/min)	300	300	300	300	300	300	300	
<b>N</b>  <b>STAINLESS STEELS (DIFFICULT)</b> 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	46	RPM	4847	2424	1818	1454	1212	1039	909	
		(37-55)	Fr	0.047	0.095	0.127	0.158	0.190	0.221	0.253	
			Feed (mm/min)	230	230	230	230	230	230	230	
	≤ 375 Bhn or ≤ 40 HRc	34	RPM	3555	1777	1333	1066	889	762	666	
		(27-40)	Fr	0.042	0.084	0.113	0.141	0.169	0.197	0.225	
			Feed (mm/min)	150	150	150	150	150	150	150	
<b>K</b>  <b>CAST IRONS</b> Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	110	RPM	11633	5816	4362	3490	2908	2493	2181	
		(88-132)	Fr	0.109	0.218	0.291	0.364	0.437	0.509	0.582	
			Feed (mm/min)	1270	1270	1270	1270	1270	1270	1270	
	≤ 260 Bhn or ≤ 26 HRc	102	RPM	10825	5413	4059	3248	2706	2320	2030	
		(82-123)	Fr	0.109	0.218	0.291	0.363	0.436	0.509	0.581	
			Feed (mm/min)	1180	1180	1180	1180	1180	1180	1180	
<b>N</b>  <b>ALUMINUM ALLOYS</b> 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	235	RPM	24882	12441	9331	7465	6220	5332	4665	
		(188-282)	Fr	0.118	0.237	0.316	0.395	0.473	0.552	0.631	
			Feed (mm/min)	2945	2945	2945	2945	2945	2945	2945	
	≤ 150 Bhn or ≤ 7 HRc	201	RPM	21327	10664	7998	6398	5332	4570	3999	
		(161-241)	Fr	0.119	0.238	0.318	0.397	0.476	0.556	0.635	
			Feed (mm/min)	2540	2540	2540	2540	2540	2540	2540	
<b>N</b>  <b>COPPER ALLOYS</b> Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	168	RPM	17773	8886	6665	5332	4443	3808	3332	
		(134-201)	Fr	0.048	0.096	0.128	0.159	0.191	0.223	0.255	
			Feed (mm/min)	850	850	850	850	850	850	850	
	≤ 200 Bhn or ≤ 23 HRc	134	RPM	14218	7109	5332	4265	3555	3047	2666	
		(107-161)	Fr	0.048	0.096	0.128	0.161	0.193	0.225	0.257	
			Feed (mm/min)	685	685	685	685	685	685	685	

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			3	6	8	10	12	14	16		
<b>S</b>	<b>SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400, Rene, Waspaloy</b>	≤ 300 Bhn or ≤ 32 HRc	29	RPM	3070	1535	1151	921	767	658	576
			(23-35)	Fr	0.020	0.039	0.052	0.065	0.078	0.091	0.104
				Feed (mm/min)	60	60	60	60	60	60	60
		≤ 400 Bhn or ≤ 43 HRc	15	RPM	1616	808	606	485	404	346	303
				Fr	0.015	0.031	0.041	0.052	0.062	0.072	0.083
			(12-18)	Feed (mm/min)	25	25	25	25	25	25	25
	<b>TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V</b>	≤ 275 Bhn or ≤ 28 HRc	66	RPM	6947	3474	2605	2084	1737	1489	1303
				(52-79)	Fr	0.040	0.079	0.106	0.132	0.158	0.185
			Feed (mm/min)	275	275	275	275	275	275	275	
		≤ 350 Bhn or ≤ 38 HRc	49	RPM	5170	2585	1939	1551	1293	1108	969
				(39-59)	Fr	0.039	0.077	0.103	0.129	0.155	0.181
			Feed (mm/min)	200	200	200	200	200	200	200	
≤ 440 Bhn or ≤ 47 HRc	26	RPM	2747	1373	1030	824	687	589	515		
		(21-31)	Fr	0.029	0.058	0.078	0.097	0.117	0.136	0.155	
	Feed (mm/min)	80	80	80	80	80	80	80			
<b>H</b>	<b>TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2</b>	≤ 200 Bhn or ≤ 13 HRc	44	RPM	4686	2343	1757	1406	1171	1004	879
				(35-53)	Fr	0.061	0.122	0.162	0.203	0.243	0.284
			Feed (mm/min)	285	285	285	285	285	285	285	
		≤ 375 Bhn or ≤ 40 HRc	29	RPM	3070	1535	1151	921	767	658	576
				(23-35)	Fr	0.029	0.059	0.078	0.098	0.117	0.137
			Feed (mm/min)	90	90	90	90	90	90	90	
	≤ 475 Bhn or ≤ 50 HRc	26	RPM	2747	1373	1030	824	687	589	515	
			(21-31)	Fr	0.018	0.036	0.049	0.061	0.073	0.085	0.097
		Feed (mm/min)	50	50	50	50	50	50	50		

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)  
 $rpm = (Vc \times 1000) / (DC \times 3.14)$   
 $mm/min = Fr \times rpm$   
 reduce speed and feed for materials harder than listed  
 refer to the SGS Tool Wizard® for complete technical information ([www.kyocera-sgstool.com](http://www.kyocera-sgstool.com))