

METRIC
Hi-PerCarb®

Series 135 3D Metric	Hardness	Vc (m/min)	DC • mm									
			1.5	3	6	8	10	12	16	20		
P CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	117	RPM	24882	12441	6220	4665	3732	3110	2333	1866	
		(94-141)	Fr	0.047	0.094	0.189	0.252	0.315	0.378	0.504	0.630	
			Feed (mm/min)	1175	1175	1175	1175	1175	1175	1175	1175	
	≤ 275 Bhn or ≤ 28 HRc	107	RPM	22620	11310	5655	4241	3393	2827	2121	1696	
		(85-128)	Fr	0.043	0.086	0.172	0.229	0.286	0.343	0.457	0.572	
			Feed (mm/min)	970	970	970	970	970	970	970	970	
	≤ 475 Bhn or ≤ 45 HRc	61	RPM	12926	6463	3231	2424	1939	1616	1212	969	
		(49-73)	Fr	0.036	0.071	0.142	0.190	0.237	0.285	0.380	0.475	
			Feed (mm/min)	460	460	460	460	460	460	460	460	
	M ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	91	RPM	19388	9694	4847	3635	2908	2424	1818	1454
			(73-110)	Fr	0.036	0.071	0.142	0.190	0.237	0.285	0.380	0.475
				Feed (mm/min)	690	690	690	690	690	690	690	690
≤ 375 Bhn or ≤ 40 HRc		56	RPM	11956	5978	2989	2242	1793	1495	1121	897	
		(45-68)	Fr	0.031	0.061	0.122	0.163	0.204	0.244	0.326	0.407	
			Feed (mm/min)	365	365	365	365	365	365	365	365	
≤ 450 Bhn or ≤ 48 HRc		40	RPM	8402	4201	2100	1575	1260	1050	788	630	
		(32-48)	Fr	0.021	0.042	0.083	0.111	0.139	0.167	0.222	0.278	
			Feed (mm/min)	175	175	175	175	175	175	175	175	
K STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F		≤ 185 Bhn or ≤ 9 HRc	84	RPM	17773	8886	4443	3332	2666	2222	1666	1333
			(67-101)	Fr	0.031	0.061	0.123	0.164	0.204	0.245	0.327	0.409
				Feed (mm/min)	545	545	545	545	545	545	545	545
	≤ 275 Bhn or ≤ 28 HRc	52	RPM	10987	5493	2747	2060	1648	1373	1030	824	
		(41-62)	Fr	0.024	0.047	0.095	0.126	0.158	0.189	0.252	0.316	
			Feed (mm/min)	260	260	260	260	260	260	260	260	
K STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	27	RPM	5816	2908	1454	1091	872	727	545	436	
		(22-33)	Fr	0.023	0.046	0.093	0.124	0.155	0.186	0.248	0.309	
			Feed (mm/min)	135	135	135	135	135	135	135	135	
	≤ 375 Bhn or ≤ 40 HRc	20	RPM	4201	2100	1050	788	630	525	394	315	
		(16-24)	Fr	0.020	0.040	0.081	0.108	0.135	0.162	0.216	0.270	
			Feed (mm/min)	85	85	85	85	85	85	85	85	
K CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	98	RPM	20681	10340	5170	3878	3102	2585	1939	1551	
		(78-117)	Fr	0.055	0.110	0.220	0.293	0.366	0.439	0.585	0.732	
			Feed (mm/min)	1135	1135	1135	1135	1135	1135	1135	1135	
	≤ 260 Bhn or ≤ 26 HRc	87	RPM	18419	9209	4605	3454	2763	2302	1727	1381	
		(69-104)	Fr	0.055	0.110	0.219	0.292	0.366	0.439	0.585	0.731	
			Feed (mm/min)	1010	1010	1010	1010	1010	1010	1010	1010	

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Series 135 3D Metric	Hardness	Vc (m/min)	DC • mm									
			1.5	3	6	8	10	12	16	20		
N ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	213	RPM	45239	22620	11310	8482	6786	5655	4241	3393	
		(171-256)	Fr	0.059	0.119	0.238	0.317	0.396	0.476	0.634	0.793	
		Feed (mm/min)	2690	2690	2690	2690	2690	2690	2690	2690	2690	
	≤ 150 Bhn or ≤ 7 HRc	183	RPM	38777	19388	9694	7271	5816	4847	3635	2908	
		(146-219)	Fr	0.060	0.120	0.240	0.320	0.400	0.480	0.640	0.799	
		Feed (mm/min)	2325	2325	2325	2325	2325	2325	2325	2325	2325	
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	152	RPM	32314	16157	8078	6059	4847	4039	3029	2424
			(122-183)	Fr	0.024	0.048	0.096	0.128	0.160	0.192	0.256	0.320
			Feed (mm/min)	776	776	776	776	776	776	776	776	776
		≤ 200 Bhn or ≤ 23 HRc	122	RPM	25851	12926	6463	4847	3878	3231	2424	1939
			(98-146)	Fr	0.024	0.049	0.097	0.130	0.162	0.195	0.260	0.325
			Feed (mm/min)	630	630	630	630	630	630	630	630	630
S SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400, Rene, Waspaloy	≤ 300 Bhn or ≤ 32 HRc	17	RPM	3555	1777	889	666	533	444	333	267	
		(13-20)	Fr	0.010	0.020	0.039	0.053	0.066	0.079	0.105	0.131	
		Feed (mm/min)	35	35	35	35	35	35	35	35	35	
	≤ 400 Bhn or ≤ 43 HRc	9	RPM	1939	969	485	364	291	242	182	145	
		(7-11)	Fr	0.008	0.015	0.031	0.041	0.052	0.062	0.083	0.103	
		Feed (mm/min)	15	15	15	15	15	15	15	15	15	
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	41	RPM	8725	4362	2181	1636	1309	1091	818	654
			(33-49)	Fr	0.021	0.042	0.085	0.113	0.141	0.170	0.226	0.283
			Feed (mm/min)	185	185	185	185	185	185	185	185	185
		≤ 350 Bhn or ≤ 38 HRc	30	RPM	6463	3231	1616	1212	969	808	606	485
			(24-37)	Fr	0.019	0.039	0.077	0.103	0.129	0.155	0.206	0.258
			Feed (mm/min)	125	125	125	125	125	125	125	125	125
≤ 440 Bhn or ≤ 47 HRc	17	RPM	3555	1777	889	666	533	444	333	267		
	(13-20)	Fr	0.014	0.028	0.056	0.075	0.094	0.113	0.150	0.188		
	Feed (mm/min)	50	50	50	50	50	50	50	50	50		
H TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 200 Bhn or ≤ 13 HRc	40	RPM	8402	4201	2100	1575	1260	1050	788	630	
		(32-48)	Fr	0.032	0.063	0.126	0.168	0.210	0.252	0.336	0.421	
		Feed (mm/min)	265	265	265	265	265	265	265	265	265	
	≤ 375 Bhn or ≤ 40 HRc	27	RPM	5816	2908	1454	1091	872	727	545	436	
		(22-33)	Fr	0.014	0.028	0.055	0.073	0.092	0.110	0.147	0.183	
		Feed (mm/min)	80	80	80	80	80	80	80	80	80	
	≤ 475 Bhn or ≤ 50 HRc	23	RPM	4847	2424	1212	909	727	606	454	364	
		(18-27)	Fr	0.009	0.019	0.037	0.050	0.062	0.074	0.099	0.124	
		Feed (mm/min)	45	45	45	45	45	45	45	45	45	

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)