

SGS
Solid Carbide Tools

 **SERIES 33**
THREE FLUTE END MILLS

Stainless Steel

High Performance End Mills

Performance by Design



ISO 9001 Certified Company





Using the latest in engineering design and grinding capabilities, the new Series 33 High Performance End Mills handle slotting of difficult materials such as Stainless Steel, Titanium, and Inconel. Ideal for applications struggling with chip evacuation, this 3-Flute design offers increased chip clearance and a reduction in harmonics.

- Unique 3-Flute design provides more controlled and manageable chip formation.
- Engineered stepped core configuration provides stability for aggressive ramping and rigidity when flute is completely engaged.
- Open structure at the axial end accommodates material flow and load reduction during operations.
- Variable geometry design provides superior chatter and vibration suppression during aggressive milling.
- Available with SGS Patented Jet Stream Technology for precise coolant placement.
- Exclusively coated with Ti-NAMITE-A for superior wear, built up edge resistance and increased tool life.

Ti-NAMITE-A

Series 33 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 coating has a high hardness giving ultimate protection against abrasive wear and erosion. Ideal for cast iron, high temperature alloys, titanium, steels, and stainless steel applications.

Hardness (HV): 3300

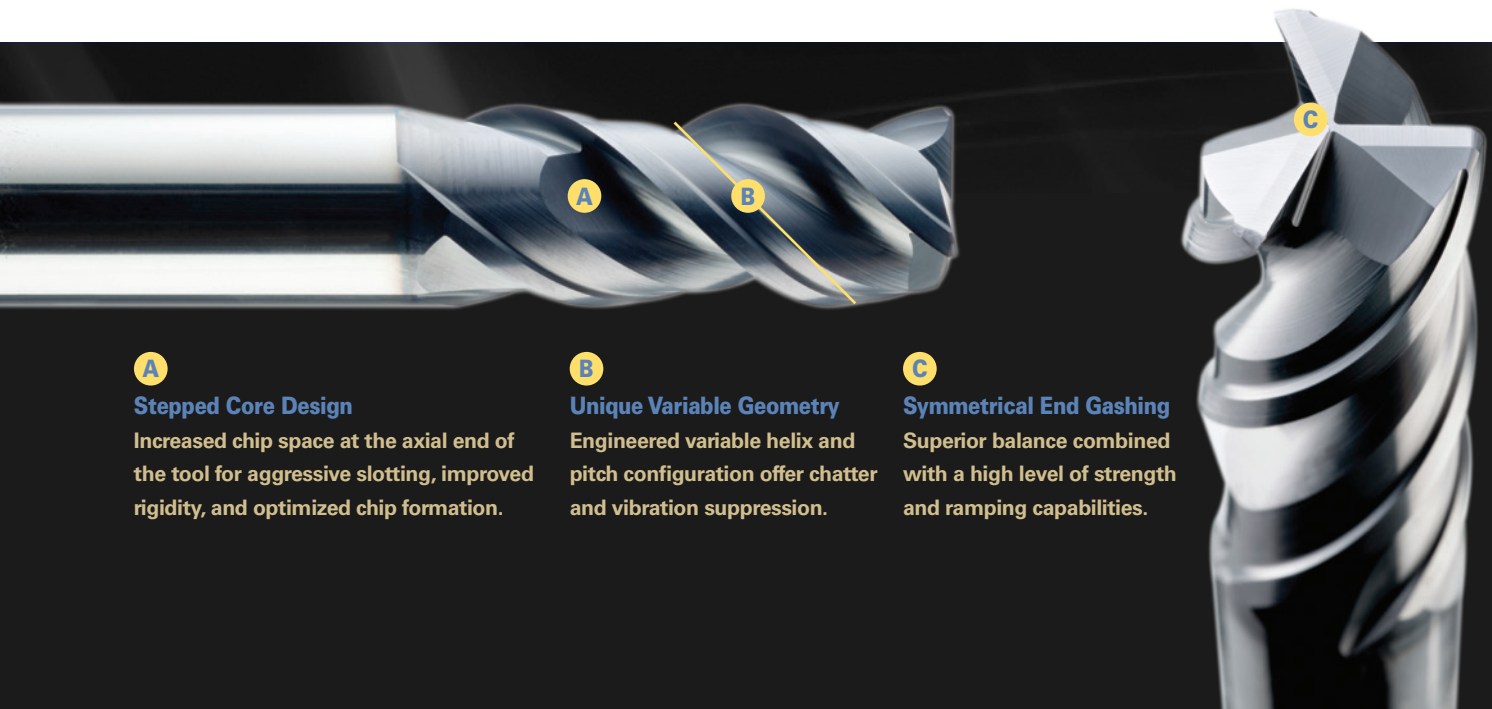
Oxidation Temperature: 800°C – 1472°F

Coefficient of Friction: 0.45

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

THE SERIES 33 IS IDEAL FOR AGGRESSIVE RAMPING, POCKETING AND SLOTTING OF DIFFICULT MATERIALS:

- **Aerospace Structure Components**
- **Medical Replacement Parts**
- **Automotive Performance Components**
- **Stainless Steel Valves**



A

Stepped Core Design

Increased chip space at the axial end of the tool for aggressive slotting, improved rigidity, and optimized chip formation.

B

Unique Variable Geometry

Engineered variable helix and pitch configuration offer chatter and vibration suppression.

C

Symmetrical End Gashing

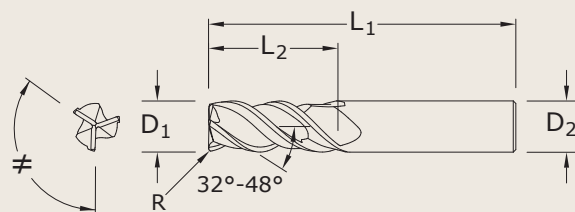
Superior balance combined with a high level of strength and ramping capabilities.

TOLERANCES (inch)

DIAMETER	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 = +.000 / -.002


SERIES 33CR
(FRACTIONAL)

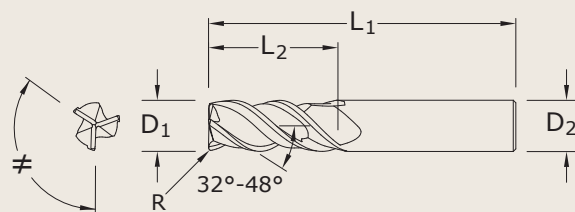
Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Corner Radius R	Ti-NAMITE-A (AlTiN) EDP No.
1/8	3/8	2-1/2	1/4	0.015	33345
3/16	9/16	2-1/2	1/4	0.015	33346
1/4	3/4	2-1/2	1/4	0.020	33347
5/16	13/16	2-1/2	5/16	0.020	33348
3/8	1	2-1/2	3/8	0.020	33349
7/16	1-1/8	2-3/4	7/16	0.020	33350
1/2	1-1/4	3-1/4	1/2	0.030	33351
5/8	1-1/2	3-1/2	5/8	0.040	33352
3/4	1-3/4	4	3/4	0.040	33353
1	2-1/4	5	1	0.040	33354

TOLERANCES (mm)

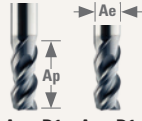
DIAMETER	D ₁	D ₂
3 - 6	+0,000 / -0,030	h6
> 6 - 10	+0,000 / -0,040	h6
>10 - 25	+0,000 / -0,050	h6

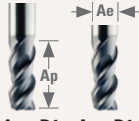
CORNER RADIUS TOLERANCES (mm)

R = +0,00 / -0,05


SERIES 33MCR
(METRIC)

Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Corner Radius R	Ti-NAMITE-A (AlTiN) EDP No.
3	9	57	6	0,3	43445
4	12	57	6	0,3	43446
5	15	57	6	0,3	43447
6	18	57	6	0,5	43448
8	20	63	8	0,5	43449
10	27	72	10	0,5	43450
12	30	83	12	0,5	43451
16	38	92	16	1,0	43452
20	46	104	20	1,0	43453

Hardness BRINELL	Series 33 Fractal			Vc (SFM)	Diameter (inch)																	
			Ap x D1		Ae x D1		RPM	Fz	Feed (IPM)	RPM	Fz	Feed (IPM)	RPM	Fz	Feed (IPM)	RPM	Fz	Feed (IPM)	RPM	Fz	Feed (IPM)	
> 175 < 250	CARBON STEEL 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	Profile	1.5	0.5	600	RPM	18183	9092	6061	4546	3637	3031	2273									
					(500-700)	Fz	0.00046	0.00120	0.00229	0.00306	0.00337	0.00367	0.00428									
						Feed (IPM)	25	33	42	42	37	33	29									
		Slotting	1	1	400	RPM	14516	7258	4839	3629	2903	2419	1815									
						(400-500)	Fz	0.00046	0.00120	0.00229	0.00306	0.00337	0.00367	0.00428								
							Feed (IPM)	20	26	33	33	29	27	23								
> 250 < 350	ALLOY STEEL 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	Profile	1.5	0.5	400	RPM	11460	5730	3820	2865	2292	1910	1433									
					(400-500)	Fz	0.00034	0.00092	0.00172	0.00229	0.00252	0.00275	0.00321									
						Feed (IPM)	12	16	20	20	17	16	14									
		Slotting	1	1	310	RPM	9168	4584	3056	2292	1834	1528	1146									
						(300-360)	Fz	0.00034	0.00092	0.00172	0.00229	0.00252	0.00275	0.00321								
							Feed (IPM)	9	13	16	16	14	13	11								
> 250 < 350	TOOL STEEL A2, D2, H13, L2, M2, P20, S7, T15, W2	Profile	1.5	0.5	300	RPM	9168	4584	3056	2292	1834	1528	1146									
					(250-350)	Fz	0.00034	0.00092	0.00172	0.00229	0.00252	0.00275	0.00321									
						Feed (IPM)	9	13	16	16	14	13	11									
		Slotting	1	1	220	RPM	7334	3667	2445	1834	1467	1222	917									
						(190-250)	Fz	0.00034	0.00092	0.00172	0.00229	0.00252	0.00275	0.00321								
							Feed (IPM)	7	10	13	13	11	10	9								
> 200 < 260	MEDIUM & LOW ALLOY CAST IRON Gray, Malleable, Ductile	Profile	1.5	0.5	450	RPM	9168	4584	3056	2292	1834	1528	1146									
					(400-500)	Fz	0.00031	0.00084	0.00157	0.00210	0.00231	0.00252	0.00294									
						Feed (IPM)	9	12	14	14	13	12	10									
		Slotting	1	1	325	RPM	7334	3667	2445	1834	1467	1222	917									
						(300-375)	Fz	0.00031	0.00084	0.00157	0.00210	0.00231	0.00252	0.00294								
							Feed (IPM)	7	9	12	12	10	9	8								
> 250 < 350	DIFFICULT HIGH ALLOY CAST IRON Gray, Malleable, Ductile	Profile	1.5	0.5	275	RPM	5806	2903	1935	1452	1161	968	726									
					(200-350)	Fz	0.00025	0.00067	0.00126	0.00168	0.00185	0.00202	0.00235									
						Feed (IPM)	4	6	7	7	6	6	5									
		Slotting	1	1	220	RPM	4584	2292	1528	1146	917	764	573									
						(200-250)	Fz	0.00025	0.00067	0.00126	0.00168	0.00185	0.00202	0.00235								
							Feed (IPM)	3	5	6	6	5	5	4								
< 250	STAINLESS STEEL (FREE MACHING) 303, 416, 420F, 430F 440F,	Profile	1.5	0.5	450	RPM	18336	9168	6112	4584	3667	3056	2292									
					(400-500)	Fz	0.00037	0.00090	0.00186	0.00247	0.00272	0.00297	0.00346									
						Feed (IPM)	20	25	34	34	30	27	24									
		Slotting	1	1	300	RPM	14669	7334	4890	3667	2934	2445	1834									
						(250-350)	Fz	0.00037	0.00090	0.00186	0.00247	0.00272	0.00297	0.00346								
							Feed (IPM)	16	20	27	27	24	22	19								
< 275	STAINLESS STEEL (DIFFICULT) 304, 304L, 316, 316L	Profile	1.5	0.5	400	RPM	12071	6036	4024	3018	2414	2012	1509									
					(350-450)	Fz	0.00030	0.00079	0.00148	0.00198	0.00218	0.00238	0.00277									
						Feed (IPM)	11	14	18	18	16	14	13									
		Slotting	1	1	280	RPM	9626	4813	3209	2407	1925	1604	1203									
						(250-380)	Fz	0.00030	0.00079	0.00148	0.00198	0.00218	0.00238	0.00277								
							Feed (IPM)	9	11	14	14	13	11	10								
< 325	STAINLESS STEEL (PH) 13-8 PH, 15-5PH, 17-4 PH, Custom 450	Profile	1.5	0.5	310	RPM	11002	5501	3667	2750	2200	1834	1375									
					(210-350)	Fz	0.00030	0.00079	0.00148	0.00198	0.00218	0.00238	0.00277									
						Feed (IPM)	10	13	16	16	14	13	11									
		Slotting	1	1	240	RPM	8862	4431	2954	2216	1772	1477	1108									
						(200-300)	Fz	0.00030	0.00079	0.00148	0.00198	0.00218	0.00238	0.00277								
							Feed (IPM)	8	11	13	13	12	11	9								

Hardness BRINELL	Series 33 Fractal				Vc (SFM)	Diameter (inch)							
			Ap x D1	Ae x D1									
						1/8	1/4	3/8	1/2	5/8	3/4	1	
< 300	NICKEL, COBALT AND IRON BASED SUPERALLOYS Inconel 601, 617, 625, Incoly 800, Monel 400		1.5	0.5	85	RPM	2384	1192	795	596	477	397	298
					(70-120)	Fz	0.00026	0.00068	0.00128	0.00170	0.00187	0.00204	0.00234
					Feed (IPM)	2	2	3	3	3	2	2	
			1	1	60	RPM	1925	963	642	481	385	321	241
					(50-100)	Fz	0.00026	0.00068	0.00128	0.00170	0.00187	0.00204	0.00234
						2	2	2	2	2	2	2	
> 300	NICKEL, COBALT AND IRON BASED SUPERALLOYS (DIFFICULT) Inconel 718, 750X, Incoly 925, Waspaloy, Hastelloy, Rene		1.5	0.5	60	RPM	1895	947	632	474	379	316	237
					(45-75)	Fz	0.00018	0.00048	0.00089	0.00119	0.00131	0.00143	0.00167
					Feed (IPM)	1	1	2	2	1	1	1	
			1	1	40	RPM	1497	749	499	374	299	250	187
					(20-60)	Fz	0.00018	0.00048	0.00089	0.00119	0.00131	0.00143	0.00167
					Feed (IPM)	1	1	1	1	1	1	1	
< 350	TITANIUM BASE ALLOY Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si		1.5	0.5	275	RPM	6570	3285	2190	1643	1314	1095	821
					(200-350)	Fz	0.00030	0.00080	0.00150	0.00200	0.00220	0.00240	0.00281
					Feed (IPM)	6	8	10	10	9	8	7	
			1	1	150	RPM	5195	2598	1732	1299	1039	866	649
					(100-250)	Fz	0.00030	0.00080	0.00150	0.00200	0.00220	0.00240	0.00281
					Feed (IPM)	5	6	8	8	7	6	5	
< 450	TITANIUM BASE ALLOY (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al		1.5	0.5	180	RPM	2445	1222	815	611	489	407	306
					(140-220)	Fz	0.00030	0.00080	0.00120	0.00180	0.00210	0.00240	0.00280
					Feed (IPM)	2	3	3	3	3	3	3	
			1	1	100	RPM	1834	917	611	458	367	306	229
					(80-140)	Fz	0.00030	0.00080	0.00120	0.00180	0.00210	0.00240	0.00280
					Feed (IPM)	2	2	2	2	2	2	2	

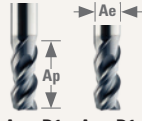
* Maximum recommended depth shown

* For High Speed Machining with a Radial Width of Cut 5%-7% of D1 please refer for the SGS Website Calculators and Tool Wizard to compensate for chip thinning in the Feed Rate parameters

* Finish cuts typically require reduced Feed; also the Radial Width of Cut recommended is not more than 2% x D1

* Reduce Speed & Feed for material harder than listed

* Above recommendations are based on ideal conditions; For smaller taper machining centers or less rigid conditions please adjust parameters accordingly on diameters greater than 1/2"

Hardness BRINELL	Series 33 Metric			Vc (m/min)	Diameter (mm)								
		Ap x D1	Ae x D1		3	6	8	10	12	16	20		
		Profile	Slotting										
> 175 < 250	CARBON STEEL 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536		1.5	0.5	181	RPM	19227	9613	7210	5768	4807	3605	2884
					(145-218)	Fz	0.01090	0.02870	0.04900	0.06120	0.07340	0.08590	0.09550
						Feed (mm/min)	629	828	1060	1059	1058	929	826
			1	1	145	RPM	15349	7675	5756	4605	3837	2878	2302
					(116-174)	Fz	0.01090	0.02870	0.04900	0.06120	0.07340	0.08590	0.09550
						Feed (mm/min)	502	661	846	845	845	742	660
> 250 < 350	ALLOY STEEL 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100		1.5	0.5	114	RPM	12118	6059	4544	3635	3029	2272	1818
					(91-137)	Fz	0.00810	0.02160	0.03680	0.04600	0.05510	0.06430	0.07160
						Feed (mm/min)	294	393	502	502	501	438	390
			1	1	91	RPM	9694	4847	3635	2908	2424	1818	1454
					(73-110)	Fz	0.00810	0.02160	0.03680	0.04600	0.05510	0.06430	0.07160
						Feed (mm/min)	236	314	401	401	401	351	312
> 250 < 350	TOOL STEEL A2, D2, H13, L2, M2, P20, S7, T15, W2		1.5	0.5	91	RPM	9694	4847	3635	2908	2424	1818	1454
					(73-110)	Fz	0.00810	0.02160	0.03680	0.04600	0.05510	0.06430	0.07160
						Feed (mm/min)	236	314	401	401	401	351	312
			1	1	73	RPM	7755	3878	2908	2327	1939	1454	1163
					(59-88)	Fz	0.00810	0.02160	0.03680	0.04600	0.05510	0.06430	0.07160
						Feed (mm/min)	188	251	321	321	320	281	250
> 200 < 260	MEDIUM & LOW ALLOY CAST IRON Gray, Malleable, Ductile		1.5	0.5	91	RPM	9694	4847	3635	2908	2424	1818	1454
					(73-110)	Fz	0.00740	0.01980	0.03350	0.04190	0.05030	0.05890	0.06550
						Feed (mm/min)	215	288	365	366	366	321	286
			1	1	73	RPM	7755	3878	2908	2327	1939	1454	1163
					(59-88)	Fz	0.00740	0.01980	0.03350	0.04190	0.05030	0.05890	0.06550
						Feed (mm/min)	172	230	292	292	293	257	229
> 250 < 350	DIFFICULT HIGH ALLOY CAST IRON Gray, Malleable, Ductile		1.5	0.5	58	RPM	6140	3070	2302	1842	1535	1151	921
					(46-69)	Fz	0.00610	0.01570	0.02690	0.03350	0.04040	0.04700	0.05260
						Feed (mm/min)	112	145	186	185	186	162	145
			1	1	46	RPM	4847	2424	1818	1454	1212	909	727
					(37-55)	Fz	0.00610	0.01570	0.02690	0.03350	0.04040	0.04700	0.05260
						Feed (mm/min)	89	114	147	146	147	128	115
< 250	STAINLESS STEEL (FREE MACHING) 303, 416, 420F, 430F 440F,		1.5	0.5	183	RPM	19388	9694	7271	5816	4847	3635	2908
					(146-219)	Fz	0.00890	0.02310	0.03960	0.04950	0.05940	0.06930	0.07720
						Feed (mm/min)	690	896	1152	1152	1152	1008	898
			1	1	146	RPM	15511	7755	5816	4653	3878	2908	2327
					(117-176)	Fz	0.00890	0.02310	0.03960	0.04950	0.05940	0.06930	0.07720
						Feed (mm/min)	552	717	921	921	921	806	718
< 275	STAINLESS STEEL (DIFFICULT) 304, 304L, 316, 316L		1.5	0.5	120	RPM	12764	6382	4786	3829	3191	2393	1915
					(96-144)	Fz	0.00710	0.01850	0.03180	0.03960	0.04750	0.05560	0.06200
						Feed (mm/min)	362	472	609	607	606	532	475
			1	1	96	RPM	10179	5089	3817	3054	2545	1909	1527
					(77-115)	Fz	0.00710	0.01850	0.03180	0.03960	0.04750	0.05560	0.06200
						Feed (mm/min)	289	377	486	484	483	424	379
< 325	STAINLESS STEEL (PH) 13-8 PH, 15-5PH, 17-4 PH, Custom 450		1.5	0.5	110	RPM	11633	5816	4362	3490	2908	2181	1745
					(88-132)	Fz	0.00710	0.01850	0.03180	0.03960	0.04750	0.05560	0.06200
						Feed (mm/min)	330	430	555	553	553	485	433
			1	1	88	RPM	9371	4686	3514	2811	2343	1757	1406
					(71-106)	Fz	0.00710	0.01850	0.03180	0.03960	0.04750	0.05560	0.06200
						Feed (mm/min)	266	347	447	445	445	391	349

Ap x D1 Ae x D1													
Hardness BRINELL	Series 33 Metric		Ap x D1	Ae x D1	Vc (m/min)	Diameter (mm)							
						3	6	8	10	12	16	20	
< 300	NICKEL, COBALT AND IRON BASED SUPERALLOYS Inconel 601, 617, 625, Incoly 800, Monel 400		1.5	0.5	24	RPM	2520	1260	945	756	630	473	378
					(19-29)	Fz	0.00610	0.02000	0.02720	0.03400	0.04090	0.04780	0.05310
						Feed (mm/min)	46	76	77	77	77	68	60
			1	1	19	RPM	2036	1018	763	611	509	382	305
					(15-23)	Fz	0.00610	0.02000	0.02720	0.03400	0.04090	0.04780	0.05310
						Feed (mm/min)	37	61	62	62	62	55	49
> 300	NICKEL, COBALT AND IRON BASED SUPERALLOYS (DIFFICULT) Inconel 718, 750X, Incoly 925, Waspaloy, Hastelloy, Rene		1.5	0.5	19	RPM	2003	1002	751	601	501	376	301
					(15-23)	Fz	0.00430	0.01120	0.01900	0.02390	0.02840	0.03330	0.03710
						Feed (mm/min)	26	34	43	43	43	38	33
			1	1	15	RPM	1583	792	594	475	396	297	238
					(12-18)	Fz	0.00430	0.01120	0.01900	0.02390	0.02840	0.03330	0.03710
						Feed (mm/min)	20	27	34	34	34	30	26
< 350	TITANIUM BASE ALLOY Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si		1.5	0.5	66	RPM	6947	3474	2605	2084	1737	1303	1042
					(52-79)	Fz	0.00710	0.01880	0.03200	0.04010	0.04800	0.05610	0.06250
						Feed (mm/min)	148	196	250	251	250	219	195
			1	1	52	RPM	5493	2747	2060	1648	1373	1030	824
					(41-62)	Fz	0.00900	0.01800	0.02500	0.03100	0.03800	0.04500	0.05400
						Feed (mm/min)	148	148	155	153	157	139	133
< 450	TITANIUM BASE ALLOY (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al		1.5	0.5	24	RPM	2585	1293	969	776	646	485	388
					(20-29)	Fz	0.00710	0.01880	0.03200	0.04010	0.04800	0.05610	0.06250
						Feed (mm/min)	55	73	93	93	93	82	73
			1	1	18	RPM	1939	969	727	582	485	364	291
					(15-22)	Fz	0.00710	0.01880	0.03200	0.04010	0.04800	0.05610	0.06250
						Feed (mm/min)	41	55	70	70	70	61	55

* Maximum recommended depth shown

* For High Speed Machining with a Radial Width of Cut 5%-7% of D1 please refer for the SGS Website Calculators and Tool Wizard to compensate for chip thinning in the Feed Rate parameters

* Finish cuts typically require reduced Feed; also the Radial Width of Cut recommended is not more than 2% x D1

* Reduce Speed & Feed for material harder than listed

* Above recommendations are based on ideal conditions; For smaller taper machining centers or less rigid conditions please adjust parameters accordingly on diameters greater than 1/2"



Solid Carbide Tools

Solutions Around The Globe

SGS Tool Company is a privately-held, ISO-certified leader of round solid carbide cutting tool technology for the aerospace, metalworking, and automotive industries with manufacturing sites in the United States and United Kingdom. Our global network of Sales Representatives, Industrial Distributors, and Agents blanket the world selling into more than 60 countries.

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- ISO-certified quality procedures
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- Specialists in extreme and demanding product applications
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