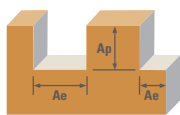


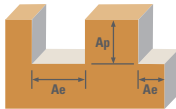
4 Flute: Square, Ball



M4, M4B 3xD Fractional	Hardness	Profile	Ae x D ₁		Ap x D ₁	Vc (SFM)		Diameter (D ₁) (inch)					
			≤ .10	≤ .25				≤ 2	0.005	0.015	0.031	0.062	0.093
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	Profile	≤ .10	≤ .25	≤ 2	365	RPM	278860	89378	44689	22309	14865	11619
						(292-438)	Fz	0.000015	0.00005	0.00010	0.00019	0.00029	0.00037
							Feed (ipm)	16.99	16.99	16.99	16.99	16.99	16.99
		Slot	1	≤ .15	≤ .35	290	RPM	221560	71013	35506	17725	11810	9232
						(232-348)	Fz	0.000015	0.00005	0.00010	0.00019	0.00029	0.00037
							Feed (ipm)	13.50	13.50	13.50	13.50	13.50	13.50
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	Profile	≤ .10	≤ .25	≤ 2	210	RPM	160440	51423	25712	12835	8552	6685
						(168-252)	Fz	0.000014	0.00004	0.00009	0.00017	0.00026	0.00033
							Feed (ipm)	8.91	8.91	8.91	8.91	8.91	8.91
		Slot	1	≤ .15	≤ .35	165	RPM	126060	40404	20202	10085	6720	5253
						(132-198)	Fz	0.000014	0.00004	0.00009	0.00017	0.00026	0.00033
							Feed (ipm)	7.00	7.00	7.00	7.00	7.00	7.00
H	Profile	≤ .10	≤ .25	≤ 2	175	RPM	133700	42853	21426	10696	7127	5571	
					(140-210)	Fz	0.000011	0.00003	0.00007	0.00014	0.00021	0.00026	
						Feed (ipm)	5.88	5.88	5.88	5.88	5.88	5.88	
	Slot	1	≤ .15	≤ .35	140	RPM	106960	34282	17141	8557	5701	4457	
					(112-168)	Fz	0.000011	0.00003	0.00007	0.00014	0.00021	0.00026	
						Feed (ipm)	4.70	4.70	4.70	4.70	4.70	4.70	
K	Profile	≤ .10	≤ .25	≤ 2	305	RPM	233020	74686	37343	18642	12421	9709	
					(244-366)	Fz	0.000015	0.00005	0.00010	0.00019	0.00029	0.00037	
						Feed (ipm)	14.32	14.32	14.32	14.32	14.32	14.32	
	Slot	1	≤ .15	≤ .35	245	RPM	187180	59994	29997	14974	9978	7799	
					(196-294)	Fz	0.000015	0.00005	0.00010	0.00019	0.00029	0.00037	
						Feed (ipm)	11.50	11.50	11.50	11.50	11.50	11.50	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	Profile	≤ .10	≤ .25	≤ 2	340	RPM	259760	83256	41628	20781	13846	10823
						(272-408)	Fz	0.000015	0.00005	0.00009	0.00019	0.00028	0.00036
							Feed (ipm)	15.74	15.74	15.74	15.74	15.74	15.74
		Slot	1	≤ .15	≤ .35	270	RPM	206280	66115	33058	16502	10996	8595
						(216-324)	Fz	0.000015	0.00005	0.00009	0.00019	0.00028	0.00036
							Feed (ipm)	12.50	12.50	12.50	12.50	12.50	12.50
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	Profile	≤ .10	≤ .25	≤ 2	235	RPM	179540	57545	28772	14363	9570	7481
						(188-282)	Fz	0.000014	0.00004	0.00009	0.00017	0.00026	0.00034
							Feed (ipm)	10.04	10.04	10.04	10.04	10.04	10.04
		Slot	1	≤ .15	≤ .35	185	RPM	141340	45301	22651	11307	7534	5889
						(148-222)	Fz	0.000014	0.00004	0.00009	0.00017	0.00026	0.00034
							Feed (ipm)	7.90	7.90	7.90	7.90	7.90	7.90
STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	Profile	≤ .10	≤ .25	≤ 2	215	RPM	164260	52647	26324	13141	8756	6844	
					(172-258)	Fz	0.000010	0.00003	0.00006	0.00012	0.00018	0.00024	
						Feed (ipm)	6.45	6.45	6.45	6.45	6.45	6.45	
	Slot	1	≤ .15	≤ .35	170	RPM	129880	41628	20814	10390	6923	5412	
					(136-204)	Fz	0.000010	0.00003	0.00006	0.00012	0.00018	0.00024	
						Feed (ipm)	5.10	5.10	5.10	5.10	5.10	5.10	

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FRACTIONAL 4 Flute: Square, Ball

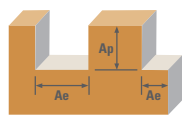


M4, M4B 3xD Fractional	Hardness	Profile	Ae x D ₁		Ap x D ₁	Vc (SFM)	Diameter (D ₁) (inch)						
			≤ .10	≤ .25			≤ 2	0.005	0.015	0.031	0.062	0.093	0.120
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	Profile	≤ .10	≤ .25	≤ 2	60	RPM	45840	14692	7346	3667	2443	1910
						(48-72)	Fz	0.000008	0.00002	0.00005	0.00010	0.00015	0.00019
						Feed (ipm)	1.47	1.47	1.47	1.47	1.47	1.47	
		Slot	1	≤ .15	≤ .35	45	RPM	34380	11019	5510	2750	1833	1433
						(36-54)	Fz	0.000008	0.00002	0.00005	0.00010	0.00015	0.00019
						Feed (ipm)	1.10	1.10	1.10	1.10	1.10	1.10	
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	Profile	≤ .10	≤ .25	≤ 2	45	RPM	34380	11019	5510	2750	1833	1433
						(36-54)	Fz	0.000006	0.00002	0.00004	0.00007	0.00011	0.00013
						Feed (ipm)	0.77	0.77	0.77	0.77	0.77	0.77	
		Slot	1	≤ .15	≤ .35	35	RPM	26740	8571	4285	2139	1425	1114
						(28-42)	Fz	0.000006	0.00002	0.00004	0.00007	0.00011	0.00013
						Feed (ipm)	0.60	0.60	0.60	0.60	0.60	0.60	
TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	Profile	≤ .10	≤ .25	≤ 2	160	RPM	122240	39179	19590	9779	6516	5093	
					(128-192)	Fz	0.000010	0.00003	0.00006	0.00012	0.00018	0.00024	
					Feed (ipm)	4.80	4.80	4.80	4.80	4.80	4.80		
	Slot	1	≤ .15	≤ .35	130	RPM	99320	31833	15917	7946	5294	4138	
					(104-156)	Fz	0.000010	0.00003	0.00006	0.00012	0.00018	0.00024	
					Feed (ipm)	3.90	3.90	3.90	3.90	3.90	3.90		
TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	Profile	≤ .10	≤ .25	≤ 2	60	RPM	45840	14692	7346	3667	2443	1910	
					(48-72)	Fz	0.000007	0.00002	0.00004	0.00008	0.00012	0.00016	
					Feed (ipm)	1.20	1.20	1.20	1.20	1.20	1.20		
	Slot	1	≤ .15	≤ .35	45	RPM	34380	11019	5510	2750	1833	1433	
					(36-54)	Fz	0.000007	0.00002	0.00004	0.00008	0.00012	0.00016	
					Feed (ipm)	0.90	0.90	0.90	0.90	0.90	0.90		
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	Profile	≤ .10	≤ .25	≤ 2	1000	RPM	764000	244872	122436	61120	40725	31833
						(800-1200)	Fz	0.000047	0.00015	0.00029	0.00058	0.00087	0.00112
						Feed (ipm)	142.50	142.50	142.50	142.50	142.50	142.50	
		Slot	1	≤ .15	≤ .35	800	RPM	611200	195897	97949	48896	32580	25467
						(640-960)	Fz	0.000047	0.00015	0.00029	0.00058	0.00087	0.00112
						Feed (ipm)	114.00	114.00	114.00	114.00	114.00	114.00	
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	Profile	≤ .10	≤ .25	≤ 2	515	RPM	393460	126109	63054	31477	20973	16394
						(412-618)	Fz	0.000034	0.00011	0.00021	0.00043	0.00064	0.00082
						Feed (ipm)	54.01	54.01	54.01	54.01	54.01	54.01	
		Slot	1	≤ .15	≤ .35	410	RPM	313240	100397	50199	25059	16697	13052
						(328-492)	Fz	0.000034	0.00011	0.00021	0.00043	0.00064	0.00082
						Feed (ipm)	43.00	43.00	43.00	43.00	43.00	43.00	
PLASTICS Polycarbonate, PVC, Polypropylene	Profile	≤ .10	≤ .25	≤ 2	1000	RPM	764000	244872	122436	61120	40725	31833	
					(800-1200)	Fz	0.000047	0.00015	0.00029	0.00058	0.00087	0.00112	
					Feed (ipm)	142.50	142.50	142.50	142.50	142.50	142.50		
	Slot	1	≤ .15	≤ .35	800	RPM	611200	195897	97949	48896	32580	25467	
					(640-960)	Fz	0.000047	0.00015	0.00029	0.00058	0.00087	0.00112	
					Feed (ipm)	114.00	114.00	114.00	114.00	114.00	114.00		

Note:

- Bhn (Brinell) HRC (Rockwell C)
- when recommended speed exceeds your capability, use maximum available and recalculate ipm
- rpm = Vc x 3.82 / D1
- ipm = Fz x 4 x rpm
- helical ramp at 2 degrees or less, using slotting speed and feed rates (plunging is not recommended)
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D1 maximum)
- refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)

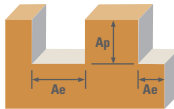
4 Flute: Square, Ball



M4L, M4LB 5xD Fractional	Hardness	Ae x D ₁		Ap x D ₁		Vc (SFM)		Diameter (D ₁) (inch)						
		≤ .10	≤ .25	≤ .10	≤ .20			0.005	0.015	0.031	0.062	0.093	0.120	
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	Profile ≤ 275 Bhn or ≤ 28 HRc	≤ .10	≤ .25	≤ .10	≤ .20	365	RPM	278860	89378	44689	22309	14865	11619
							(292-438)	Fz	0.000006	0.00002	0.00004	0.00008	0.00012	0.00015
								Feed (ipm)	7.11	7.11	7.11	7.11	7.11	7.11
		Slot	1	≤ .10	≤ .20	290	RPM	221560	71013	35506	17725	11810	9232	
						(232-348)	Fz	0.000006	0.00002	0.00004	0.00008	0.00012	0.00015	
							Feed (ipm)	5.65	5.65	5.65	5.65	5.65	5.65	
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	Profile ≤ 375 Bhn or ≤ 40 HRc	≤ .10	≤ .25	≤ .10	≤ .20	210	RPM	160440	51423	25712	12835	8552	6685
							(168-252)	Fz	0.000006	0.00002	0.00004	0.00007	0.00011	0.00014
								Feed (ipm)	3.64	3.64	3.64	3.64	3.64	3.64
		Slot	1	≤ .10	≤ .20	165	RPM	126060	40404	20202	10085	6720	5253	
						(132-198)	Fz	0.000006	0.00002	0.00004	0.00007	0.00011	0.00014	
							Feed (ipm)	2.86	2.86	2.86	2.86	2.86	2.86	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	Profile ≤ 375 Bhn or ≤ 40 HRc	≤ .10	≤ .25	≤ .10	≤ .20	175	RPM	133700	42853	21426	10696	7127	5571
							(140-210)	Fz	0.000005	0.00001	0.00003	0.00006	0.00009	0.00011
								Feed (ipm)	2.50	2.50	2.50	2.50	2.50	2.50
		Slot	1	≤ .10	≤ .20	140	RPM	106960	34282	17141	8557	5701	4457	
						(112-168)	Fz	0.000005	0.00001	0.00003	0.00006	0.00009	0.00011	
							Feed (ipm)	2.00	2.00	2.00	2.00	2.00	2.00	
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	Profile ≤ 220 Bhn or ≤ 19 HRc	≤ .10	≤ .25	≤ .10	≤ .20	305	RPM	233020	74686	37343	18642	12421	9709
							(244-366)	Fz	0.000006	0.00002	0.00004	0.00008	0.00012	0.00015
								Feed (ipm)	5.95	5.95	5.95	5.95	5.95	5.95
		Slot	1	≤ .10	≤ .20	245	RPM	187180	59994	29997	14974	9978	7799	
						(196-294)	Fz	0.000006	0.00002	0.00004	0.00008	0.00012	0.00015	
							Feed (ipm)	4.78	4.78	4.78	4.78	4.78	4.78	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	Profile ≤ 275 Bhn or ≤ 28 HRc	≤ .10	≤ .25	≤ .10	≤ .20	340	RPM	259760	83256	41628	20781	13846	10823
							(272-408)	Fz	0.000006	0.00002	0.00004	0.00008	0.00012	0.00015
								Feed (ipm)	6.62	6.62	6.62	6.62	6.62	6.62
		Slot	1	≤ .10	≤ .20	270	RPM	206280	66115	33058	16502	10996	8595	
						(216-324)	Fz	0.000006	0.00002	0.00004	0.00008	0.00012	0.00015	
							Feed (ipm)	5.26	5.26	5.26	5.26	5.26	5.26	
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	Profile ≤ 275 Bhn or ≤ 28 HRc	≤ .10	≤ .25	≤ .10	≤ .20	235	RPM	179540	57545	28772	14363	9570	7481
							(188-282)	Fz	0.000006	0.00002	0.00004	0.00007	0.00011	0.00014
								Feed (ipm)	4.06	4.06	4.06	4.06	4.06	4.06
		Slot	1	≤ .10	≤ .20	185	RPM	141340	45301	22651	11307	7534	5889	
						(148-222)	Fz	0.000006	0.00002	0.00004	0.00007	0.00011	0.00014	
							Feed (ipm)	3.20	3.20	3.20	3.20	3.20	3.20	
STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	Profile ≤ 325 Bhn or ≤ 35 HRc	≤ .10	≤ .25	≤ .10	≤ .20	215	RPM	164260	52647	26324	13141	8756	6844	
						(172-258)	Fz	0.000004	0.00001	0.00003	0.00005	0.00008	0.00010	
							Feed (ipm)	2.66	2.66	2.66	2.66	2.66	2.66	
	Slot	1	≤ .10	≤ .20	170	RPM	129880	41628	20814	10390	6923	5412		
					(136-204)	Fz	0.000004	0.00001	0.00003	0.00005	0.00008	0.00010		
						Feed (ipm)	2.10	2.10	2.10	2.10	2.10	2.10		

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FRACTIONAL 4 Flute: Square, Ball

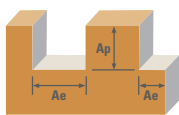


M4L, M4LB 5xD Fractional	Hardness	Profile	Ae x D ₁		Ap x D ₁	Vc (SFM)	RPM	Diameter (D ₁) (inch)					
			≤ .10	≤ .25				≤ 3	0.005	0.015	0.031	0.062	0.093
SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ .10	≤ .25	≤ 3	60	RPM	45840	14692	7346	3667	2443	1910
						(48-72)	Fz	0.000004	0.00001	0.00002	0.00005	0.00007	0.00009
						Feed (ipm)	0.67	0.67	0.67	0.67	0.67	0.67	
		Slot	1	≤ .10	≤ .20	45	RPM	34380	11019	5510	2750	1833	1433
						(36-54)	Fz	0.000004	0.00001	0.00002	0.00005	0.00007	0.00009
						Feed (ipm)	0.50	0.50	0.50	0.50	0.50	0.50	
	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ .10	≤ .25	≤ 3	45	RPM	34380	11019	5510	2750	1833	1433
						(36-54)	Fz	0.000002	0.00001	0.00001	0.00003	0.00004	0.00006
						Feed (ipm)	0.32	0.32	0.32	0.32	0.32	0.32	
		Slot	1	≤ .10	≤ .20	35	RPM	26740	8571	4285	2139	1425	1114
						(28-42)	Fz	0.000002	0.00001	0.00001	0.00003	0.00004	0.00006
						Feed (ipm)	0.25	0.25	0.25	0.25	0.25	0.25	
≤ 350 Bhn or ≤ 38 HRc	Profile	≤ .10	≤ .25	≤ 3	160	RPM	122240	39179	19590	9779	6516	5093	
					(128-192)	Fz	0.000004	0.00001	0.00003	0.00005	0.00008	0.00010	
					Feed (ipm)	1.97	1.97	1.97	1.97	1.97	1.97		
	Slot	1	≤ .10	≤ .20	130	RPM	99320	31833	15917	7946	5294	4138	
					(104-156)	Fz	0.000004	0.00001	0.00003	0.00005	0.00008	0.00010	
					Feed (ipm)	1.60	1.60	1.60	1.60	1.60	1.60		
≤ 440 Bhn or ≤ 47 HRc	Profile	≤ .10	≤ .25	≤ 3	60	RPM	45840	14692	7346	3667	2443	1910	
					(48-72)	Fz	0.000003	0.00001	0.00002	0.00004	0.00005	0.00007	
					Feed (ipm)	0.53	0.53	0.53	0.53	0.53	0.53		
	Slot	1	≤ .10	≤ .20	45	RPM	34380	11019	5510	2750	1833	1433	
					(36-54)	Fz	0.000003	0.00001	0.00002	0.00004	0.00005	0.00007	
					Feed (ipm)	0.40	0.40	0.40	0.40	0.40	0.40		
≤ 150 Bhn or ≤ 7 HRc	Profile	≤ .10	≤ .25	≤ 3	1000	RPM	764000	244872	122436	61120	40725	31833	
					(800-1200)	Fz	0.000019	0.00006	0.00012	0.00024	0.00035	0.00045	
					Feed (ipm)	57.50	57.50	57.50	57.50	57.50	57.50		
	Slot	1	≤ .10	≤ .20	800	RPM	611200	195897	97949	48896	32580	25467	
					(640-960)	Fz	0.000019	0.00006	0.00012	0.00024	0.00035	0.00045	
					Feed (ipm)	46.00	46.00	46.00	46.00	46.00	46.00		
≤ 140 Bhn or ≤ 3 HRc	Profile	≤ .10	≤ .25	≤ 3	515	RPM	393460	126109	63054	31477	20973	16394	
					(412-618)	Fz	0.000014	0.00004	0.00009	0.00018	0.00027	0.00034	
					Feed (ipm)	22.23	22.23	22.23	22.23	22.23	22.23		
	Slot	1	≤ .10	≤ .20	410	RPM	313240	100397	50199	25059	16697	13052	
					(328-492)	Fz	0.000014	0.00004	0.00009	0.00018	0.00027	0.00034	
					Feed (ipm)	17.70	17.70	17.70	17.70	17.70	17.70		
PLASTICS Polycarbonate, PVC, Polypropylene	Profile	≤ .10	≤ .25	≤ 3	1000	RPM	764000	244872	122436	61120	40725	31833	
					(800-1200)	Fz	0.000019	0.00006	0.00012	0.00024	0.00035	0.00045	
					Feed (ipm)	57.50	57.50	57.50	57.50	57.50	57.50		
	Slot	1	≤ .10	≤ .20	800	RPM	611200	195897	97949	48896	32580	25467	
					(640-960)	Fz	0.000019	0.00006	0.00012	0.00024	0.00035	0.00045	
					Feed (ipm)	46.00	46.00	46.00	46.00	46.00	46.00		

Note:

- Bhn (Brinell) HRc (Rockwell C)
- when recommended speed exceeds your capability, use maximum available and recalculate ipm
- rpm = Vc x 3.82 / D₁
- ipm = Fz x 4 x rpm
- helical ramp at 2 degrees or less, using slotting speed and feed rates (plunging is not recommended)
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D₁ maximum)
- refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)

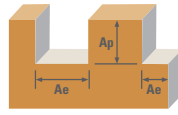
4 Flute: Square, Ball



M4E, M4EB 8xD Fractional	Hardness	Profile	Ae x D ₁	Ap x D ₁	Vc (SFM)	Diameter (D ₁) (inch)							
						0.015	0.031	0.062	0.093	0.120			
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ .05	≤ .10	≤ 4	365	RPM	89378	44689	22309	14865	11619
							(292-438)	Fz	0.000020	0.000040	0.000081	0.000121	0.000155
							Feed (ipm)	7.20	7.20	7.20	7.20	7.20	
H	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ .05	≤ .10	≤ 4	175	RPM	51423	25712	12835	8552	6685
							(140-210)	Fz	0.000018	0.000035	0.000070	0.000105	0.000135
							Feed (ipm)	3.60	3.60	3.60	3.60	3.60	
K	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ .05	≤ .10	≤ 4	340	RPM	42853	21426	10696	7127	5571
							(272-408)	Fz	0.000015	0.000029	0.000058	0.000088	0.000112
							Feed (ipm)	2.50	2.50	2.50	2.50	2.50	
M	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ .05	≤ .10	≤ 4	305	RPM	74686	37343	18642	12421	9709
							(244-366)	Fz	0.000020	0.000040	0.000080	0.000121	0.000154
							Feed (ipm)	6.00	6.00	6.00	6.00	6.00	
S	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ .05	≤ .10	≤ 4	340	RPM	83256	41628	20781	13846	10823
							(272-408)	Fz	0.000020	0.000040	0.000081	0.000121	0.000155
							Feed (ipm)	6.70	6.70	6.70	6.70	6.70	
S	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ .05	≤ .10	≤ 4	235	RPM	57545	28772	14363	9570	7481
							(188-282)	Fz	0.000018	0.000036	0.000071	0.000107	0.000137
							Feed (ipm)	4.10	4.10	4.10	4.10	4.10	
S	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ .05	≤ .10	≤ 4	215	RPM	52647	26324	13141	8756	6844
							(172-258)	Fz	0.000012	0.000025	0.000049	0.000074	0.000095
							Feed (ipm)	2.60	2.60	2.60	2.60	2.60	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ .05	≤ .10	≤ 4	60	RPM	14692	7346	3667	2443	1910
							(48-72)	Fz	0.000011	0.000022	0.000045	0.000068	0.000086
							Feed (ipm)	0.66	0.66	0.66	0.66	0.66	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ .05	≤ .10	≤ 4	45	RPM	11019	5510	2750	1833	1433
							(36-54)	Fz	0.000007	0.000015	0.000030	0.000045	0.000058
							Feed (ipm)	0.33	0.33	0.33	0.33	0.33	
S	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ .05	≤ .10	≤ 4	160	RPM	39179	19590	9779	6516	5093
							(128-192)	Fz	0.000013	0.000026	0.000051	0.000077	0.000098
							Feed (ipm)	2.00	2.00	2.00	2.00	2.00	
N	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile	≤ .05	≤ .10	≤ 4	60	RPM	14692	7346	3667	2443	1910
							(48-72)	Fz	0.000009	0.000018	0.000036	0.000054	0.000069
							Feed (ipm)	0.53	0.53	0.53	0.53	0.53	
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 150 Bhn or ≤ 7 HRc	Profile	≤ .05	≤ .10	≤ 4	1000	RPM	244872	122436	61120	40725	31833
							(800-1200)	Fz	0.000059	0.000118	0.000237	0.000356	0.000455
							Feed (ipm)	58.00	58.00	58.00	58.00	58.00	
N	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	Profile	≤ .05	≤ .10	≤ 4	515	RPM	126109	63054	31477	20973	16394
							(412-618)	Fz	0.000046	0.000091	0.000183	0.000274	0.000351
							Feed (ipm)	23.00	23.00	23.00	23.00	23.00	
N	PLASTICS Polycarbonate, PVC, Polypropylene	Profile	≤ .05	≤ .10	≤ 4	≤ 4	1000	RPM	244872	122436	61120	40725	31833
							(800-1200)	Fz	0.000059	0.000118	0.000237	0.000356	0.000455
							Feed (ipm)	58.00	58.00	58.00	58.00	58.00	

- Note:**
- Bhn (Brinell) HRc (Rockwell C)
 - when recommended speed exceeds your capability, use maximum available and recalculate ipm
 - rpm = Vc x 3.82 / D₁
 - ipm = Fz x 4 x rpm
 - helical ramp at 2 degrees or less, using slotting speed and feed rates (plunging is not recommended)
 - reduce speed and feed for materials harder than listed
 - reduce feed and Ae when finish milling (.02 x D₁ maximum)
 - refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)

FRACTIONAL 4 Flute: Square, Ball

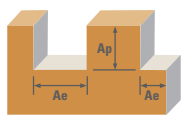


M4X, M4XB 12xD Fractional	Hardness	Profile	Ae x D ₁		Ap x D ₁	Vc (SFM)	Diameter (D ₁) (inch)						
							0.0156	0.0312	0.0625	0.0938	0.1200		
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ .03	≤ .06	≤ 6	365 RPM	89378	44689	22309	14865	11619	
							(292-438)	Fz	0.000012	0.000025	0.000049	0.000074	0.000095
							Feed (ipm)	4.40	4.40	4.40	4.40	4.40	
ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ .03	≤ .06	≤ 6	175 RPM	51423	25712	12835	8552	6685		
							(140-210)	Fz	0.000011	0.000021	0.000043	0.000064	0.000082
							Feed (ipm)	2.20	2.20	2.20	2.20	2.20	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ .03	≤ .06	≤ 6	340 RPM	42853	21426	10696	7127	5571	
							(272-408)	Fz	0.000009	0.000018	0.000035	0.000053	0.000067
							Feed (ipm)	1.50	1.50	1.50	1.50	1.50	
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ .03	≤ .06	≤ 6	305 RPM	74686	37343	18642	12421	9709	
							(244-366)	Fz	0.000009	0.000018	0.000036	0.000054	0.000070
							Feed (ipm)	2.70	2.70	2.70	2.70	2.70	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ .03	≤ .06	≤ 6	340 RPM	83256	41628	20781	13846	10823	
							(272-408)	Fz	0.000012	0.000025	0.000049	0.000074	0.000095
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ .03	≤ .06	≤ 6	235 RPM	57545	28772	14363	9570	7481	
								(188-282)	Fz	0.000011	0.000022	0.000044	0.000065
	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ .03	≤ .06	≤ 6	215 RPM	52647	26324	13141	8756	6844	
								(172-258)	Fz	0.000008	0.000015	0.000030	0.000046
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ .03	≤ .06	≤ 6	60 RPM	14692	7346	3667	2443	1910	
							(48-72)	Fz	0.000007	0.000014	0.000027	0.000041	0.000052
SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ .03	≤ .06	≤ 6	45 RPM	11019	5510	2750	1833	1433		
							(36-54)	Fz	0.000005	0.000009	0.000018	0.000027	0.000035
TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ .03	≤ .06	≤ 6	160 RPM	39179	19590	9779	6516	5093		
							(128-192)	Fz	0.000008	0.000015	0.000031	0.000046	0.000059
TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile	≤ .03	≤ .06	≤ 6	60 RPM	14692	7346	3667	2443	1910		
							(48-72)	Fz	0.000005	0.000011	0.000022	0.000033	0.000042
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 150 Bhn or ≤ 7 HRc	Profile	≤ .03	≤ .06	≤ 6	1000 RPM	244872	122436	61120	40725	31833	
							(800-1200)	Fz	0.000037	0.000074	0.000147	0.000221	0.000283
							Feed (ipm)	36.00	36.00	36.00	36.00	36.00	
COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	Profile	≤ .03	≤ .06	≤ 6	515 RPM	126109	63054	31477	20973	16394		
							(412-618)	Fz	0.000028	0.000056	0.000111	0.000167	0.000213
PLASTICS Polycarbonate, PVC, Polypropylene	Profile	≤ .03	≤ .06	≤ 6	1000 RPM	244872	122436	61120	40725	31833			
						(800-1200)	Fz	0.000037	0.000074	0.000147	0.000221	0.000283	
							Feed (ipm)	36.00	36.00	36.00	36.00	36.00	

Note:

- Bhn (Brinell) HRc (Rockwell C)
- when recommended speed exceeds your capability, use maximum available and recalculate ipm
- rpm = Vc x 3.82 / D₁
- ipm = Fz x 4 x rpm
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D₁ maximum)
- refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstoool.com)

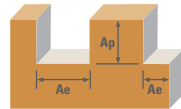
2 Flute: Square, Ball



M2M, M2MB 1.5xD Metric	Hardness	Ae x D ₁	Ap x D ₁	Vc (m/min)	Diameter (D ₁) (mm)									
					0.1	0.5	1	1.5	2	2.5	3			
CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ .30	≤ .50	≤ 1	111	RPM	353837	70767	35384	23589	17692	14153	11795
						(89-134)	Fz	0.00043	0.00216	0.00432	0.00648	0.00865	0.01081	0.01297
						Feed (mm/min)	306	306	306	306	306	306	306	
	Slot 	1	≤ .20	≤ .50	88	RPM	281131	56226	28113	18742	14057	11245	9371	
					(71-106)	Fz	0.00043	0.00216	0.00432	0.00648	0.00865	0.01081	0.01297	
					Feed (mm/min)	243	243	243	243	243	243	243		
ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile 	≤ .30	≤ .50	≤ 1	64	RPM	203577	40715	20358	13572	10179	8143	6786
						(51-77)	Fz	0.00038	0.00192	0.00384	0.00576	0.00769	0.00961	0.01153
						Feed (mm/min)	156	156	156	156	156	156	156	
	Slot 	1	≤ .20	≤ .50	50	RPM	159954	31991	15995	10664	7998	6398	5332	
					(40-60)	Fz	0.00038	0.00192	0.00384	0.00576	0.00769	0.00961	0.01153	
					Feed (mm/min)	123	123	123	123	123	123	123		
TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile 	≤ .30	≤ .50	≤ 1	53	RPM	169648	33930	16965	11310	8482	6786	5655
						(43-64)	Fz	0.00032	0.00160	0.00320	0.00480	0.00640	0.00800	0.00962
						Feed (mm/min)	109	109	109	109	109	109	109	
	Slot 	1	≤ .20	≤ .50	43	RPM	135718	27144	13572	9048	6786	5429	4524	
					(34-51)	Fz	0.00032	0.00160	0.00320	0.00480	0.00640	0.00800	0.00962	
					Feed (mm/min)	87	87	87	87	87	87	87		
CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile 	≤ .30	≤ .50	≤ 1	93	RPM	295672	59134	29567	19711	14784	11827	9856
						(74-112)	Fz	0.00043	0.00217	0.00433	0.00650	0.00866	0.01083	0.01301
						Feed (mm/min)	256	256	256	256	256	256	256	
	Slot 	1	≤ .20	≤ .50	75	RPM	237507	47501	23751	15834	11875	9500	7917	
					(60-90)	Fz	0.00043	0.00217	0.00433	0.00650	0.00866	0.01083	0.01301	
					Feed (mm/min)	206	206	206	206	206	206	206		
STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ .30	≤ .50	≤ 1	104	RPM	329602	65920	32960	21973	16480	13184	10987
						(83-124)	Fz	0.00043	0.00216	0.00432	0.00648	0.00865	0.01081	0.01295
						Feed (mm/min)	285	285	285	285	285	285	285	
	Slot 	1	≤ .20	≤ .50	82	RPM	261742	52348	26174	17449	13087	10470	8725	
					(66-99)	Fz	0.00043	0.00216	0.00432	0.00648	0.00865	0.01081	0.01295	
					Feed (mm/min)	226	226	226	226	226	226	226		
STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ .30	≤ .50	≤ 1	72	RPM	227813	45563	22781	15188	11391	9113	7594
						(57-86)	Fz	0.00038	0.00192	0.00385	0.00577	0.00769	0.00961	0.01154
						Feed (mm/min)	175	175	175	175	175	175	175	
	Slot 	1	≤ .20	≤ .50	56	RPM	179342	35868	17934	11956	8967	7174	5978	
					(45-68)	Fz	0.00038	0.00192	0.00385	0.00577	0.00769	0.00961	0.01154	
					Feed (mm/min)	138	138	138	138	138	138	138		
STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc	Profile 	≤ .30	≤ .50	≤ 1	66	RPM	208425	41685	20842	13895	10421	8337	6947
						(52-79)	Fz	0.00027	0.00136	0.00272	0.00408	0.00544	0.00680	0.00819
						Feed (mm/min)	113	113	113	113	113	113	113	
	Slot 	1	≤ .20	≤ .50	52	RPM	164801	32960	16480	10987	8240	6592	5493	
					(41-62)	Fz	0.00027	0.00136	0.00272	0.00408	0.00544	0.00680	0.00819	
					Feed (mm/min)	90	90	90	90	90	90	90		

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2 Flute: Square, Ball



M2M, M2MB 1.5xD Metric	Hardness	Profile Ae x D ₁	Slot Ap x D ₁	Vc (m/min)	Diameter (D ₁) (mm)							
					0.1	0.5	1	1.5	2	2.5	3	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400 ≤ 300 Bhn or ≤ 32 HRc	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	18	RPM	58165	11633	5816	3878	2908	2327	1939
				(15-22)	Fz	0.00024	0.00121	0.00242	0.00362	0.00483	0.00604	0.00722
				Feed (mm/min)	28	28	28	28	28	28	28	
		Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	14	RPM	43624	8725	4362	2908	2181	1745	1454	
			(11-16)	Fz	0.00024	0.00121	0.00242	0.00362	0.00483	0.00604	0.00722	
			Feed (mm/min)	21	21	21	21	21	21	21		
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene ≤ 400 Bhn or ≤ 43 HRc	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	14	RPM	43624	8725	4362	2908	2181	1745	1454
				(11-16)	Fz	0.00016	0.00080	0.00161	0.00241	0.00322	0.00402	0.00486
				Feed (mm/min)	14	14	14	14	14	14	14	
		Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	11	RPM	33930	6786	3393	2262	1696	1357	1131	
			(9-13)	Fz	0.00016	0.00080	0.00161	0.00241	0.00322	0.00402	0.00486	
			Feed (mm/min)	11	11	11	11	11	11	11		
TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si ≤ 350 Bhn or ≤ 38 HRc	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	49	RPM	155107	31021	15511	10340	7755	6204	5170	
			(39-59)	Fz	0.00027	0.00136	0.00272	0.00408	0.00544	0.00680	0.00821	
			Feed (mm/min)	84	84	84	84	84	84	84		
	Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	40	RPM	126024	25205	12602	8402	6301	5041	4201		
		(32-48)	Fz	0.00027	0.00136	0.00272	0.00408	0.00544	0.00680	0.00821		
		Feed (mm/min)	69	69	69	69	69	69	69			
TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al ≤ 440 Bhn or ≤ 47 HRc	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	18	RPM	58165	11633	5816	3878	2908	2327	1939	
			(15-22)	Fz	0.00019	0.00096	0.00192	0.00288	0.00384	0.00480	0.00585	
			Feed (mm/min)	22	22	22	22	22	22	22		
	Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	14	RPM	43624	8725	4362	2908	2181	1745	1454		
		(11-16)	Fz	0.00019	0.00096	0.00192	0.00288	0.00384	0.00480	0.00585		
		Feed (mm/min)	17	17	17	17	17	17	17			
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075 ≤ 150 Bhn or ≤ 7 HRc	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	305	RPM	969416	193883	96942	64628	48471	38777	32314
				(244-366)	Fz	0.00128	0.00639	0.01277	0.01916	0.02555	0.03193	0.03832
				Feed (mm/min)	2477	2477	2477	2477	2477	2477	2477	
		Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	244	RPM	775533	155107	77553	51702	38777	31021	25851	
			(195-293)	Fz	0.00128	0.00639	0.01277	0.01916	0.02555	0.03193	0.03832	
			Feed (mm/min)	1981	1981	1981	1981	1981	1981	1981		
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass ≤ 140 Bhn or ≤ 3 HRc	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	157	RPM	499249	99850	49925	33283	24962	19970	16642
				(126-188)	Fz	0.00096	0.00479	0.00959	0.01438	0.01917	0.02396	0.02876
				Feed (mm/min)	957	957	957	957	957	957	957	
		Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	125	RPM	397461	79492	39746	26497	19873	15898	13249	
			(100-150)	Fz	0.00096	0.00479	0.00959	0.01438	0.01917	0.02396	0.02876	
			Feed (mm/min)	762	762	762	762	762	762	762		
PLASTICS Polycarbonate, PVC, Polypropylene	Profile Ae x D ₁ ≤ .30 ≤ .50	Slot Ap x D ₁ ≤ 1	305	RPM	969416	193883	96942	64628	48471	38777	32314	
			(244-366)	Fz	0.00128	0.00639	0.01277	0.01916	0.02555	0.03193	0.03832	
			Feed (mm/min)	2477	2477	2477	2477	2477	2477	2477		
	Slot Ae x D ₁ 1 Ap x D ₁ ≤ .20 ≤ .50	244	RPM	775533	155107	77553	51702	38777	31021	25851		
		(195-293)	Fz	0.00128	0.00639	0.01277	0.01916	0.02555	0.03193	0.03832		
		Feed (mm/min)	1981	1981	1981	1981	1981	1981	1981			

Note:

- Bhn (Brinell) HRc (Rockwell C)
- when recommended speed exceeds your capability, use maximum available and recalculate ipm
- rpm = (Vc x 1000) / (D₁ x 3.14)
- mm/min = Fz x 2 x rpm
- helical ramp at 2 degrees or less, using slotting speed and feed rates (plunging is not recommended)
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D₁ maximum)
- refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)