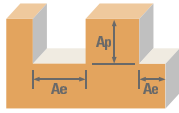


METRIC

2 Flute: Square, Double, Stub, Long Reach, Ball

3 Flute: Square, Long Reach, Ball

4 Flute: Square, Double, Stub, Long Reach, Ball, Corner Radius



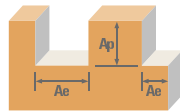
Series  
1M, 3M, 5M,  
14M, 15M, 16M,  
17M, 59M  
Metric

Series	Hardness	Flutes	Ae x DC	Ap x DC	Vc (m/min)	DC • mm											
						0.4	0.75	1.5	3	6	10	12	20	25			
P CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	Profile	2	≤ 0.50	≤ 1.5	140	RPM	111483	59458	29729	14864	7432	4459	3716	2230	1784	
							Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070	
							Feed (mm/min)	178	178	184	208	282	357	357	285	250	
		Slot	3	≤ 0.25	≤ 1.5	102	RPM	81189	43301	21650	10825	5413	3248	2706	1624	1299	
							Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070	
							Feed (mm/min)	130	130	134	152	206	260	260	208	182	
	4	≤ 0.25	≤ 1.5	(82-123)	RPM	195	195	201	227	309	390	390	312	273			
					Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070			
					Feed (mm/min)	260	260	268	303	411	520	520	416	364			
	M ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	Profile	2	≤ 0.50	≤ 1.5	102	RPM	81189	43301	21650	10825	5413	3248	2706	1624	1299
								Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
								Feed (mm/min)	81	104	95	130	152	188	195	156	135
Slot			3	≤ 0.25	≤ 1.5	75	RPM	59377	31668	15834	7917	3958	2375	1979	1188	950	
							Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052	
							Feed (mm/min)	59	76	70	95	111	138	143	114	99	
4		≤ 0.25	≤ 1.5	(60-90)	RPM	119	152	139	190	222	276	285	228	198			
					Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052			
					Feed (mm/min)	119	152	139	190	222	276	285	228	198			
K STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F 440F		≤ 275 Bhn or ≤ 28 HRc	Profile	2	≤ 0.50	≤ 1.5	113	RPM	89671	47825	23912	11956	5978	3587	2989	1793	1435
								Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
								Feed (mm/min)	90	115	105	143	167	208	215	172	149
	Slot		3	≤ 0.25	≤ 1.5	82	RPM	65436	34899	17449	8725	4362	2617	2181	1309	1047	
							Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052	
							Feed (mm/min)	65	84	77	105	122	152	157	126	109	
	4	≤ 0.25	≤ 1.5	(66-99)	RPM	131	168	154	209	244	304	314	251	218			
					Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042			
					Feed (mm/min)	62	66	63	66	99	119	119	91	83			
	N STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L, 17-4 PH, 15-5, 13-4, Custom 450	≤ 275 Bhn or ≤ 28 HRc	Profile	2	≤ 0.50	≤ 1.5	78	RPM	61800	32960	16480	8240	4120	2472	2060	1236	989
								Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042
								Feed (mm/min)	93	99	94	99	148	178	179	137	125
Slot			3	≤ 0.25	≤ 1.5	56	RPM	44836	23912	11956	5978	2989	1793	1495	897	717	
							Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042	
							Feed (mm/min)	45	48	45	48	72	86	87	66	60	
4		≤ 0.25	≤ 1.5	(45-68)	RPM	67	72	68	72	108	129	130	100	90			
					Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042			
					Feed (mm/min)	90	96	91	96	143	172	173	133	121			
O CAST IRONS Gray, Malleable, Ductile		≤ 220 Bhn or ≤ 19 HRc	Profile	2	≤ 0.50	≤ 1.5	102	RPM	81189	43301	21650	10825	5413	3248	2706	1624	1299
								Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
								Feed (mm/min)	130	130	134	152	206	260	260	208	182
	Slot		3	≤ 0.25	≤ 1.5	75	RPM	59377	31668	15834	7917	3958	2375	1979	1188	950	
							Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070	
							Feed (mm/min)	95	95	98	111	150	190	190	152	133	
	4	≤ 0.25	≤ 1.5	(60-90)	RPM	143	143	147	166	226	285	285	228	200			
					Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070			
					Feed (mm/min)	190	190	196	222	301	380	380	304	266			
	P ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 150 Bhn or ≤ 7 HRc	Profile	2	≤ 0.50	≤ 1.5	268	RPM	213272	113745	56872	28436	14218	8531	7109	4265	3412
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
								Feed (mm/min)	640	728	682	796	1081	1365	1365	1092	955
Slot			3	≤ 0.25	≤ 1.5	195	RPM	155107	82724	41362	20681	10340	6204	5170	3102	2482	
							Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140	
							Feed (mm/min)	465	529	496	579	786	993	993	794	695	
4		≤ 0.25	≤ 1.5	(156-234)	RPM	698	794	745	869	1179	1489	1489	1191	1042			
					Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140			
					Feed (mm/min)	698	794	745	869	1179	1489	1489	1191	1042			

continued on next page

# 2 Flute: Square, Double, Stub, Long Reach, Ball 3 Flute: Square, Long Reach, Ball 4 Flute: Square, Double, Stub, Long Reach, Ball, Corner Radius

Series  
1M, 3M, 5M,  
14M, 15M, 16M,  
17M, 59M  
Metric



Series	Hardness	Flutes	Ae x DC	Ap x DC	Vc (m/min)	DC • mm										
						0.4	0.75	1.5	3	6	10	12	20	25		
COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRC	Profile	2 ≤ 0.50 ≤ 1.5	3 ≤ 0.25 ≤ 1.5	(118-177)	148 RPM	117542	62689	31344	15672	7836	4702	3918	2351	1881	
						Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070	
						Feed (mm/min)	188	188	194	219	298	376	376	301	263	
							282	282	292	329	447	564	564	451	395	
							376	376	389	439	596	752	752	602	527	
							84824	45239	22620	11310	5655	3393	2827	1696	1357	
		Slot	2 1 ≤ 1	3 1 ≤ 0.5	4 1 ≤ 0.4	(118-177)	148 RPM	117542	62689	31344	15672	7836	4702	3918	2351	1881
							Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
							Feed (mm/min)	136	136	140	158	215	271	271	217	190
								204	204	210	238	322	407	407	326	285
								271	271	280	317	430	543	543	434	380
								84824	45239	22620	11310	5655	3393	2827	1696	1357
PLASTICS Polycarbonate, PVC, Polypropylene		Profile	2 ≤ 0.50 ≤ 1.5	3 ≤ 0.25 ≤ 1.5	(215-322)	268 RPM	213272	113745	56872	28436	14218	8531	7109	4265	3412	
						Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140	
						Feed (mm/min)	640	728	682	796	1081	1365	1365	1092	955	
							960	1092	1024	1194	1621	2047	2047	1638	1433	
							1280	1456	1365	1592	2161	2730	2730	2184	1911	
							155107	82724	41362	20681	10340	6204	5170	3102	2482	
		Slot	2 1 ≤ 1	3 1 ≤ 0.5	4 1 ≤ 0.4	(156-234)	195 RPM	155107	82724	41362	20681	10340	6204	5170	3102	2482
							Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
							Feed (mm/min)	465	529	496	579	786	993	993	794	695
								698	794	745	869	1179	1489	1489	1191	1042
								931	1059	993	1158	1572	1985	1985	1588	1390
								155107	82724	41362	20681	10340	6204	5170	3102	2482
GRAPHITE		Profile	2 ≤ 0.50 ≤ 1.5	3 ≤ 0.25 ≤ 1.5	(161-241)	201 RPM	159954	85309	42654	21327	10664	6398	5332	3199	2559	
						Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140	
						Feed (mm/min)	480	546	512	597	810	1024	1024	819	717	
							720	819	768	896	1216	1536	1536	1228	1075	
							960	1092	1024	1194	1621	2047	2047	1638	1433	
							116330	62043	31021	15511	7755	4653	3878	2327	1861	
		Slot	2 1 ≤ 1	3 1 ≤ 0.5	4 1 ≤ 0.4	(117-176)	146 RPM	116330	62043	31021	15511	7755	4653	3878	2327	1861
							Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
							Feed (mm/min)	349	397	372	434	589	745	745	596	521
								523	596	558	651	884	1117	1117	893	782
								698	794	745	869	1179	1489	1489	1191	1042
								116330	62043	31021	15511	7755	4653	3878	2327	1861
SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, 718, Incoloy 800, Monel 400, Rene, Waspalloy	≤ 300 Bhn or ≤ 32 HRC	Profile	2 ≤ 0.50 ≤ 1.5	3 ≤ 0.25 ≤ 1.5	(16-24)	20 RPM	15753	8402	4201	2100	1050	630	525	315	252	
						Fz	0.0005	0.0007	0.0014	0.004	0.010	0.021	0.024	0.032	0.035	
						Feed (mm/min)	16	12	12	17	21	26	25	20	18	
							24	18	18	25	32	40	38	30	26	
							32	24	24	34	42	53	50	40	35	
							10906	5816	2908	1454	727	436	364	218	174	
		Slot	2 1 ≤ 1	3 1 ≤ 0.5	4 1 ≤ 0.4	(11-16)	14 RPM	10906	5816	2908	1454	727	436	364	218	174
							Fz	0.0005	0.0007	0.0014	0.004	0.010	0.021	0.024	0.032	0.035
							Feed (mm/min)	11	8	8	12	15	18	17	14	12
								16	12	12	17	22	27	26	21	18
								22	16	16	23	29	37	35	28	24
								10906	5816	2908	1454	727	436	364	218	174
TITANIUM ALLOYS Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti10Al2Fe3Al, Ti5Al53Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti152 Cr3Sn3Al	≤ 350 Bhn or ≤ 38 HRC	Profile	2 ≤ 0.50 ≤ 1.5	3 ≤ 0.25 ≤ 1.5	(44-66)	55 RPM	43624	23266	11633	5816	2908	1745	1454	872	698	
						Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042	
						Feed (mm/min)	44	47	44	47	70	84	84	65	59	
							65	70	66	70	105	126	127	97	88	
							87	93	88	93	140	168	169	129	117	
							31506	16803	8402	4201	2100	1260	1050	630	504	
		Slot	2 1 ≤ 1	3 1 ≤ 0.5	4 1 ≤ 0.4	(32-48)	40 RPM	31506	16803	8402	4201	2100	1260	1050	630	504
							Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042
							Feed (mm/min)	32	34	32	34	50	60	61	47	42
								47	50	48	50	76	91	91	70	64
								63	67	64	67	101	121	122	93	85
								31506	16803	8402	4201	2100	1260	1050	630	504
TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRC	Profile	2 ≤ 0.50 ≤ 1.5	3 ≤ 0.25 ≤ 1.5	(77-115)	96 RPM	76342	40715	20358	10179	5089	3054	2545	1527	1221	
						Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052	
						Feed (mm/min)	76	98	90	122	143	177	183	147	127	
							115	147	134	183	214	266	275	220	191	
							153	195	179	244	285	354	366	293	254	
							55741	29729	14864	7432	3716	2230	1858	1115	892	
		Slot	2 1 ≤ 1	3 1 ≤ 0.5	4 1 ≤ 0.4	(56-84)	70 RPM	55741	29729	14864	7432	3716	2230	1858	1115	892
							Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
							Feed (mm/min)	56	71	65	89	104	129	134	107	93
								84	107	98	134	156	194	201	161	139
								111	143	131	178	208	259	268	214	186
								55741	29729	14864	7432	3716	2230	1858	1115	892

Bhn (Brinell)    HRc (Rockwell C)  
rpm = (Vc x 1000) / (DC x 3.14)  
mm/min = Fz x number of flutes x rpm  
reduce speed and feed for materials harder than listed

limit cut depths of long and extra long flute mills to .05 x DC when slotting or profiling  
reduce feed and Ae when finish milling (.02 x DC maximum)  
refer to the SGS Tool Wizard® for complete technical information  
(www.kyocera-sgstool.com)