KYOCERA

SGS
Solid Carbide Tools

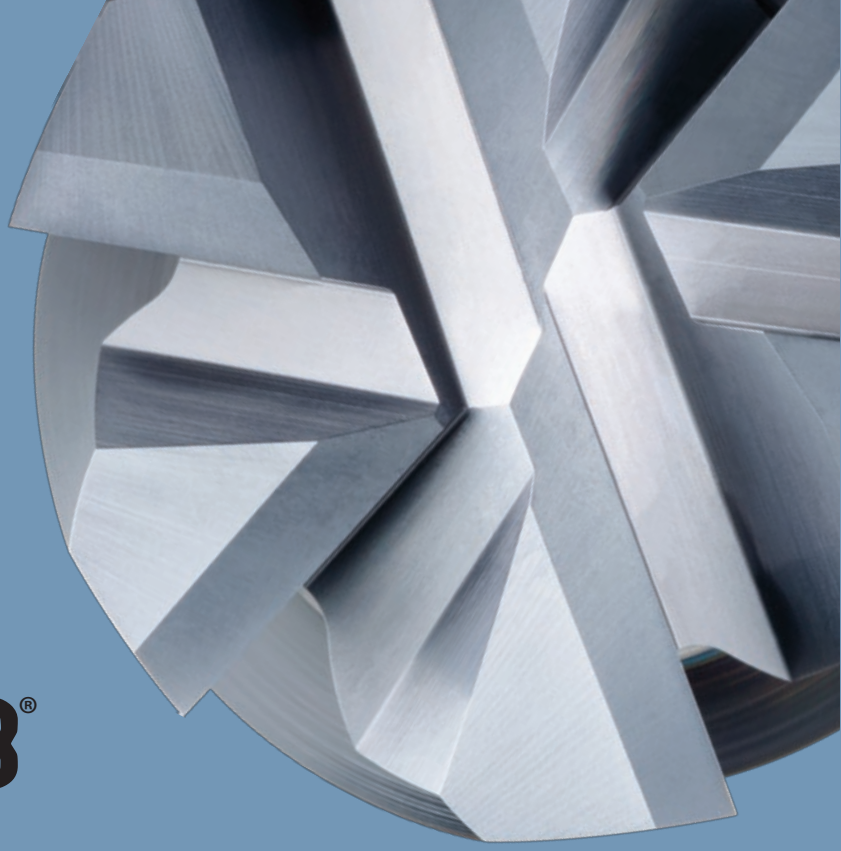
Six Flute High Performance End Mills

TCARB®
Six Flute End Mills

New Expanded Offering

www.kyocera-sgstool.com

ISO 9001 Certified



T-CARB®

Six Flute End Mills

T-Carb® 6-Flute High Performance End Mills are ideal for aggressive high speed machining using Trochoidal and Peel Milling techniques. The additional flutes allow higher feed rates at reduced tool loads, ultimately preventing breakage and failure. The variable pitch geometry allows the T-Carb® to excel in multiple operations calling for aggressive roughing and finishing, resulting in faster cycle times and lower costs. The series is offered in a variety of length, neck and corner radius options and is coated with Ti-NAMITE-X for ultimate thermal barrier protection.

Titanium

T-CARB® HIGH SPEED MACHINING END MILLS ARE **IDEAL FOR AGGRESSIVE MILLING APPLICATIONS** IN THESE TARGET MARKETS:

- Aerospace Structural and Titanium Components
- Medical Replacement Parts and Joints
- Automotive & Motorized Vehicles
- Energy and Power Generation

FEATURES & BENEFITS

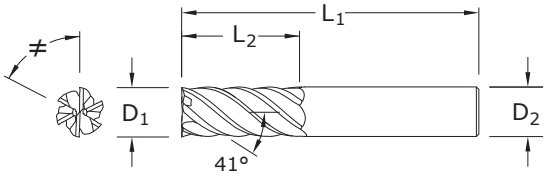
- Incorporates unique 6-Flute design for High Speed Machining operations requiring high accuracy and less deflection
- Designed for aggressive ramping at high speeds where evacuation and load might be a factor
- Engineered for High Speed Milling using Trochoidal and Peel Milling techniques
- Exceptional performance with minimal deflection in difficult materials such as titanium alloys and stainless steels
- Eccentric relief provides superior strength and smoother surface finish
- Variable Flute Geometry maximizes productivity and tool life by reducing the harmful harmonics associated with aggressive milling
- Available in a variety of corner radius and reach options
- Exclusively coated with Ti-NAMITE-X for superior wear and increased tool life
- New Expanded tools

Ti-NAMITE-X ADVANCED TOOL COATING

Ti-NAMITE-X provides outstanding results in a diverse range of applications including medium-hard to very hard steels (40–65 HRC) and titanium alloys. The layered design of the coating, along with the nanocomposite grain structure provides the hardness necessary for extreme wear resistance with the toughness required to withstand interrupted cutting. Ti-NAMITE-X allows for a broad spectrum of high-performance machining from aggressive material removal rates to high speed machining and finishing.

Hardness (HV): 3600
Oxidation Temperature: 1150°C – 2100°F
Coefficient of Friction: 0.45
Thickness: 1 – 4 Microns (based on tool diameter)

CARB®
Six Flute End Mills



TOLERANCES (inch)

DIAMETER	D_1	D_2
1/4 - 1	+0.000 / –0.002	h6

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Ti-Namite-X (TX) EDP No.
1/4	3/4	2-1/2	1/4	35100
3/8	1	2-1/2	3/8	35101
1/2	1-1/4	3	1/2	35102
5/8	1-5/8	3-1/2	5/8	35103
3/4	1-5/8	4	3/4	35104
1	2-5/8	6	1	35105


Square


Straight


Right Spiral


Regular


Flute Spacing Unequal

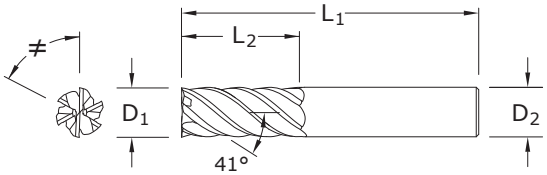
Positive Rake Angle


External Coolant

6
Flutes

TOLERANCES (mm)

DIAMETER	D_1	D_2
6 - 20	+0,000 / -0,050	h6



Square

Straight

Right Spiral

Regular

Flute Spacing Unequal

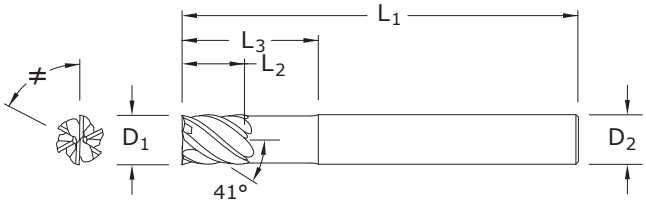
Positive Rake Angle

External Coolant

6 Flutes

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Ti-Namite-X (TX) EDP No.
6,0	19,0	63,0	6,0	45100
8,0	20,0	63,0	8,0	45101
10,0	22,0	75,0	10,0	45102
12,0	26,0	83,0	12,0	45103
16,0	32,0	92,0	16,0	45104
20,0	38,0	104,0	20,0	45105

CARB®
Six Flute End Mills



TOLERANCES (inch)

DIAMETER	D_1	D_2
1/4 - 1	+0.000 / –0.002	h6

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Reach L_3	Ti-Namite-X (TX) EDP No.
1/4	3/8	4	1/4	1-1/8	35106
3/8	1/2	4	3/8	2-1/8	35107
1/2	5/8	4	1/2	2-1/4	35108
5/8	3/4	5	5/8	2-1/2	35109
3/4	1	6	3/4	3-3/8	35110
1	1-1/4	6	1	3-3/8	35111


Square


Straight


Right Spiral


Long Reach Neck

Flute Spacing Unequal

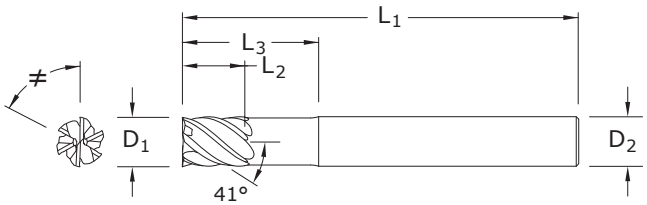
Positive Rake Angle


External Coolant

Flutes

TOLERANCES (mm)

DIAMETER	D_1	D_2
6 - 20	+0,000 / -0,050	h6



Square

Straight

Right Spiral

Long Reach Neck

Flute Spacing Unequal

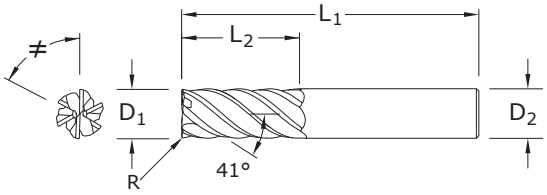
Positive Rake Angle

External Coolant

6 Flutes

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Reach L_3	Ti-Namite-X (TX) EDP No.
6,0	8,0	75,0	6,0	32,0	45106
8,0	10,0	75,0	8,0	32,0	45107
10,0	12,0	100,0	10,0	40,0	45108
12,0	15,0	100,0	12,0	48,0	45109
16,0	20,0	115,0	16,0	65,0	45110
20,0	24,0	150,0	20,0	80,0	45111

CARB®
Six Flute End Mills



TOLERANCES (inch)

DIAMETER	D_1	D_2	R
1/4 - 1	+0.000 / –0.002	h6	+0.000 / –0.002

New Expanded Tools

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Corner Radius R	Ti-Namite-X (TX) EDP No.
1/4	3/4	2-1/2	1/4	.015	35112
1/4	3/4	2-1/2	1/4	.030	35150
3/8	1	2-1/2	3/8	.015	35113
3/8	1	2-1/2	3/8	.030	35114
1/2	1-1/4	3	1/2	.015	35151
1/2	1-1/4	3	1/2	.030	35115
1/2	1-1/4	3	1/2	.060	35152
1/2	1-1/4	3	1/2	.090	35116
1/2	1-1/4	3	1/2	.120	35117
5/8	1-5/8	3-1/2	5/8	.015	35153
5/8	1-5/8	3-1/2	5/8	.030	35118
5/8	1-5/8	3-1/2	5/8	.060	35154
5/8	1-5/8	3-1/2	5/8	.090	35119
5/8	1-5/8	3-1/2	5/8	.120	35120
5/8	1-5/8	3-1/2	5/8	.190	35155
3/4	1-5/8	4	3/4	.030	35121
3/4	1-5/8	4	3/4	.060	35156
3/4	1-5/8	4	3/4	.090	35122
3/4	1-5/8	4	3/4	.120	35123
3/4	1-5/8	4	3/4	.190	35157
3/4	1-5/8	4	3/4	.250	35158
1	2-5/8	6	1	.030	35124
1	2-5/8	6	1	.060	35159
1	2-5/8	6	1	.090	35125
1	2-5/8	6	1	.120	35126
1	2-5/8	6	1	.190	35160
1	2-5/8	6	1	.250	35161


Corner


Straight


Right Spiral


Regular


Flute Spacing Unequal

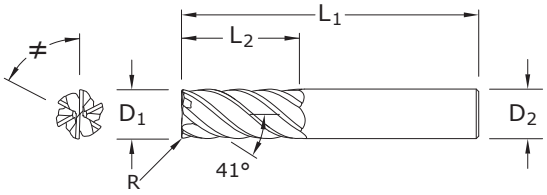
Positive Rake Angle


External Coolant

6
Flutes

Series 51CR | Fractional

TOLERANCES (mm)			
DIAMETER	D_1	D_2	R
6 - 20	+0,000 / -0,050	h6	+0,000 / -0,050

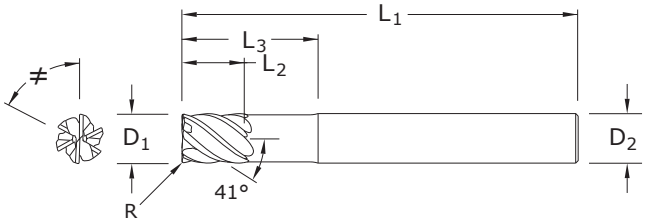


New Expanded Tools

Corner
Straight
Right Spiral
Regular
Flute Spacing Unequal
Positive Rake Angle
External Coolant
6 Flutes

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Corner Radius R	Ti-Namite-X (TX) EDP No.
6,0	19,0	63,0	6,0	0,5	45112
6,0	19,0	63,0	6,0	1,0	45170
6,0	19,0	63,0	6,0	1,5	45171
8,0	20,0	63,0	8,0	0,5	45113
8,0	20,0	63,0	8,0	1,0	45114
8,0	20,0	63,0	8,0	1,2	45150
8,0	20,0	63,0	8,0	1,5	45172
8,0	20,0	63,0	8,0	2,0	45173
10,0	22,0	75,0	10,0	0,5	45174
10,0	22,0	75,0	10,0	1,0	45115
10,0	22,0	75,0	10,0	1,5	45116
10,0	22,0	75,0	10,0	2,0	45117
10,0	22,0	75,0	10,0	2,5	45175
12,0	26,0	83,0	12,0	0,5	45176
12,0	26,0	83,0	12,0	0,76	45177
12,0	26,0	83,0	12,0	1,0	45118
12,0	26,0	83,0	12,0	1,5	45119
12,0	26,0	83,0	12,0	2,0	45120
12,0	26,0	83,0	12,0	2,5	45178
12,0	26,0	83,0	12,0	3,0	45179
16,0	32,0	92,0	16,0	1,0	45121
16,0	32,0	92,0	16,0	1,5	45122
16,0	32,0	92,0	16,0	2,0	45123
16,0	32,0	92,0	16,0	2,5	45180
16,0	32,0	92,0	16,0	3,0	45181
16,0	32,0	92,0	16,0	4,0	45182
20,0	38,0	104,0	20,0	1,0	45124
20,0	38,0	104,0	20,0	1,5	45125
20,0	38,0	104,0	20,0	2,0	45126
20,0	38,0	104,0	20,0	2,5	45183
20,0	38,0	104,0	20,0	3,0	45184
20,0	38,0	104,0	20,0	4,0	45185
20,0	38,0	104,0	20,0	5,0	45186

CARB®
Six Flute End Mills



TOLERANCES (inch)

DIAMETER	D_1	D_2	R
1/4 - 1	+0.000 / –0.002	h6	+0.000 / –0.002

New Expanded Tools

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Reach L_3	Corner Radius R	Ti-Namite-X (TX) EDP No.
1/4	3/8	4	1/4	1-1/8	.015	35127
1/4	3/8	4	1/4	1-1/8	.030	35180
3/8	1/2	4	3/8	2-1/8	.015	35128
3/8	1/2	4	3/8	2-1/8	.030	35129
1/2	5/8	4	1/2	2-1/4	.015	35181
1/2	5/8	4	1/2	2-1/4	.030	35130
1/2	5/8	4	1/2	2-1/4	.060	35182
1/2	5/8	4	1/2	2-1/4	.090	35131
1/2	5/8	4	1/2	2-1/4	.120	35132
5/8	3/4	5	5/8	2-1/2	.015	35183
5/8	3/4	5	5/8	2-1/2	.030	35133
5/8	3/4	5	5/8	2-1/2	.060	35184
5/8	3/4	5	5/8	2-1/2	.090	35134
5/8	3/4	5	5/8	2-1/2	.120	35135
5/8	3/4	5	5/8	2-1/2	.190	35185
3/4	1	6	3/4	3-3/8	.030	35136
3/4	1	6	3/4	3-3/8	.060	35186
3/4	1	6	3/4	3-3/8	.090	35137
3/4	1	6	3/4	3-3/8	.120	35138
3/4	1	6	3/4	3-3/8	.190	35187
3/4	1	6	3/4	3-3/8	.250	35188
1	1-1/4	6	1	3-3/8	.030	35139
1	1-1/4	6	1	3-3/8	.060	35189
1	1-1/4	6	1	3-3/8	.090	35140
1	1-1/4	6	1	3-3/8	.120	35141
1	1-1/4	6	1	3-3/8	.190	35190
1	1-1/4	6	1	3-3/8	.250	35191


Corner


Straight


Right Spiral


Long Reach Neck


Flute Spacing Unequal

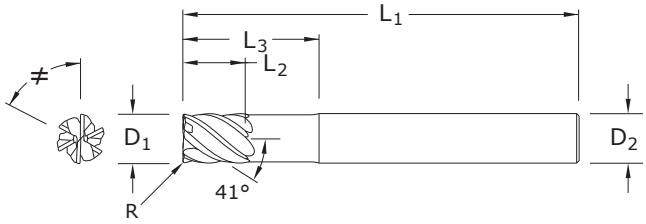

Positive Rake Angle


External Coolant

6
Flutes

Series 51LC | Fractional

TOLERANCES (mm)			
DIAMETER	D_1	D_2	R
6 - 20	+0,000 / -0,050	h6	+0,000 / -0,050

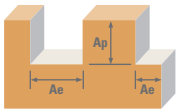


New Expanded Tools

Corner
Straight
Right Spiral
Long Reach Neck
Flute Spacing Unequal
Positive Rake Angle
External Coolant
6 Flutes

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Reach L_3	Corner Radius R	Ti-Namite-X (TX) EDP No.
6,0	8,0	75,0	6,0	32,0	0,5	45127
6,0	8,0	75,0	6,0	32,0	1,0	45187
6,0	8,0	75,0	6,0	32,0	1,5	45188
8,0	10,0	75,0	8,0	32,0	0,5	45128
8,0	10,0	75,0	8,0	32,0	1,0	45129
8,0	10,0	75,0	8,0	32,0	1,5	45189
8,0	10,0	75,0	8,0	32,0	2,0	45190
10,0	12,0	100,0	10,0	40,0	0,5	45191
10,0	12,0	100,0	10,0	40,0	1,0	45130
10,0	12,0	100,0	10,0	40,0	1,5	45131
10,0	12,0	100,0	10,0	40,0	2,0	45132
10,0	12,0	100,0	10,0	40,0	2,5	45192
12,0	15,0	100,0	12,0	48,0	0,5	45193
12,0	15,0	100,0	12,0	48,0	0,76	45194
12,0	15,0	100,0	12,0	48,0	1,0	45133
12,0	15,0	100,0	12,0	48,0	1,5	45134
12,0	15,0	100,0	12,0	48,0	2,0	45135
12,0	15,0	100,0	12,0	48,0	2,5	45195
12,0	15,0	100,0	12,0	48,0	3,0	45196
16,0	20,0	115,0	16,0	65,0	1,0	45136
16,0	20,0	115,0	16,0	65,0	1,5	45137
16,0	20,0	115,0	16,0	65,0	2,0	45138
16,0	20,0	115,0	16,0	65,0	2,5	45197
16,0	20,0	115,0	16,0	65,0	3,0	45198
16,0	20,0	115,0	16,0	65,0	4,0	45199
20,0	24,0	150,0	20,0	80,0	1,0	45139
20,0	24,0	150,0	20,0	80,0	1,5	45140
20,0	24,0	150,0	20,0	80,0	2,0	45141
20,0	24,0	150,0	20,0	80,0	2,5	45200
20,0	24,0	150,0	20,0	80,0	3,0	45201
20,0	24,0	150,0	20,0	80,0	4,0	45202
20,0	24,0	150,0	20,0	80,0	5,0	45203

CARB®
Six Flute End Mills



	Series 51, 51CR, 51L, 51LC Fractional	Hardness		Ae x D_1	Ap x D_1	Vc (sfm)		Diameter (D_1) (inch) 1/4	3/8	1/2	5/8	3/4	1
P	**CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536**	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	720	RPM	11002	7334	5501	4401	3667	2750
						(576-864)	Fz	0.0020	0.0035	0.0050	0.0055	0.0061	0.0071
							Feed (ipm)	132	154	165	145	134	117
			HSM	≤ 0.05	≤ 2	915	RPM	13981	9321	6991	5592	4660	3495
						(732-1098)	Fz	0.0028	0.0053	0.0070	0.0077	0.0085	0.0100
							Feed (ipm)	235	296	294	258	238	210
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.1	≤ 1	490	RPM	7487	4991	3744	2995	2496	1872
						(392-588)	Fz	0.0015	0.0029	0.0038	0.0042	0.0046	0.0054
							Feed (ipm)	67	87	85	75	69	61
			HSM	≤ 0.05	≤ 2	620	RPM	9474	6316	4737	3789	3158	2368
						(496-744)	Fz	0.0021	0.0039	0.0052	0.0057	0.0062	0.0073
							Feed (ipm)	119	148	148	130	117	104
H	**TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2**	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.1	≤ 1	240	RPM	3667	2445	1834	1467	1222	917
						(192-288)	Fz	0.0012	0.0023	0.0030	0.0034	0.0037	0.0043
							Feed (ipm)	26	34	33	30	27	24
			HSM	≤ 0.05	≤ 2	305	RPM	4660	3107	2330	1864	1553	1165
						(244-366)	Fz	0.0017	0.0032	0.0042	0.0046	0.0050	0.0059
							Feed (ipm)	48	60	59	51	47	41
M	**STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F**	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	510	RPM	7793	5195	3896	3117	2598	1948
						(459-561)	Fz	0.0015	0.0028	0.0038	0.0041	0.0045	0.0053
							Feed (ipm)	70	87	89	77	70	62
			HSM	≤ 0.05	≤ 2	650	RPM	9932	6621	4966	3973	3311	2483
						(585-715)	Fz	0.0021	0.0038	0.0051	0.0056	0.0061	0.0072
							Feed (ipm)	125	151	152	133	121	107
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	350	RPM	5348	3565	2674	2139	1783	1337
						(315-385)	Fz	0.0012	0.0023	0.0030	0.0033	0.0036	0.0042
							Feed (ipm)	39	49	48	42	39	34
			HSM	≤ 0.05	≤ 2	450	RPM	6876	4584	3438	2750	2292	1719
						(405-495)	Fz	0.0017	0.0032	0.0042	0.0046	0.0050	0.0059
							Feed (ipm)	70	88	87	76	69	61
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.1	≤ 1	325	RPM	4966	3311	2483	1986	1655	1242
						(293-358)	Fz	0.0012	0.0023	0.0030	0.0033	0.0036	0.0042
							Feed (ipm)	36	46	45	39	36	31
			HSM	≤ 0.05	≤ 2	410	RPM	6265	4177	3132	2506	2088	1566
						(369-451)	Fz	0.0017	0.0032	0.0042	0.0046	0.0050	0.0059
							Feed (ipm)	64	80	79	69	63	55

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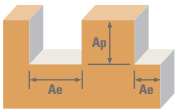
CARB® Six Flute End Mills

	Series 51, 51CR, 51L, 51LC Fractional	Hardness		 Ae x D_1	Ap x D_1	Vc (sfm)		Diameter (D_1) (inch) 1/4	3/8	1/2	5/8	3/4	1
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.1	≤ 1	105	RPM	1604	1070	802	642	535	401
						(84-126)	Fz	0.0014	0.0027	0.0036	0.0039	0.0043	0.0050
							Feed (ipm)	13	17	17	15	14	12
			HSM	≤ 0.05	≤ 2	130	RPM	1986	1324	993	795	662	497
						(104-156)	Fz	0.0016	0.0036	0.0048	0.0053	0.0058	0.0067
							Feed (ipm)	19	29	29	25	23	20
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.1	≤ 1	80	RPM	1222	815	611	489	407	306
						(64-96)	Fz	0.0010	0.0018	0.0025	0.0027	0.0029	0.0034
							Feed (ipm)	7	9	9	8	7	6
			HSM	≤ 0.05	≤ 2	100	RPM	1528	1019	764	611	509	382
						(80-120)	Fz	0.0013	0.0025	0.0034	0.0037	0.0041	0.0047
							Feed (ipm)	12	15	16	14	13	11
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.1	≤ 1	280	RPM	4278	2852	2139	1711	1426	1070
						(224-336)	Fz	0.0010	0.0018	0.0025	0.0027	0.0029	0.0034
							Feed (ipm)	26	31	32	28	25	22
			HSM	≤ 0.05	≤ 2	355	RPM	5424	3616	2712	2170	1808	1356
						(284-426)	Fz	0.0013	0.0025	0.0034	0.0037	0.0041	0.0047
							Feed (ipm)	42	54	55	48	44	38
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile	≤ 0.1	≤ 1	155	RPM	2368	1579	1184	947	789	592
						(124-186)	Fz	0.0010	0.0018	0.0025	0.0027	0.0029	0.0034
							Feed (ipm)	14	17	18	15	14	12
			HSM	≤ 0.05	≤ 2	200	RPM	3056	2037	1528	1222	1019	764
						(160-240)	Fz	0.0013	0.0025	0.0034	0.0037	0.0041	0.0047
							Feed (ipm)	24	31	31	27	25	22

Note:
- Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
- rpm = Vc x 3.82 / D_1
- ipm = Fz x 6 x rpm
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D_1 maximum)
- refer to the KYOCERA SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)

TOOLWIZARD® 2.1
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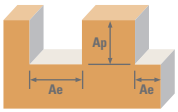
CARB®
Six Flute End Mills

	Series 51M, 51MCR, 51ML, 51MLC Metric	Hardness		 Ae x D_1	Ap x D_1	Vc (m/min)		Diameter (D_1) (mm) 6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	219	RPM	11633	8725	6980	5816	4362	3490
						(176-263)	Fz	0.048	0.081	0.101	0.121	0.142	0.158
							Feed (mm/min)	3350	4240	4230	4223	3717	3308
			HSM	≤ 0.05	≤ 2	279	RPM	14784	11088	8870	7392	5544	4435
						(223-335)	Fz	0.066	0.113	0.141	0.169	0.197	0.220
							Feed (mm/min)	5854	7517	7504	7495	6553	5854
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.1	≤ 1	149	RPM	7917	5938	4750	3958	2969	2375
						(119-179)	Fz	0.036	0.061	0.077	0.092	0.107	0.119
							Feed (mm/min)	1710	2173	2195	2185	1906	1696
			HSM	≤ 0.05	≤ 2	189	RPM	10017	7513	6010	5009	3756	3005
						(151-227)	Fz	0.049	0.083	0.104	0.125	0.146	0.163
							Feed (mm/min)	2945	3741	3750	3756	3291	2939
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.1	≤ 1	73	RPM	3878	2908	2327	1939	1454	1163
						(59-88)	Fz	0.029	0.049	0.061	0.073	0.086	0.096
							Feed (mm/min)	675	855	852	849	750	670
			HSM	≤ 0.05	≤ 2	93	RPM	4928	3696	2957	2464	1848	1478
						(74-112)	Fz	0.040	0.069	0.086	0.103	0.120	0.134
							Feed (mm/min)	1183	1530	1526	1523	1331	1189
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	155	RPM	8240	6180	4944	4120	3090	2472
						(140-171)	Fz	0.035	0.060	0.075	0.090	0.105	0.117
							Feed (mm/min)	1730	2225	2225	2225	1947	1735
			HSM	≤ 0.05	≤ 2	198	RPM	10502	7877	6301	5251	3938	3151
						(178-218)	Fz	0.048	0.082	0.102	0.122	0.143	0.159
							Feed (mm/min)	3025	3875	3856	3844	3379	3006
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	107	RPM	5655	4241	3393	2827	2121	1696
						(96-117)	Fz	0.029	0.049	0.061	0.073	0.086	0.096
							Feed (mm/min)	984	1247	1242	1238	1094	977
			HSM	≤ 0.05	≤ 2	137	RPM	7271	5453	4362	3635	2726	2181
						(123-151)	Fz	0.040	0.069	0.086	0.103	0.120	0.134
							Feed (mm/min)	1745	2258	2251	2247	1963	1754
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.1	≤ 1	99	RPM	5251	3938	3151	2626	1969	1575
						(89-109)	Fz	0.029	0.049	0.061	0.073	0.086	0.096
							Feed (mm/min)	914	1158	1153	1150	1016	907
			HSM	≤ 0.05	≤ 2	125	RPM	6624	4968	3975	3312	2484	1987
						(112-137)	Fz	0.040	0.069	0.086	0.103	0.120	0.134
							Feed (mm/min)	1590	2057	2051	2047	1789	1598

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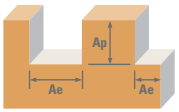

	Series 51M, 51MCR, 51ML, 51MLC Metric	Hardness		Ae x D_1	Ap x D_1	Vc (m/min)		Diameter (D_1) (mm) 6	8	10	12	16	20
S	**SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400**	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.1	≤ 1	32	RPM	1696	1272	1018	848	636	509
						(26-38)	Fz	0.034	0.057	0.071	0.085	0.100	0.110
							Feed (mm/min)	346	435	434	433	382	336
			HSM	≤ 0.05	≤ 2	40	RPM	2100	1575	1260	1050	788	630
						(32-48)	Fz	0.046	0.077	0.097	0.120	0.140	0.150
							Feed (mm/min)	580	728	733	756	662	567
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.1	≤ 1	24	RPM	1293	969	776	646	485	388
						(20-29)	Fz	0.023	0.039	0.049	0.059	0.068	0.077
							Feed (mm/min)	178	227	228	229	198	179
			HSM	≤ 0.05	≤ 2	30	RPM	1616	1212	969	808	606	485
						(24-37)	Fz	0.032	0.054	0.068	0.081	0.095	0.110
							Feed (mm/min)	310	393	396	393	345	320
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.1	≤ 1	85	RPM	4524	3393	2714	2262	1696	1357
						(68-102)	Fz	0.023	0.039	0.049	0.059	0.068	0.077
							Feed (mm/min)	624	794	798	801	692	627
			HSM	≤ 0.05	≤ 2	108	RPM	5736	4302	3441	2868	2151	1721
						(87-130)	Fz	0.032	0.054	0.068	0.081	0.095	0.110
							Feed (mm/min)	1101	1394	1404	1394	1226	1136
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile	≤ 0.1	≤ 1	47	RPM	2504	1878	1503	1252	939	751
						(38-57)	Fz	0.023	0.039	0.049	0.059	0.068	0.077
							Feed (mm/min)	346	440	442	443	383	347
			HSM	≤ 0.05	≤ 2	61	RPM	3231	2424	1939	1616	1212	969
						(49-73)	Fz	0.032	0.054	0.068	0.081	0.095	0.110
							Feed (mm/min)	620	785	791	785	691	640

Note:
- Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
- rpm = (Vc x 1000) / (D_1 x 3.14)
- mm/min = Fz x 6 x rpm
- reduce speed and feed for materials harder than listed
- reduce feed and Ae when finish milling (.02 x D_1 maximum)
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