SGS®
Solid Carbide Tools

VALUE AT THE SPINDLE®

AHB
TOOLING & MACHINERY

COMPLETE METALWORKING SOLUTIONS

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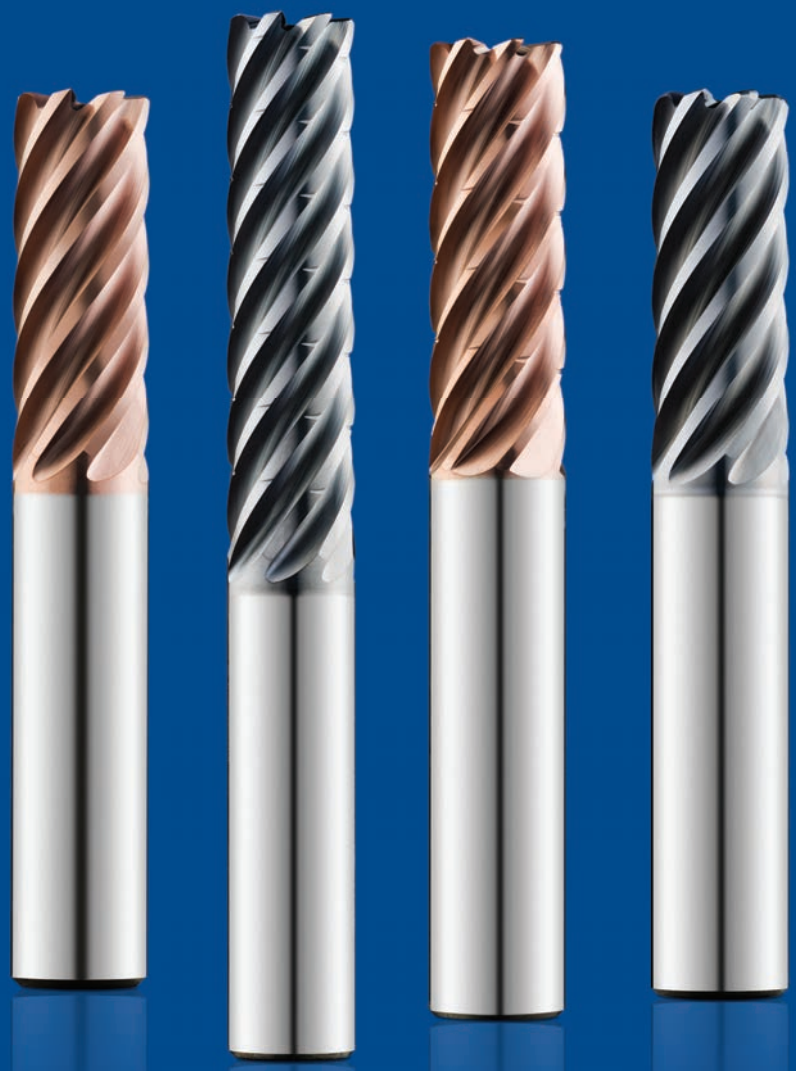
H-Carb High Efficiency Endmills

77 H-CARB



KYOCERA

www.kyocera-sgstool.com
ISO 9001:2015 Certified

7 FLUTE H-CARB

INTRODUCING THE H-CARB SEVEN FLUTE HIGH EFFICIENCY ENDMILL

The H-Carb Seven Flute High Efficiency Endmill specializes in deep axial trochoidal and high-speed machining applications offered at various lengths of cut. The specialized core and flute design improves rigidity and chip flow while reducing deflection. The seven-flute design allows for superior finishes at high rates over 5 and 6 flute tools. The series is offered in a variety of cut lengths and end configurations with two cutting edge styles. The H-Carb is available with either Ti-NAMITE-M or Ti-NAMITE-A coatings for superior tool life and performance in a variety of ferrous materials and high temp alloys.

THE H-CARB IS IDEAL FOR HIGH-EFFICIENCY ROUGHING AND FINISHING IN THE FOLLOWING TARGET MATERIALS:

- Titanium
- High-Temperature Alloys
- Stainless Steels
- Carbon and Alloyed Steels
- Cast Iron
- Hardened Steels

EXPANSIVE OFFERING

- Over 500 items in portfolio
- Available in 3 lengths of cut
- Full complement of corner radii available
- Specials and alterations are available upon request
- Available coatings are suitable for dry machining in ferrous based materials such as cast irons and many carbon steels
- Chip Breaker profile standard in portfolio

Ti-NAMITE-M

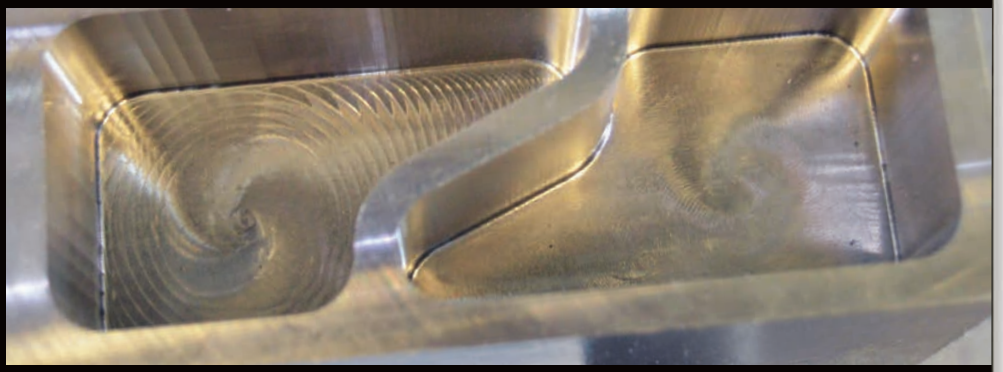
Features of Ti-Namite-M include high wear resistance, reduced friction, and excellent prevention of cutting edge build up. The coating provides superior material removal rates and tool life when used in high performance operations in cast iron and steel and with difficult to machine materials like titanium.

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

Ti-NAMITE-A

The H-Carb is available with an abrasive resistant and hard coating. The coating has a high hardness giving ultimate protection against abrasive wear and erosion. Ideal for high temperature alloys and stainless-steel applications.

Hardness (HV): 3700
Oxidation Temperature: 1100°C / 2010°F
Coefficient of Friction: 0.30
Thickness: 1 – 4 Microns (based on tool diameter)



FEATURES

END WORK

- Open center design delivers efficiency during entry movements into the workpiece
- Specially engineered gash provides increased strength at the end of the tool

CHIP BREAKER

- Breaks up the chips formed by the long flute length allowing for better chip flow and evacuation in deep pocketing operations
- Specialized design enhances edge strength and reduces load

FLUTING & HELIX ANGLE

- The innovative seven flute design allows for higher feed rates, decreasing cycle time and improving productivity
- An optimized core improves rigidity, chip flow and reduced deflection
- The variable flute indexing provides advanced chatter suppression
- Optimized Helix angle provides enhanced shearing capabilities

CAPABILITIES

ROUGHING

- 2.5xD length of cut is capable of 20% radial engagement at full axial depth of cut
- 3xD length of cut is capable of 15% radial engagement at full axial depth of cut
- 4xD length of cut is capable of 10% radial engagement at full axial depth of cut

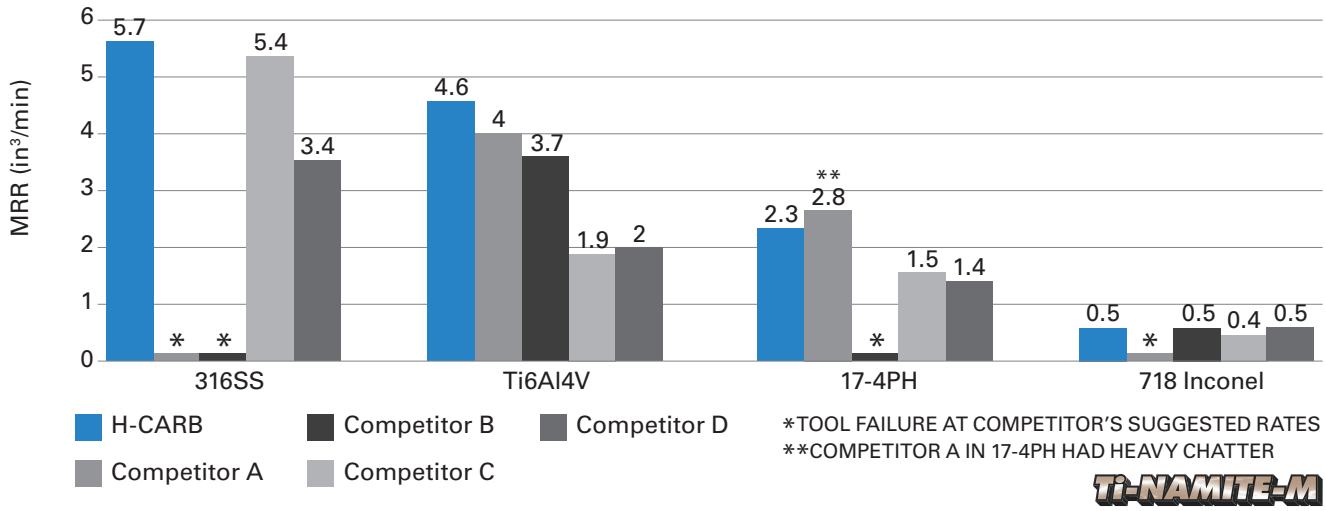
FINISHING

- Varying length of cuts available to attain an optimal surface finish
- The seven-flute design allows for superior finishes at higher rates over 5 and 6 flute tools, allowing for superior finishes in a shorter cycle time

HIGH-SPEED MACHINING

- Long flute length enables deep axial cuts at high speeds and feeds, enhancing material removal rate in a wide range of difficult to machine materials
- Exclusive TI-NAMITE-M coating for high heat resistance to enhance tool life in difficult to machine materials like titanium
- Available with TI-NAMITE-A coating for superior wear, edge build-up resistance and extended tool life in difficult to machine materials like stainless steel

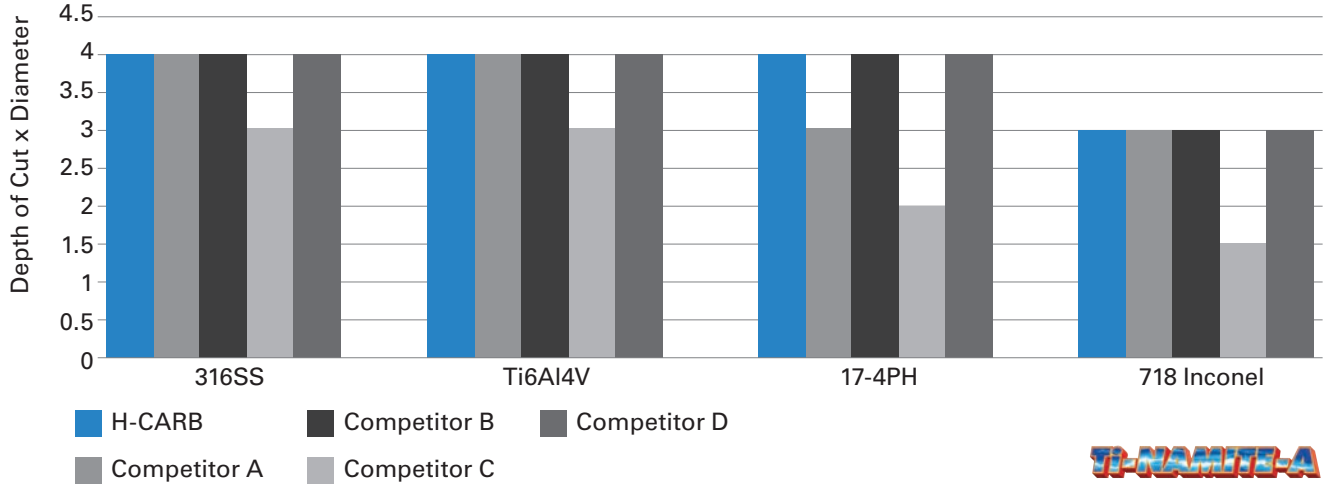
MATERIAL REMOVAL RATE COMPARISON
(Suggested Parameters for 5% Ae)



*TOOL FAILURE AT COMPETITOR'S SUGGESTED RATES
**COMPETITOR A IN 17-4PH HAD HEAVY CHATTER

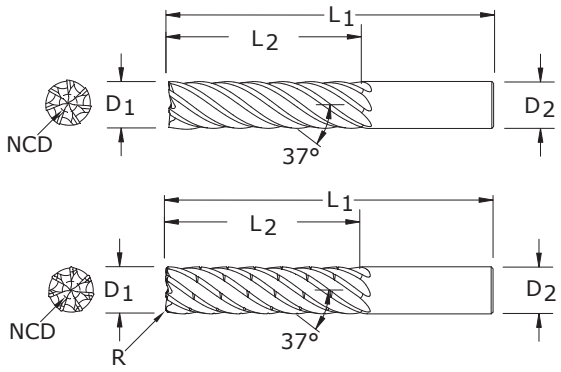
Ti-NAMITE-M

MAX SUGGESTED AXIAL DEPTH OF CUT
10% Ae (4xD Tools)



Ti-NAMITE-A

H-CARB



TOLERANCES (inch)

D_1	D_1	D_2
1/8 - 1/4	+0.0000 / –0.0012	h6
> 1/4 - 3/8	+0.0000 / –0.0016	h6
> 3/8 - 1	+0.0000 / –0.0020	h6

CORNER RADIUS TOLERANCES (inch)

R = +0.0000 / –0.0020

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Corner Radius R	Non-Cutting Center Diameter (NCD)	Ti-Namite-A (TA) EDP No.	Ti-Namite-A (TA) EDP No. Chip Breaker	Ti-Namite-M (TM) EDP No.	Ti-Namite-M (TM) EDP No. Chip Breaker
1/4	5/8	2-1/2	1/4	–	0.0845	77100	77102	77101	77103
1/4	5/8	2-1/2	1/4	0.015	0.0845	77104	77106	77105	77107
1/4	5/8	2-1/2	1/4	0.030	0.0845	77108	77110	77109	77111
1/4	3/4	2-1/2	1/4	–	0.0845	77112	77114	77113	77115
1/4	3/4	2-1/2	1/4	0.015	0.0845	77116	77118	77117	77119
1/4	3/4	2-1/2	1/4	0.030	0.0845	77120	77122	77121	77123
1/4	1	3	1/4	–	0.0845	77124	77126	77125	77127
1/4	1	3	1/4	0.015	0.0845	77128	77130	77129	77131
1/4	1	3	1/4	0.030	0.0845	77132	77134	77133	77135
3/8	15/16	3	3/8	–	0.1268	77136	77138	77137	77139
3/8	15/16	3	3/8	0.015	0.1268	77140	77142	77141	77143
3/8	15/16	3	3/8	0.030	0.1268	77144	77146	77145	77147
3/8	1-1/8	3-1/4	3/8	–	0.1268	77148	77150	77149	77151
3/8	1-1/8	3-1/4	3/8	0.015	0.1268	77152	77154	77153	77155
3/8	1-1/8	3-1/4	3/8	0.030	0.1268	77156	77158	77157	77159
3/8	1-1/2	3-1/2	3/8	–	0.1268	77160	77162	77161	77163
3/8	1-1/2	3-1/2	3/8	0.015	0.1268	77164	77166	77165	77167
3/8	1-1/2	3-1/2	3/8	0.030	0.1268	77168	77170	77169	77171
1/2	1-1/4	3-1/4	1/2	–	0.1690	77172	77174	77173	77175
1/2	1-1/4	3-1/4	1/2	0.030	0.1690	77176	77178	77177	77179
1/2	1-1/4	3-1/4	1/2	0.060	0.1690	77180	77182	77181	77183
1/2	1-1/2	3-1/2	1/2	–	0.1690	77184	77186	77185	77187
1/2	1-1/2	3-1/2	1/2	0.030	0.1690	77188	77190	77189	77191
1/2	1-1/2	3-1/2	1/2	0.060	0.1690	77192	77194	77193	77195
1/2	2	4	1/2	–	0.1690	77196	77198	77197	77199
1/2	2	4	1/2	0.030	0.1690	77200	77202	77201	77203
1/2	2	4	1/2	0.060	0.1690	77204	77206	77205	77207
5/8	1-9/16	3-3/4	5/8	–	0.2113	77208	77210	77209	77211
5/8	1-9/16	3-3/4	5/8	0.030	0.2113	77212	77214	77213	77215
5/8	1-9/16	3-3/4	5/8	0.060	0.2113	77216	77218	77217	77219
5/8	1-7/8	4	5/8	–	0.2113	77220	77222	77221	77223
5/8	1-7/8	4	5/8	0.030	0.2113	77224	77226	77224	77227
5/8	1-7/8	4	5/8	0.060	0.2113	77228	77230	77229	77231

(continued on next page)

Square

Corner

Straight

Right Spiral

2.5xD Length of Cut

3xD Length of Cut

4xD Length of Cut

Flute Spacing Unequal

Positive Rake Angle

External Coolant

Chip Breaker

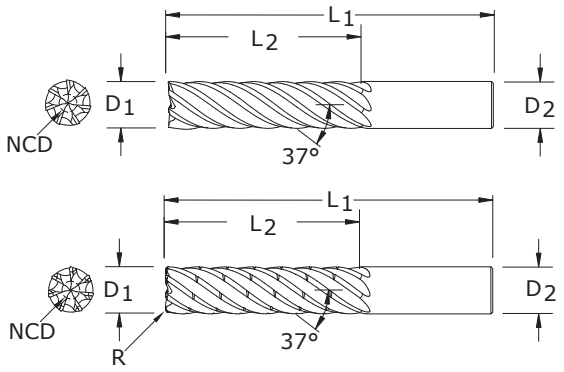
7 Flutes

TOLERANCES (inch)

D_1	D_1	D_2
1/8 - 1/4	+0.0000 / –0.0012	h6
> 1/4 - 3/8	+0.0000 / –0.0016	h6
> 3/8 - 1	+0.0000 / –0.0020	h6

CORNER RADIUS TOLERANCES (inch)

R = +0.0000 / –0.0020



Square

Corner

Straight

Right Spiral

2.5xD Length of Cut

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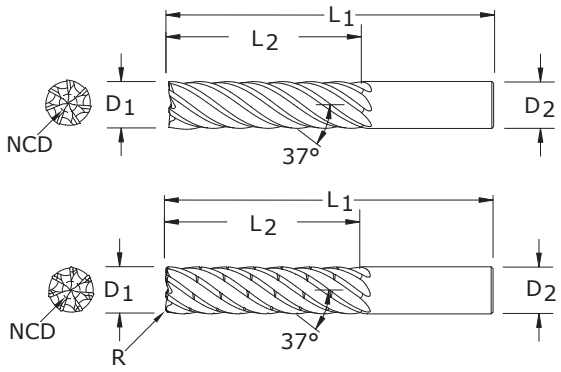
External Coolant

Chip Breaker

7 Flutes

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Corner Radius R	Non-Cutting Center Diameter (NCD)	Ti-Namite-A (TA) EDP No.	Ti-Namite-A (TA) EDP No. Chip Breaker	Ti-Namite-M (TM) EDP No.	Ti-Namite-M (TM) EDP No. Chip Breaker
5/8	2-1/2	4-1/2	5/8	–	0.2113	77232	77234	77233	77235
5/8	2-1/2	4-1/2	5/8	0.030	0.2113	77236	77238	77237	77239
5/8	2-1/2	4-1/2	5/8	0.060	0.2113	77240	77242	77241	77243
3/4	1-7/8	4	3/4	–	0.2535	77244	77246	77245	77247
3/4	1-7/8	4	3/4	.030	0.2113	77248	77250	77249	77251
3/4	1-7/8	4	3/4	.060	0.2113	77252	77254	77253	77255
3/4	1-7/8	4	3/4	.120	0.2113	77256	77258	77257	77259
3/4	2-1/4	4-1/2	3/4	–	0.2535	77260	77262	77261	77263
3/4	2-1/4	4-1/2	3/4	.030	0.2535	77264	77266	77265	77267
3/4	2-1/4	4-1/2	3/4	.060	0.2535	77268	77270	77269	77271
3/4	2-1/4	4-1/2	3/4	.120	0.2535	77272	77274	77273	77275
3/4	3	5-1/4	3/4	–	0.2535	77276	77278	77277	77279
3/4	3	5-1/4	3/4	.030	0.2535	77280	77282	77281	77283
3/4	3	5-1/4	3/4	.060	0.2535	77284	77286	77285	77287
3/4	3	5-1/4	3/4	.120	0.2535	77288	77290	77289	77291
1	2-1/2	5-1/2	1	–	0.3380	77292	77294	77293	77295
1	2-1/2	5-1/2	1	.030	0.3380	77296	77298	77297	77299
1	2-1/2	5-1/2	1	.060	0.3380	77300	77302	77301	77303
1	2-1/2	5-1/2	1	.120	0.3380	77304	77306	77305	77307
1	3	5-3/4	1	–	0.3380	77308	77310	77309	77311
1	3	5-3/4	1	.030	0.3380	77312	77314	77313	77315
1	3	5-3/4	1	.060	0.3380	77316	77318	77317	77319
1	3	5-3/4	1	.120	0.3380	77320	77322	77321	77323
1	4	7	1	–	0.3380	77324	77326	77325	77327
1	4	7	1	.030	0.3380	77328	77330	77329	77331
1	4	7	1	.060	0.3380	77332	77334	77333	77335
1	4	7	1	.120	0.3380	77336	77338	77337	77339

H-CARB



TOLERANCES (mm)

D_1	D_1	D_2
6	+0,000 / –0,030	h6
> 6 - 10	+0,000 / –0,040	h6
> 10 - 25	+0,000 / –0,050	h6

CORNER RADIUS TOLERANCES (mm)

R = +0,000 / –0,050

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Corner Radius R	Non-Cutting Center Diameter (NCD)	Ti-Namite-A (TA) EDP No.	Ti-Namite-A (TA) EDP No. Chip Breaker	Ti-Namite-M (TM) EDP No.	Ti-Namite-M (TM) EDP No. Chip Breaker
6,0	15,0	63,0	6,0	–	2,03	74300	74302	74301	74303
6,0	15,0	63,0	6,0	0,3	2,03	74304	74306	74305	74307
6,0	15,0	63,0	6,0	0,5	2,03	74308	74310	74309	74311
6,0	18,0	63,0	6,0	–	2,03	74316	74318	74317	74319
6,0	18,0	63,0	6,0	0,3	2,03	74320	74322	74321	74323
6,0	18,0	63,0	6,0	0,5	2,03	74324	74326	74325	74327
6,0	24,0	75,0	6,0	–	2,03	74332	74334	74333	74335
6,0	24,0	75,0	6,0	0,3	2,03	74336	74338	74337	74339
6,0	24,0	75,0	6,0	0,5	2,03	74340	74342	74341	74343
8,0	20,0	75,0	8,0	–	2,71	74348	74350	74349	74351
8,0	20,0	75,0	8,0	0,5	2,71	74352	74354	74353	74355
8,0	20,0	75,0	8,0	1,0	2,71	74356	74358	74357	74359
8,0	20,0	75,0	8,0	2,0	2,71	74360	74362	74361	74363
8,0	24,0	75,0	8,0	–	2,71	74364	74366	74365	74367
8,0	24,0	75,0	8,0	0,5	2,71	74368	74370	74369	74371
8,0	24,0	75,0	8,0	1,0	2,71	74372	74374	74373	74375
8,0	24,0	75,0	8,0	2,0	2,71	74376	74378	74377	74379
8,0	32,0	85,0	8,0	–	2,71	74380	74382	74381	74383
8,0	32,0	85,0	8,0	0,5	2,71	74384	74386	74385	74387
8,0	32,0	85,0	8,0	1,0	2,71	74388	74390	74389	74391
8,0	32,0	85,0	8,0	2,0	2,71	74392	74394	74393	74395
10,0	25,0	75,0	10,0	–	3,38	74396	74398	74397	74399
10,0	25,0	75,0	10,0	0,5	3,38	74400	74402	74401	74403
10,0	25,0	75,0	10,0	1,0	3,38	74404	74406	74405	74407
10,0	30,0	80,0	10,0	–	3,38	74408	74410	74409	74411
10,0	30,0	80,0	10,0	0,5	3,38	74412	74414	74413	74415
10,0	30,0	80,0	10,0	1,0	3,38	74416	74418	74417	74419
10,0	40,0	100,0	10,0	–	3,38	74420	74422	74421	74423
10,0	40,0	100,0	10,0	0,5	3,38	74424	74426	74425	74427
10,0	40,0	100,0	10,0	1,0	3,38	74428	74430	74429	74431
12,0	30,0	83,0	12,0	–	4,06	74432	74434	74433	74435
12,0	30,0	83,0	12,0	0,5	4,06	74436	74438	74437	74439
12,0	30,0	83,0	12,0	1,0	4,06	74440	74442	74441	74443
12,0	36,0	83,0	12,0	–	4,06	74444	74446	74445	74447
12,0	36,0	83,0	12,0	0,5	4,06	74448	74450	74449	74451
12,0	36,0	83,0	12,0	1,0	4,06	74452	74454	74453	74455

(continued on next page)

Square

Corner

Straight

Right Spiral

2.5xD Length of Cut

3xD Length of Cut

4xD Length of Cut

Flute Spacing Unequal

Positive Rake Angle

External Coolant

Chip Breaker

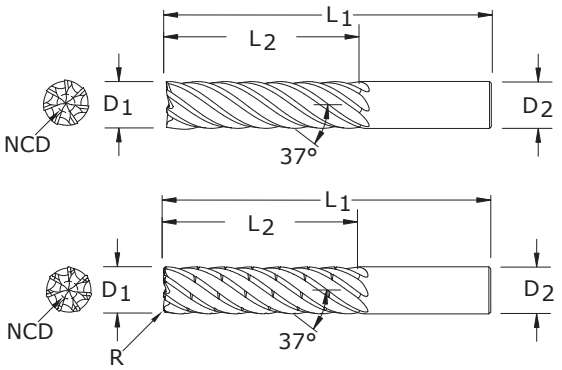
7 Flutes

TOLERANCES (mm)

D_1	D_1	D_2
6	+0,000 / –0,030	h6
> 6 - 10	+0,000 / –0,040	h6
> 10 - 25	+0,000 / –0,050	h6

CORNER RADIUS TOLERANCES (mm)

R = +0,000 / –0,050



Square
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2.5xD Length of Cut
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Chip Breaker
7 Flutes

Cutting Diameter D_1	Length of Cut L_2	Overall Length L_1	Shank Diameter D_2	Corner Radius R	Non-Cutting Center Diameter (NCD)	Ti-Namite-A (TA) EDP No.	Ti-Namite-A (TA) EDP No. Chip Breaker	Ti-Namite-M (TM) EDP No.	Ti-Namite-M (TM) EDP No. Chip Breaker
12,0	48,0	100,0	12,0	–	4,06	74456	74458	74457	74459
12,0	48,0	100,0	12,0	0,5	4,06	74460	74462	74461	74463
12,0	48,0	100,0	12,0	1,0	4,06	74464	74466	74465	74467
16,0	40,0	92,0	16,0	–	5,41	74468	74470	74469	74471
16,0	40,0	92,0	16,0	0,5	5,41	74472	74474	74473	74475
16,0	40,0	92,0	16,0	1,0	5,41	74476	74478	74477	74479
16,0	48,0	100,0	16,0	–	5,41	74480	74482	74481	74483
16,0	48,0	100,0	16,0	0,5	5,41	74484	74486	74485	74487
16,0	48,0	100,0	16,0	1,0	5,41	74488	74490	74489	74491
16,0	64,0	115,0	16,0	–	5,41	74492	74494	74493	74495
16,0	64,0	115,0	16,0	0,5	5,41	74496	74498	74497	74499
16,0	64,0	115,0	16,0	1,0	5,41	74500	74502	74501	74503
20,0	50,0	100,0	20,0	–	6,76	74504	74506	74505	74507
20,0	50,0	100,0	20,0	0,5	6,76	74508	74510	74509	74511
20,0	50,0	100,0	20,0	1,0	6,76	74512	74514	74513	74515
20,0	50,0	100,0	20,0	2,0	6,76	74516	74518	74517	74519
20,0	60,0	115,0	20,0	–	6,76	74520	74522	74521	74523
20,0	60,0	115,0	20,0	0,5	6,76	74524	74526	74525	74527
20,0	60,0	115,0	20,0	1,0	6,76	74528	74530	74529	74531
20,0	60,0	115,0	20,0	2,0	6,76	74532	74534	74533	74535
20,0	80,0	140,0	20,0	–	6,76	74536	74538	74537	74539
20,0	80,0	140,0	20,0	0,5	6,76	74540	74542	74541	74543
20,0	80,0	140,0	20,0	1,0	6,76	74544	74546	74545	74547
20,0	80,0	140,0	20,0	2,0	6,76	74548	74550	74549	74551
25,0	63,0	135,0	25,0	–	8,45	74552	74554	74553	74555
25,0	63,0	135,0	25,0	1,0	8,45	74556	74558	74557	74559
25,0	63,0	135,0	25,0	2,0	8,45	74560	74562	74561	74563
25,0	63,0	135,0	25,0	3,0	8,45	74564	74566	74565	74567
25,0	75,0	150,0	25,0	–	8,45	74568	74570	74569	74571
25,0	75,0	150,0	25,0	1,0	8,45	74572	74574	74573	74575
25,0	75,0	150,0	25,0	2,0	8,45	74576	74578	74577	74579
25,0	75,0	150,0	25,0	3,0	8,45	74580	74582	74581	74583
25,0	100,0	170,0	25,0	–	8,45	74584	74586	74585	74587
25,0	100,0	170,0	25,0	1,0	8,45	74588	74590	74589	74591
25,0	100,0	170,0	25,0	2,0	8,45	74592	74594	74593	74595
25,0	100,0	170,0	25,0	3,0	8,45	74596	74598	74597	74599

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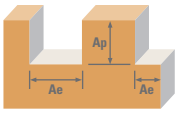

	Series 77, 77CR Fractional	Hardness		Ae x D_1	Ap x D_1	Vc (sfm)		D_1 • inch 1/4	3/8	1/2	5/8	3/4	1
P	**CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536**	≤ 275 Bhn or ≤ 28 HRc					RPM	11002	7334	5501	4401	3667	2750
			HSM	2.5xD		626	Fz	0.0014	0.0024	0.0034	0.0037	0.0041	0.0048
				≤ 0.2	≤ APMX	(501-752)	Feed (ipm)	104	121	130	114	106	92
			HSM	3xD		655	Fz	0.0015	0.0027	0.0038	0.0042	0.0047	0.0054
				≤ 0.15	≤ APMX	(524-786)	Feed (ipm)	118	137	147	130	120	105
			HSM	4xD		720	Fz	0.0018	0.0032	0.0045	0.0050	0.0055	0.0064
				≤ 0.1	≤ APMX	(576-864)	Feed (ipm)	139	162	173	152	141	123
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc					RPM	9550	6367	4775	3820	3183	2388
			HSM	2.5xD		544	Fz	0.0009	0.0017	0.0023	0.0026	0.0029	0.0034
				≤ 0.2	≤ APMX	(435-653)	Feed (ipm)	60	77	75	68	64	56
			HSM	3xD		569	Fz	0.0010	0.0020	0.0026	0.0029	0.0032	0.0038
				≤ 0.15	≤ APMX	(455-683)	Feed (ipm)	68	87	85	77	72	64
			HSM	4xD		625	Fz	0.0012	0.0023	0.0030	0.0034	0.0038	0.0045
				≤ 0.1	≤ APMX	(500-750)	Feed (ipm)	80	103	100	91	85	75
M	**STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F**	≤ 275 Bhn or ≤ 28 HRc					RPM	7793	5195	3896	3117	2598	1948
			HSM	2.5xD		444	Fz	0.0010	0.0019	0.0026	0.0028	0.0030	0.0036
				≤ 0.2	≤ APMX	(355-532)	Feed (ipm)	55	69	70	60	55	49
			HSM	3xD		464	Fz	0.0011	0.0021	0.0029	0.0031	0.0034	0.0041
				≤ 0.15	≤ APMX	(371-557)	Feed (ipm)	63	78	79	68	63	55
			HSM	4xD		510	Fz	0.0014	0.0025	0.0034	0.0037	0.0041	0.0048
				≤ 0.1	≤ APMX	(408-612)	Feed (ipm)	74	92	93	81	74	65
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc					RPM	5348	3565	2674	2139	1783	1337
			HSM	2.5xD		305	Fz	0.0008	0.0016	0.0020	0.0022	0.0024	0.0028
				≤ 0.2	≤ APMX	(244-365)	Feed (ipm)	30	39	38	33	30	27
			HSM	3xD		319	Fz	0.0009	0.0018	0.0023	0.0025	0.0028	0.0032
				≤ 0.15	≤ APMX	(255-382)	Feed (ipm)	34	44	43	38	34	30
			HSM	4xD		350	Fz	0.0011	0.0021	0.0027	0.0030	0.0032	0.0038
				≤ 0.1	≤ APMX	(280-420)	Feed (ipm)	40	52	51	44	40	35
	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc					RPM	4966	3311	2483	1986	1655	1242
			HSM	2.5xD		283	Fz	0.0008	0.0016	0.0020	0.0022	0.0024	0.0028
				≤ 0.2	≤ APMX	(226-339)	Feed (ipm)	28	36	35	31	28	25
			HSM	3xD		296	Fz	0.0009	0.0018	0.0023	0.0025	0.0028	0.0032
				≤ 0.15	≤ APMX	(237-355)	Feed (ipm)	32	41	40	35	32	28
			HSM	4xD		325	Fz	0.0011	0.0021	0.0027	0.0030	0.0032	0.0038
				≤ 0.1	≤ APMX	(260-390)	Feed (ipm)	38	48	47	41	38	33

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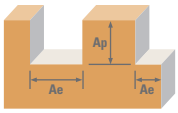

	Series 77, 77CR Fractional	Hardness		Ae x D_1	Ap x D_1	Vc (sfm)		D_1 • inch 1/4	3/8	1/2	5/8	3/4	1
P	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc					RPM	12316	8210	6158	4926	4105	3079
			HSM	2.5xD		701	Fz	0.0014	0.0024	0.0034	0.0037	0.0041	0.0048
				≤ 0.2	≤ APMX	(561-841)	Feed (ipm)	116	136	145	128	118	103
			HSM	3xD		733	Fz	0.0015	0.0027	0.0038	0.0042	0.0047	0.0054
				≤ 0.15	≤ APMX	(587-880)	Feed (ipm)	132	154	165	145	134	117
			HSM	4xD		806	Fz	0.0018	0.0032	0.0045	0.0050	0.0055	0.0064
				≤ 0.1	≤ APMX	(645-967)	Feed (ipm)	155	181	194	171	158	138
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc					RPM	7640	5093	3820	3056	2547	1910
			HSM	2.5xD		435	Fz	0.0010	0.0020	0.0026	0.0028	0.0031	0.0036
				≤ 0.2	≤ APMX	(348-522)	Feed (ipm)	54	70	69	61	55	49
			HSM	3xD		455	Fz	0.0011	0.0022	0.0029	0.0032	0.0035	0.0041
				≤ 0.15	≤ APMX	(364-546)	Feed (ipm)	61	79	78	69	63	55
			HSM	4xD		500	Fz	0.0014	0.0026	0.0034	0.0038	0.0041	0.0049
				≤ 0.1	≤ APMX	(400-600)	Feed (ipm)	72	93	91	81	74	65
N	NON-FERROUS MATERIALS	Not Recommended for this Material Group											
S	SUPER ALLOYS (NICKEL , COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc					RPM	1604	1070	802	642	535	401
			HSM	2.5xD		91	Fz	0.0009	0.0018	0.0024	0.0026	0.0029	0.0034
				≤ 0.2	≤ APMX	(73-110)	Feed (ipm)	11	14	14	12	11	9
			HSM	3xD		96	Fz	0.0011	0.0021	0.0028	0.0030	0.0033	0.0038
				≤ 0.15	≤ APMX	(76-115)	Feed (ipm)	12	15	15	13	12	11
			HSM	4xD		105	Fz	0.0013	0.0024	0.0032	0.0035	0.0039	0.0045
				≤ 0.1	≤ APMX	(84-126)	Feed (ipm)	14	18	18	16	14	13
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc					RPM						
			HSM	2.5xD		70	Fz	0.0007	0.0012	0.0017	0.0018	0.0020	0.0023
				≤ 0.2	≤ APMX	(56-84)	Feed (ipm)	6	7	7	6	6	5
			HSM	3xD		73	Fz	0.0008	0.0014	0.0019	0.0021	0.0022	0.0026
				≤ 0.15	≤ APMX	(58-87)	Feed (ipm)	7	8	8	7	6	6
			HSM	4xD		80	Fz	0.0009	0.0016	0.0023	0.0024	0.0026	0.0031
				≤ 0.1	≤ APMX	(64-96)	Feed (ipm)	8	9	10	8	7	7
	TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc					RPM	4278	2852	2139	1711	1426	1070
			HSM	2.5xD		244	Fz	0.0007	0.0012	0.0017	0.0018	0.0020	0.0023
				≤ 0.2	≤ APMX	(195-292)	Feed (ipm)	20	24	25	22	20	17
			HSM	3xD		255	Fz	0.0008	0.0014	0.0019	0.0021	0.0022	0.0026
				≤ 0.15	≤ APMX	(204-306)	Feed (ipm)	23	27	29	25	22	19
			HSM	4xD		280	Fz	0.0009	0.0016	0.0023	0.0024	0.0026	0.0031
				≤ 0.1	≤ APMX	(224-336)	Feed (ipm)	27	32	34	29	26	23
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc					RPM	2368	1579	1184	947	789	592
			HSM	2.5xD		135	Fz	0.0007	0.0012	0.0017	0.0018	0.0020	0.0023
				≤ 0.2	≤ APMX	(108-162)	Feed (ipm)	11	13	14	12	11	10
			HSM	3xD		141	Fz	0.0008	0.0014	0.0019	0.0021	0.0022	0.0026
				≤ 0.15	≤ APMX	(113-169)	Feed (ipm)	13	15	16	14	12	11
			HSM	4xD		155	Fz	0.0009	0.0016	0.0023	0.0024	0.0026	0.0031
				≤ 0.1	≤ APMX	(124-186)	Feed (ipm)	15	18	19	16	14	13

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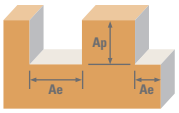
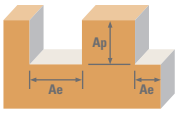


	Series 77, 77CR Fractional	Hardness		Ae x D_1	Ap x D_1	Vc (sfm)		D_1 • inch 1/4	3/8	1/2	5/8	3/4	1
							RPM	2368	1579	1184	947	789	592
H	**TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2**	≤ 375 Bhn or ≤ 40 HRc	HSM	2.5xD		135	Fz	0.0007	0.0012	0.0017	0.0018	0.0020	0.0023
				≤ 0.2	≤ APMX	(108-162)	Feed (ipm)	11	13	14	12	11	10
			HSM	3xD		141	Fz	0.0008	0.0014	0.0019	0.0021	0.0022	0.0026
				≤ 0.15	≤ APMX	(113-169)	Feed (ipm)	13	15	16	14	12	11
			HSM	4xD		155	Fz	0.0009	0.0016	0.0023	0.0024	0.0026	0.0031
				≤ 0.1	≤ APMX	(124-186)	Feed (ipm)	15	18	19	16	14	13

Note:
- Bhn (BrineII) HRc (Rockwell C) HSM (High Speed Machining)
- rpm = sfm x 3.82 / DC
- ipm = Fz x 7 x rpm
- reduce speed and feed for materials harder than listed
- 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)

SGS TOOL WIZARD



	Series 77M, 77MCR Metric	Hardness		Ae x D_1	Ap x D_1	Vc (m/min)		D_1 • mm 6	8	10	12	16	20	25
P	**CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536**	≤ 275 Bhn or ≤ 28 HRc					RPM	11648	8736	6989	5824	4368	3495	2796
			HSM	2.5xD		191	Fz	0.0324	0.0547	0.0682	0.0817	0.0959	0.1067	0.1241
				≤ 0.2	≤ APMX	(153-229)	Feed (ipm)	2642	3344	3335	3330	2931	2609	2428
			HSM	3xD		200	Fz	0.0367	0.0620	0.0773	0.0926	0.1086	0.1209	0.1406
				≤ 0.15	≤ APMX	(160-240)	Feed (ipm)	2994	3789	3780	3774	3322	2957	2752
			HSM	4xD		219	Fz	0.0432	0.0729	0.0909	0.1089	0.1278	0.1422	0.1654
				≤ 0.1	≤ APMX	(176-263)	Feed (ipm)	3522	4458	4447	4440	3908	3478	3237
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc					RPM	7927	5946	4756	3964	2973	2378	1903
			HSM	2.5xD		130	Fz	0.0243	0.0412	0.0520	0.0621	0.0722	0.0803	0.0937
				≤ 0.2	≤ APMX	(104-156)	Feed (ipm)	1348	1714	1731	1723	1503	1337	1248
			HSM	3xD		136	Fz	0.0275	0.0467	0.0589	0.0704	0.0819	0.0910	0.1062
				≤ 0.15	≤ APMX	(109-163)	Feed (ipm)	1528	1942	1961	1953	1703	1516	1414
			HSM	4xD		149	Fz	0.0324	0.0549	0.0693	0.0828	0.0963	0.1071	0.1249
				≤ 0.1	≤ APMX	(119-179)	Feed (ipm)	1798	2285	2307	2297	2004	1783	1664
M	**STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F**	≤ 275 Bhn or ≤ 28 HRc					RPM	8251	6188	4951	4125	3094	2475	1980
			HSM	2.5xD		135	Fz	0.0236	0.0405	0.0506	0.0608	0.0709	0.0790	0.0920
				≤ 0.2	≤ APMX	(108-162)	Feed (ipm)	1365	1754	1754	1754	1535	1368	1276
			HSM	3xD		141	Fz	0.0268	0.0459	0.0574	0.0689	0.0803	0.0895	0.1043
				≤ 0.15	≤ APMX	(113-170)	Feed (ipm)	1546	1988	1988	1988	1740	1551	1446
			HSM	4xD		155	Fz	0.0315	0.0540	0.0675	0.0810	0.0945	0.1053	0.1227
				≤ 0.1	≤ APMX	(124-187)	Feed (ipm)	1819	2339	2339	2339	2047	1825	1701
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc					RPM	5662	4247	3397	2831	2123	1699	1359
			HSM	2.5xD		93	Fz	0.0196	0.0331	0.0412	0.0493	0.0581	0.0648	0.0752
				≤ 0.2	≤ APMX	(74-111)	Feed (ipm)	776	983	979	977	863	771	716
			HSM	3xD		97	Fz	0.0222	0.0375	0.0467	0.0558	0.0658	0.0734	0.0853
				≤ 0.15	≤ APMX	(78-116)	Feed (ipm)	879	1114	1110	1107	978	873	811
			HSM	4xD		107	Fz	0.0261	0.0441	0.0549	0.0657	0.0774	0.0864	0.1003
				≤ 0.1	≤ APMX	(85-128)	Feed (ipm)	1035	1311	1306	1302	1150	1027	954
	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc					RPM	5258	3943	3155	2629	1972	1577	1262
			HSM	2.5xD		86	Fz	0.0196	0.0331	0.0412	0.0493	0.0581	0.0648	0.0752
				≤ 0.2	≤ APMX	(69-103)	Feed (ipm)	720	913	909	907	801	716	665
			HSM	3xD		90	Fz	0.0222	0.0375	0.0467	0.0558	0.0658	0.0734	0.0853
				≤ 0.15	≤ APMX	(72-108)	Feed (ipm)	817	1035	1031	1028	908	811	753
			HSM	4xD		99	Fz	0.0261	0.0441	0.0549	0.0657	0.0774	0.0864	0.1003
				≤ 0.1	≤ APMX	(79-119)	Feed (ipm)	961	1217	1212	1209	1068	954	886

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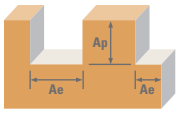
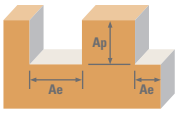


	Series 77M, 77MCR Metric	Hardness		Ae x D_1	Ap x D_1	Vc (m/min)		D_1 • mm 6	8	10	12	16	20	25
P	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc					RPM	709	899	895	893	789	704	654
			HSM	2.5xD		28	Fz	0.0324	0.0547	0.0682	0.0817	0.0959	0.1067	0.1241
				≤ 0.2	≤ APMX	(22-33)	Feed (ipm)	2010	2544	2538	2534	2230	1985	1848
			HSM	3xD		29	Fz	0.0367	0.0620	0.0773	0.0926	0.1086	0.1209	0.1406
				≤ 0.15	≤ APMX	(23-35)	Feed (ipm)	2278	2884	2877	2872	2528	2250	2094
			HSM	4xD		32	Fz	0.0432	0.0729	0.0909	0.1089	0.1278	0.1422	0.1654
				≤ 0.1	≤ APMX	(26-38)	Feed (ipm)	2681	3393	3384	3379	2974	2647	2463
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc					RPM	8068	6051	4841	4034	3025	2420	1936
			HSM	2.5xD		435	Fz	0.0243	0.0412	0.0520	0.0621	0.0722	0.0803	0.0937
				≤ 0.2	≤ APMX	(348-522)	Feed (ipm)	1372	1744	1761	1754	1530	1361	1270
			HSM	3xD		455	Fz	0.0275	0.0467	0.0589	0.0704	0.0819	0.0910	0.1062
				≤ 0.15	≤ APMX	(364-546)	Feed (ipm)	1555	1977	1996	1987	1734	1542	1439
			HSM	4xD		500	Fz	0.0324	0.0549	0.0693	0.0828	0.0963	0.1071	0.1249
				≤ 0.1	≤ APMX	(400-600)	Feed (ipm)	1830	2325	2348	2338	2039	1815	1693
N	NON-FERROUS MATERIALS	Not Recommended for this Material Group												
S	SUPER ALLOYS (NICKEL , COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc					RPM	1699	1274	1019	849	637	510	408
			HSM	2.5xD		28	Fz	0.0230	0.0385	0.0479	0.0574	0.0675	0.0743	0.0867
				≤ 0.2	≤ APMX	(22-33)	Feed (ipm)	273	343	342	341	301	265	247
			HSM	3xD		29	Fz	0.0260	0.0436	0.0543	0.0650	0.0765	0.0842	0.0983
				≤ 0.15	≤ APMX	(23-35)	Feed (ipm)	309	389	388	387	341	300	280
			HSM	4xD		32	Fz	0.0306	0.0513	0.0639	0.0765	0.0900	0.0990	0.1156
				≤ 0.1	≤ APMX	(26-38)	Feed (ipm)	364	458	456	455	401	353	330
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc					RPM	1294	971	777	647	485	388	311
			HSM	2.5xD		21	Fz	0.0155	0.0263	0.0331	0.0398	0.0459	0.0520	0.0602
				≤ 0.2	≤ APMX	(17-25)	Feed (ipm)	141	179	180	180	156	141	131
			HSM	3xD		22	Fz	0.0176	0.0298	0.0375	0.0451	0.0520	0.0589	0.0682
				≤ 0.15	≤ APMX	(18-27)	Feed (ipm)	159	203	204	204	177	160	148
			HSM	4xD		24	Fz	0.0207	0.0351	0.0441	0.0531	0.0612	0.0693	0.0803
				≤ 0.1	≤ APMX	(20-29)	Feed (ipm)	188	239	240	241	208	188	175
	TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc					RPM	4530	3397	2718	2265	1699	1359	1087
			HSM	2.5xD		74	Fz	0.0155	0.0263	0.0331	0.0398	0.0459	0.0520	0.0602
				≤ 0.2	≤ APMX	(59-89)	Feed (ipm)	492	626	629	631	546	494	458
			HSM	3xD		78	Fz	0.0176	0.0298	0.0375	0.0451	0.0520	0.0589	0.0682
				≤ 0.15	≤ APMX	(62-93)	Feed (ipm)	558	710	713	716	619	560	519
			HSM	4xD		85	Fz	0.0207	0.0351	0.0441	0.0531	0.0612	0.0693	0.0803
				≤ 0.1	≤ APMX	(68-102)	Feed (ipm)	656	835	839	842	728	659	611
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc					RPM	2508	1881	1505	1254	940	752	602
			HSM	2.5xD		41	Fz	0.0155	0.0263	0.0331	0.0398	0.0459	0.0520	0.0602
				≤ 0.2	≤ APMX	(33-49)	Feed (ipm)	273	347	348	350	302	274	254
			HSM	3xD		43	Fz	0.0176	0.0298	0.0375	0.0451	0.0520	0.0589	0.0682
				≤ 0.15	≤ APMX	(34-52)	Feed (ipm)	309	393	395	396	342	310	287
			HSM	4xD		47	Fz	0.0207	0.0351	0.0441	0.0531	0.0612	0.0693	0.0803
				≤ 0.1	≤ APMX	(38-57)	Feed (ipm)	363	462	464	466	403	365	338

continued on next page



	Series 77M, 77MCR Metric	Hardness		Ae x D_1	Ap x D_1	Vc (m/min)		D_1 • mm 6	8	10	12	16	20	25
							RPM	2368	1579	1184	947	789		592
H	**TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2**	≤ 375 Bhn or ≤ 40 HRc	HSM	2.5xD		64	Fz	3883	2912	2330	1941	1456	1165	932
				≤ 0.2	≤ APMX	(51-76)	Feed (ipm)	0.0196	0.0331	0.0412	0.0493	0.0581	0.0648	0.0752
			HSM	3xD		67	Fz	532	674	671	670	592	528	491
				≤ 0.15	≤ APMX	(53-80)	Feed (ipm)	0.0222	0.0375	0.0467	0.0558	0.0658	0.0734	0.0853
			HSM	4xD		73	Fz	603	764	761	759	671	599	556
				≤ 0.1	≤ APMX	(59-88)	Feed (ipm)	0.0261	0.0441	0.0549	0.0657	0.0774	0.0864	0.1003

Note:
- Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
- rpm = (Vc x 1000) / (DC x 3.14)
- mm/min = Fz x 7 x rpm
- reduce speed and feed for materials harder than listed
- 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)

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