

SGS
Solid Carbide Tools

MULTI  **Carb**

HIGH PERFORMANCE FINISHING END MILLS

Multi-Flute End Mills

High Performance Tooling



ISO 9001 Certified Company





TEST INFORMATION

SGS Helps Aerospace Company gain over 27 days of production while reducing the cost per part by nearly 78%!

	SGS Multi-Carb	COMPETITOR 7 Flute
Tool Diameter	.750	.750
Speed	295 sfm	220 sfm
Feed	40.5 ipm	19.9 ipm
Radial Cut (Ae)	.090	.090
Axial Cut (Ap)	.5300	.2650
Cycle Time	10.67 minutes	43.34 minutes
Metal Removal Rates	1.93 cubic inches	0.48 cubic inches

The SGS Multi-Carb was able to produce the cut at twice the axial depth of the competition at 204% greater feed rates. This equates into 4 times more metal removal at 25% of the original cycle time.

SGS was able to accomplish a tool life of 25 parts where the competitor was only able to obtain 4 parts. This was a tool life improvement of 625%. The end user was able to gain 653.4 hours of production for a total of 27.2 days per year gained.

\$131,822.29 ANNUAL COST SAVINGS

THE SAVINGS WITH SGS

Cycle Time Saved per Part: 32.67 minutes
Number of Parts per Year: 1200
Cycle Time Saved Annually: 653.4 hours
Cost to Machine per Hour: \$140.00
Machine Cost Saved Annually: \$91,481.65
Tool Life Improvement: 21 additional parts
Tooling Cost Saved per Part: \$31.17
Tooling Cost Saved Annually: \$39,300



FEATURES & BENEFITS

The Multi-Carb High Performance Finishing End Mill incorporates a large number of flutes for stability and high feed finishing capabilities in applications where surface finish and tolerance are critical factors. The large flute count design allows smoother cutting performance and increased tool life, positively impacting productivity and quality levels.

- Available with 7, 9 or 11 Flutes based on tool diameter
- Designed with a 35° Helix Angle
- High Flute Count increases feed rates and improves stability
- Odd Number of Flutes control natural harmonics while staggering entry and exit of the cutting edges
- Large Core Diameter maximizes rigidity and minimizes deflection
- Optimized Cutting Geometry provides superior surface finishes on challenging materials
- High Performance Material for reliable and consistent performance
- Ti-NAMITE-A with proven performance at high temperatures



Ti-NAMITE-A

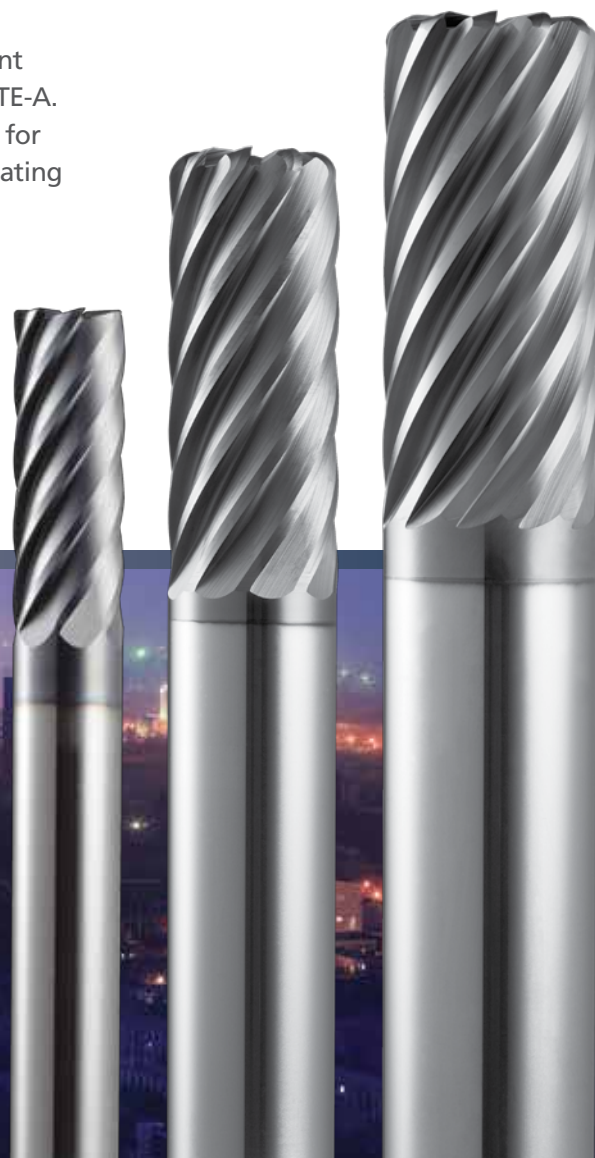
The Multi-Carb is exclusively available with the most abrasive resistant and hardest coating, Aluminum Titanium Nitride (AlTiN) or Ti-NAMITE-A. With excellent thermal and chemical resistance, Ti-NAMITE-A allows for dry cutting and improvements in performance of carbide. The TA coating has a high hardness giving ultimate protection against abrasive wear and erosion. Ideal for high temperature alloys, titanium, steels, and stainless steel applications.

Hardness (HV): 3300

Oxidation Temperature: 800°C – 1472°F

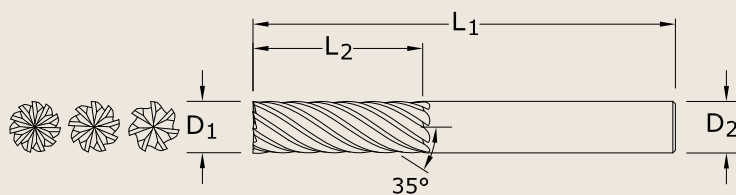
Coefficient of Friction: 0.45

Thickness: 1–4 Microns (based on tool diameter)



Series 66 | Multi-Carb Square End

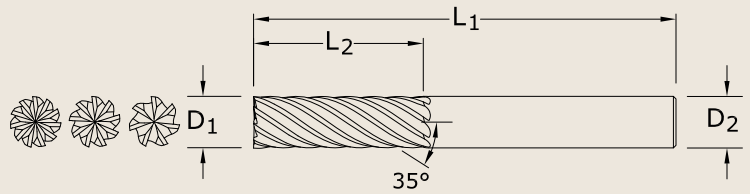
TOLERANCES (inch)		
DIAMETER	D ₁	D ₂
3/16 - 1	+0.0000 / -0.0020	h6



SERIES 66 (FRACTIONAL)

Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Number Flutes	Ti-NAMITE-A EDP No.
3/16	5/8	2	3/16	7	36620
1/4	3/4	2-1/2	1/4	7	36621
3/8	1	3	3/8	7	36622
1/2	1-1/4	3	1/2	9	36623
5/8	1-5/8	3-1/2	5/8	9	36624
3/4	1-5/8	4	3/4	11	36625
1	2	6	1	11	36626

TOLERANCES (mm)		
DIAMETER	D ₁	D ₂
6 - 25	+0,000 / -0,050	h6



**SERIES 66M
(METRIC)**

Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Number Flutes	Ti-NAMITE-A EDP No.
6	19	63	6	7	46620
8	20	63	8	7	46621
10	22	75	10	7	46622
12	26	83	12	9	46623
16	32	92	16	9	46624
20	38	104	20	11	46625
25	38	104	25	11	46626

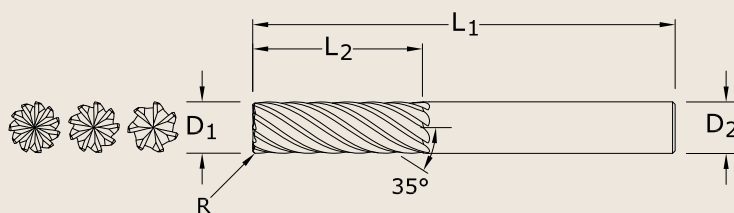
Series 66CR | Multi-Carb Corner Radius

TOLERANCES (inch)

DIAMETER	D ₁	D ₂
3/16 - 1	+0.0000 / -0.0020	h6

CORNER RADIUS TOLERANCES (inch)

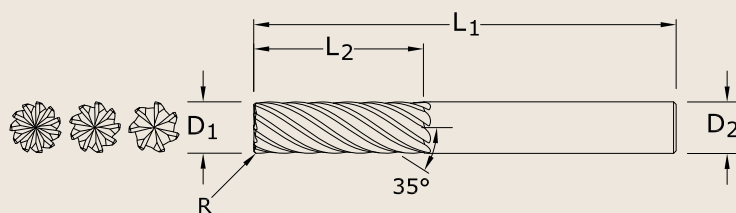
R = +0.000 / -0.002








SERIES 66CR (FRACTIONAL)

Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Corner Radius R	Number Flutes	Ti-NAMITE-A EDP No.
3/16	5/8	2	3/16	.010	7	36627
1/4	3/4	2-1/2	1/4	.015	7	36628
3/8	1	3	3/8	.015	7	36629
1/2	1-1/4	3	1/2	.030	9	36630
1/2	1-1/4	3	1/2	.090	9	36631
1/2	1-1/4	3	1/2	.120	9	36632
5/8	1-5/8	3-1/2	5/8	.030	9	36633
5/8	1-5/8	3-1/2	5/8	.090	9	36634
5/8	1-5/8	3-1/2	5/8	.120	9	36635
3/4	1-5/8	4	3/4	.030	11	36636
3/4	1-5/8	4	3/4	.090	11	36637
3/4	1-5/8	4	3/4	.120	11	36638
1	2	6	1	.030	11	36639
1	2	6	1	.090	11	36640
1	2	6	1	.120	11	36641

TOLERANCES (mm)		
DIAMETER	D ₁	D ₂
6 - 25	+0,000 / -0,050	h6
CORNER RADIUS TOLERANCES (mm)		
R = +0,000 / -0,050		


**SERIES 66MCR
(METRIC)**

Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Corner Radius R	Number Flutes	Ti-NAMITE-A EDP No.
6	19	63	6	0.5	7	46627
8	20	63	8	0.5	7	46629
10	22	75	10	0.5	7	46632
12	26	83	12	1.0	9	46636
12	26	83	12	2.0	9	46638
12	26	83	12	3.0	9	46640
16	32	92	16	1.0	9	46641
16	32	92	16	2.0	9	46643
16	32	92	16	3.0	9	46645
20	38	104	20	1.0	11	46647
20	38	104	20	2.0	11	46649
20	38	104	20	3.0	11	46651
25	38	104	25	1.0	11	46654
25	38	104	25	2.0	11	46656
25	38	104	25	3.0	11	46658

Hardness BRINELL	Series 66, 66CR Fractional				Vc (SFM)	Diameter (inch)							
		Ap x D1	Ae x D1										
				3/16		1/4	3/8	1/2	5/8	3/4	1		
≤ 175	CARBON STEEL 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	 Profile	1	≤ 0.05	720	RPM	14669	11002	7334	5501	4401	3667	2750
					(576-864)	Fz	0.0009	0.0012	0.0022	0.0030	0.0033	0.0036	0.0042
					Feed (IPM)	92	92	113	149	131	145	127	
		 Finish	2	≤ 0.02	864	RPM	17603	13202	8801	6601	5281	4401	3300
					(691-1037)	Fz	0.0007	0.0010	0.0018	0.0024	0.0026	0.0029	0.0034
					Feed (IPM)	89	89	108	143	125	139	122	
≤ 275	ALLOY STEEL 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	 Profile	1	≤ 0.05	530	RPM	10798	8098	5399	4049	3239	2699	2025
					(424-636)	Fz	0.0006	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
					Feed (IPM)	45	51	64	84	76	83	71	
		 Finish	2	≤ 0.02	636	RPM	12957	9718	6479	4859	3887	3239	2430
					(509-763)	Fz	0.0005	0.0007	0.0014	0.0018	0.0021	0.0022	0.0026
					Feed (IPM)	44	49	62	80	73	80	68	
≤ 375	TOOL STEEL A2, D2, H13, L2, M2, P20, S7, T15, W2	 Profile	1	≤ 0.05	290	RPM	5908	4431	2954	2216	1772	1477	1108
					(232-348)	Fz	0.0004	0.0006	0.0012	0.0016	0.0018	0.0019	0.0022
					Feed (IPM)	17	19	25	32	29	31	27	
		 Finish	2	≤ 0.02	348	RPM	7090	5317	3545	2659	2127	1772	1329
					(278-418)	Fz	0.0003	0.0005	0.0010	0.0013	0.0014	0.0015	0.0018
					Feed (IPM)	16	18	24	31	28	30	26	
≤ 260	CAST IRON (LOW / MEDIUM ALLOY) Gray, Malleable, Ductile	 Profile	1	≤ 0.05	525	RPM	10696	8022	5348	4011	3209	2674	2006
					(420-630)	Fz	0.0008	0.0012	0.0022	0.0030	0.0033	0.0036	0.0042
					Feed (IPM)	60	67	82	108	95	106	93	
		 Finish	2	≤ 0.02	630	RPM	12835	9626	6418	4813	3851	3209	2407
					(504-756)	Fz	0.0006	0.0010	0.0018	0.0024	0.0026	0.0029	0.0034
					Feed (IPM)	58	65	79	104	91	102	89	
> 260 ≤ 320	CAST IRON (DIFFICULT / HIGH ALLOY) Gray, Malleable, Ductile	 Profile	1	≤ 0.05	300	RPM	6112	4584	3056	2292	1834	1528	1146
					(240-360)	Fz	0.0002	0.0003	0.0006	0.0008	0.0008	0.0009	0.0011
					Feed (IPM)	9	10	12	16	14	15	13	
		 Finish	2	≤ 0.02	360	RPM	7334	5501	3667	2750	2200	1834	1375
					(288-432)	Fz	0.0001	0.0002	0.0005	0.0006	0.0007	0.0007	0.0008
					Feed (IPM)	5	9	12	15	13	15	13	
≤ 185	STAINLESS STEEL (FREE MACHINING) 303, 416, 420F, 430F 440F	 Profile	1	≤ 0.05	560	RPM	11409	8557	5705	4278	3423	2852	2139
					(448-672)	Fz	0.0006	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
					Feed (IPM)	48	54	68	89	80	88	75	
		 Finish	2	≤ 0.02	672	RPM	13691	10268	6845	5134	4107	3423	2567
					(538-806)	Fz	0.0005	0.0007	0.0014	0.0018	0.0021	0.0022	0.0026
					Feed (IPM)	46	52	65	85	77	84	72	






Hardness BRINELL	Series 66, 66CR Fractional					Vc (SFM)	Diameter (inch)						
		Ap x D1	Ae x D1	3/16	1/4		3/8	1/2	5/8	3/4	1		
≤ 185	STAINLESS STEEL (DIFFICULT) 304, 304L, 316, 316L		1	≤ 0.05	385	RPM	7844	5883	3922	2941	2353	1961	1471
					(308-462)	Fz	0.0005	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
					Feed (IPM)	27	29	38	48	42	47	42	
			2	≤ 0.02	462	RPM	9412	7059	4706	3530	2824	2353	1765
					(370-554)	Fz	0.0004	0.0006	0.0011	0.0014	0.0016	0.0018	0.0021
					Feed (IPM)	26	28	37	46	41	46	40	
≤ 325	STAINLESS STEEL (PH) 13-8 PH, 15-5PH, 17-4 PH, Custom 450		1	≤ 0.05	355	RPM	7233	5424	3616	2712	2170	1808	1356
					(284-426)	Fz	0.0005	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
					Feed (IPM)	25	27	35	44	39	44	39	
			2	≤ 0.02	426	RPM	8679	6509	4340	3255	2604	2170	1627
					(341-511)	Fz	0.0004	0.0006	0.0011	0.0014	0.0016	0.0018	0.0021
					Feed (IPM)	24	26	34	42	37	42	37	
≤ 300	SUPER ALLOYS (NICKEL, COBALT, IRON BASED) Inconel 601, 617, 625, Incoloy 800, Monel 400		1	≤ 0.05	105	RPM	2139	1604	1070	802	642	535	401
					(84-126)	Fz	0.0005	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
					Feed (IPM)	7.5	7.9	10.5	13.0	11.6	12.9	11.5	
			2	≤ 0.02	126	RPM	2567	1925	1284	963	770	642	481
					(101-151)	Fz	0.0004	0.0006	0.0011	0.0014	0.0016	0.0018	0.0021
					Feed (IPM)	7.2	7.5	10.1	12.5	11.1	12.4	11.0	
> 300	SUPER ALLOYS (NICKEL, COBALT, IRON BASED – DIFFICULT) Inconel 718, 750X, Incoloy 925, Waspaloy, Hastelloy, Rene		1	≤ 0.05	85	RPM	1732	1299	866	649	520	433	325
					(68-102)	Fz	0.0003	0.0005	0.0009	0.0012	0.0014	0.0015	0.0017
					Feed (IPM)	3.9	4.5	5.6	7.0	6.4	7.1	6.1	
			2	≤ 0.02	102	RPM	2078	1559	1039	779	623	520	390
					(82-122)	Fz	0.0002	0.0004	0.0007	0.0010	0.0011	0.0012	0.0014
					Feed (IPM)	2.9	4.3	5.4	6.7	6.1	6.9	5.8	
≤ 350	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si		1	≤ 0.05	390	RPM	7946	5959	3973	2980	2384	1986	1490
					(312-468)	Fz	0.0005	0.0008	0.0015	0.0021	0.0023	0.0025	0.0029
					Feed (IPM)	28	33	42	56	49	55	48	
			2	≤ 0.02	468	RPM	9535	7151	4767	3576	2860	2384	1788
					(374-562)	Fz	0.0004	0.0006	0.0012	0.0017	0.0018	0.0020	0.0023
					Feed (IPM)	27	32	40	54	47	52	46	
> 350 ≤ 450	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3		1	≤ 0.05	140	RPM	2852	2139	1426	1070	856	713	535
					(112-168)	Fz	0.0005	0.0008	0.0015	0.0021	0.0023	0.0025	0.0029
					Feed (IPM)	10	12	15	20	18	20	17	
			2	≤ 0.02	168	RPM	3423	2567	1711	1284	1027	856	642
					(134-202)	Fz	0.0004	0.0006	0.0012	0.0017	0.0018	0.0020	0.0023
					Feed (IPM)	10	12	14	19	17	19	16	

*Maximum recommended depth shown

*Reduce speed and feed recommendations for materials harder than listed

*Above recommendations are based on ideal conditions. Adjust parameters accordingly for smaller taper machining centers or less rigid conditions

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Hardness BRINELL	Series 66M, 66MCR Metric		Ap x D1	Ae x D1	Vc (m/min)	Diameter (mm)							
						6	8	10	12	16	20	25	
≤ 175	CARBON STEEL 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	 Profile	1	≤ 0.05	219	RPM	11609	8707	6965	5804	4353	3483	2786
					(175-263)	Fz	0.029	0.047	0.059	0.072	0.084	0.096	0.105
					Feed (mm/min)	2357	2864	2877	3761	3291	3678	3218	
		 Finish	2	≤ 0.02	263	RPM	13931	10448	8358	6965	5224	4179	3343
					(210-315)	Fz	0.023	0.038	0.047	0.058	0.067	0.077	0.084
					Feed (mm/min)	2262	2750	2762	3611	3159	3531	3089	
≤ 275	ALLOY STEEL 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	 Profile	1	≤ 0.05	162	RPM	8587	6441	5152	4294	3220	2576	2061
					(130-194)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	1322	1623	1623	2125	1942	2125	1814	
		 Finish	2	≤ 0.02	194	RPM	10305	7729	6183	5152	3864	3091	2473
					(156-233)	Fz	0.018	0.029	0.036	0.044	0.054	0.060	0.064
					Feed (mm/min)	1270	1558	1558	2040	1864	2040	1741	
≤ 375	TOOL STEEL A2, D2, H13, L2, M2, P20, S7, T15, W2	 Profile	1	≤ 0.05	88	RPM	4665	3499	2799	2332	1749	1399	1120
					(70-106)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	718	882	882	1155	1055	1155	985	
		 Finish	2	≤ 0.02	106	RPM	5598	4198	3359	2799	2099	1679	1343
					(84-127)	Fz	0.018	0.029	0.036	0.044	0.054	0.060	0.064
					Feed (mm/min)	690	846	846	1108	1013	1108	946	
≤ 260	CAST IRON (LOW / MEDIUM ALLOY) Gray, Malleable, Ductile	 Profile	1	≤ 0.05	160	RPM	8481	6361	5089	4241	3181	2544	2036
					(128-192)	Fz	0.029	0.047	0.059	0.072	0.084	0.096	0.105
					Feed (mm/min)	1722	2093	2102	2748	2404	2687	2351	
		 Finish	2	≤ 0.02	192	RPM	10178	7633	6107	5089	3817	3053	2443
					(154-230)	Fz	0.023	0.038	0.047	0.058	0.067	0.077	0.084
					Feed (mm/min)	1653	2009	2018	2638	2308	2579	2257	
> 260 ≤ 320	CAST IRON (DIFFICULT / HIGH ALLOY) Gray, Malleable, Ductile	 Profile	1	≤ 0.05	91	RPM	4824	3618	2894	2412	1809	1447	1158
					(73-109)	Fz	0.007	0.012	0.015	0.018	0.021	0.024	0.027
					Feed (mm/min)	240	309	308	397	347	376	340	
		 Finish	2	≤ 0.02	109	RPM	5789	4341	3473	2894	2171	1737	1389
					(87-131)	Fz	0.006	0.010	0.012	0.015	0.017	0.019	0.021
					Feed (mm/min)	230	297	296	381	333	361	326	
≤ 185	STAINLESS STEEL (FREE MACHINING) 303, 416, 420F, 430F 440F	 Profile	1	≤ 0.05	171	RPM	9064	6798	5439	4532	3399	2719	2175
					(137-205)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	1396	1713	1713	2243	2050	2243	1914	
		 Finish	2	≤ 0.02	205	RPM	10877	8158	6526	5439	4079	3263	2611
					(164-246)	Fz	0.018	0.029	0.036	0.044	0.054	0.060	0.064
					Feed (mm/min)	1340	1645	1645	2154	1968	2154	1838	

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Hardness BRINELL	Series 66M, 66MCR Metric			Vc (m/min)	Diameter (mm)								
		Ap x D1	Ae x D1		6	8	10	12	16	20	25		
≤ 185	STAINLESS STEEL (DIFFICULT) 304, 304L, 316, 316L	<div>Profile</div> <div></div>	1	≤ 0.05	117	RPM	6202	4651	3721	3101	2326	1861	1488
					(94-140)	Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
					Feed (mm/min)	955	1172	1172	1535	1402	1535	1310	
		<div>Finish</div> <div></div>	2	≤ 0.02	140	RPM	7442	5582	4465	3721	2791	2233	1786
					(112-168)	Fz	0.018	0.029	0.036	0.044	0.054	0.060	0.064
					Feed (mm/min)	917	1125	1125	1474	1346	1474	1257	
≤ 325	STAINLESS STEEL (PH) 13-8 PH, 15-5PH, 17-4 PH, Custom 450	<div>Profile</div> <div></div>	1	≤ 0.05	108	RPM	5725	4294	3435	2862	2147	1717	1374
					(86-130)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.065
					Feed (mm/min)	681	902	890	1108	985	1115	982	
		<div>Finish</div> <div></div>	2	≤ 0.02	130	RPM	6870	5152	4122	3435	2576	2061	1649
					(104-156)	Fz	0.014	0.024	0.030	0.034	0.041	0.047	0.052
					Feed (mm/min)	654	866	854	1063	946	1070	943	
≤ 300	SUPER ALLOYS (NICKEL, COBALT, IRON BASED) Inconel 601, 617, 625, Incoly 800, Monel 400	<div>Profile</div> <div></div>	1	≤ 0.05	32	RPM	1696	1272	1018	848	636	509	407
					(26-38)	Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.065
					Feed (mm/min)	202	267	214	328	292	330	291	
		<div>Finish</div> <div></div>	2	≤ 0.02	38	RPM	2036	1527	1221	1018	763	611	489
					(31-46)	Fz	0.014	0.024	0.030	0.034	0.041	0.047	0.052
					Feed (mm/min)	194	256	253	315	280	317	279	
> 300	SUPER ALLOYS (NICKEL, COBALT, IRON BASED – DIFFICULT) Inconel 718, 750X, Incoly 925, Waspaloy, Hastelloy, Rene	<div>Profile</div> <div></div>	1	≤ 0.05	26	RPM	1378	1034	827	689	517	413	331
					(21-31)	Fz	0.012	0.020	0.025	0.030	0.035	0.039	0.044
					Feed (mm/min)	113	143	142	184	162	176	159	
		<div>Finish</div> <div></div>	2	≤ 0.02	31	RPM	1654	1240	992	827	620	496	397
					(25-37)	Fz	0.009	0.016	0.020	0.024	0.028	0.031	0.035
					Feed (mm/min)	108	138	137	177	155	169	153	
≤ 350	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	<div>Profile</div> <div></div>	1	≤ 0.05	119	RPM	6308	4731	3785	3154	2365	1892	1514
					(95-143)	Fz	0.019	0.032	0.040	0.050	0.059	0.067	0.073
					Feed (mm/min)	839	1060	1060	1419	1256	1395	1216	
		<div>Finish</div> <div></div>	2	≤ 0.02	143	RPM	7570	5677	4542	3785	2839	2271	1817
					(114-171)	Fz	0.015	0.026	0.032	0.040	0.047	0.054	0.058
					Feed (mm/min)	805	1017	1017	1363	1206	1339	1167	
> 350 ≤ 450	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3	<div>Profile</div> <div></div>	1	≤ 0.05	43	RPM	2279	1710	1368	1140	855	684	547
					(34-52)	Fz	0.019	0.032	0.040	0.050	0.059	0.067	0.073
					Feed (mm/min)	303	383	383	513	454	504	439	
		<div>Finish</div> <div></div>	2	≤ 0.02	52	RPM	2735	2051	1641	1368	1026	821	656
					(41-62)	Fz	0.015	0.026	0.032	0.040	0.047	0.054	0.058
					Feed (mm/min)	291	368	368	492	436	484	422	

*Maximum recommended depth shown

*Reduce speed and feed recommendations for materials harder than listed

*Above recommendations are based on ideal conditions. Adjust parameters accordingly for smaller taper machining centers or less rigid conditions

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