

SGS[®]
Solid Carbide Tools



High Performance

VALUE AT THE SPINDLE

ISO 9001 Certified Company



New Expanded Offering

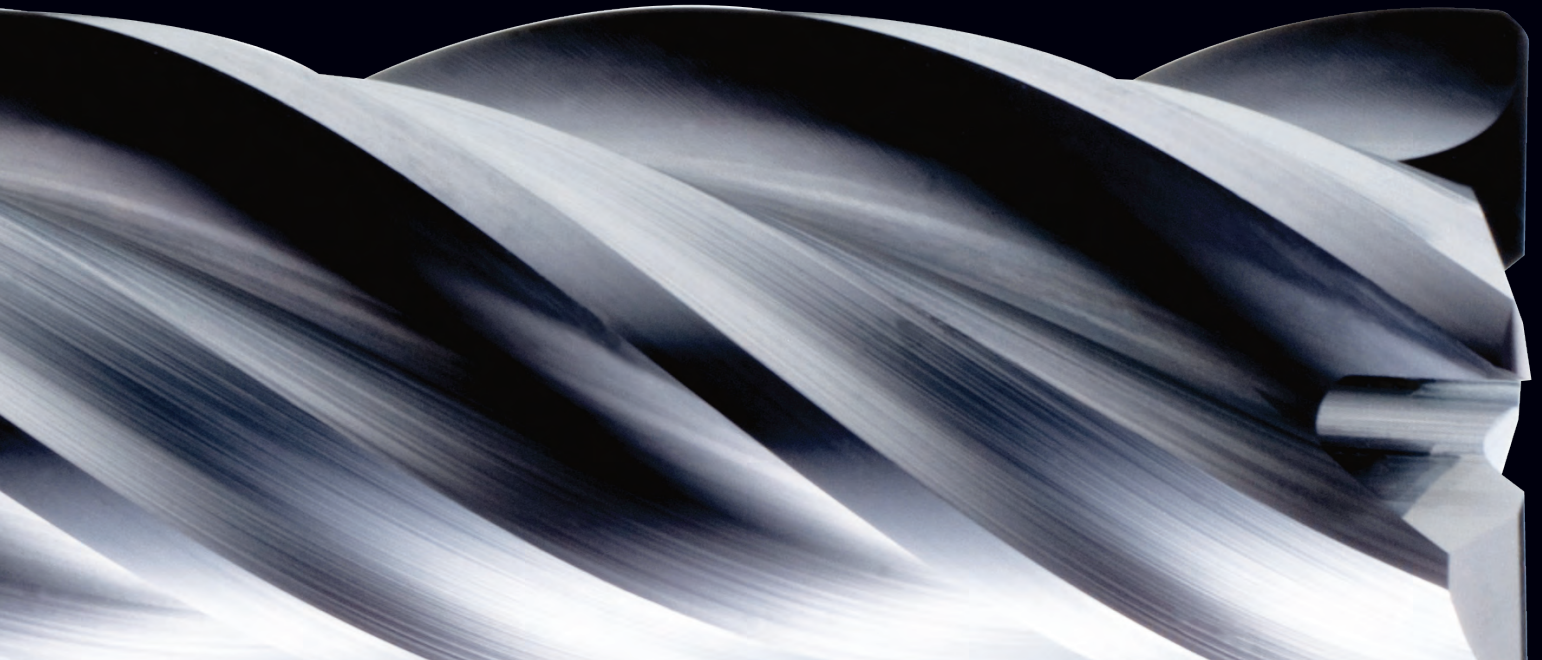
www.sgstool.com



ADVANCED PATENTED DESIGN DELIVERS ADVANCED PRODUCTIVITY

With conventional end mills, the cutting teeth entering and exiting the material creates a natural rhythm that results in damaging harmonics. Harmonics produce a frequency that resonates through the entire tool, resulting in one of the most damaging forms of cutter wear known as chatter. Chatter degrades the quality of your finish. It also creates tool pressure which has a negative effect on tool life. If you use conventional long reach tools, your chatter problem is further compounded by deflection, which limits your maximum speeds and cutting depths. Until now, your only choice was to adjust your operating parameters to account for the limitations of your conventional end mill.

WITH ITS PATENTED, ONE-OF-A-KIND GEOMETRY, THE Z-CARB-AP OFFERS **THREE STAGES OF CHATTER SUPPRESSION, RESULTING IN THE QUIETEST, MOST STABLE MILLING EXPERIENCE AVAILABLE.**



**ENHANCED CORNER GEOMETRY
WITH TIGHT TOLERANCE CORNER RADIUS**

- Improved accuracy
- Improved shearing capabilities
- Reduces tool pressure

UNEQUAL HELIX DESIGN

- Eliminates harmful harmonics unequal flute spacing
- Suppresses chatter

PATENTED VARIABLE RAKE ANGLE

- Controls cutting zone temperature
- Produces ideal chip shape and size

- New Expanded tools
- Now also available with HAIMER SAFE-LOCK option on select diameters



THREE STAGES OF CHATTER SUPPRESSION

1 Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge of typical end mills, which helps to suppress the development of damaging harmonics.

2 The patented unequal helix design aids in eliminating the damaging harmonics that occur during typical machining by changing the angle at which each cutting edge enters and exits the material during the milling process.

3 The rake angle is the main factor that determines the size and shape of the chip, as well as the pressure and temperature of the cutting zone. By incorporating the SGS Patented Variable Rake Geometry, the Z-Carb-AP can alter and control the cutting dynamic like no other tool available, which takes chatter suppression to a whole new level of advanced productivity.

LONG REACH DESIGNS

- Cut deeper and faster in long reach applications



AlTiN Ti-NAMITE-X Ti-NAMITE-X Advantages over AlTiN

Hardness (HV)	2549 HV	3600 HV	Increased hardness offers better resistance to abrasion wear and improved coating strength.
Young's Modulus of Elasticity	460 GPa	368 Gpa	Increased toughness in the coating improves the performance in applications that encounter a high level of mechanical stress such as milling.
Adhesion	70 N	130 N	Good adhesion is critical to optimum performance; the level of measured adhesion has been proven to have a direct relationship to overall tool life. With a denser more uniform coating structure Ti-NAMITE-X improves the ability for the coating to perform at higher temperatures due to an increased oxidation stability.

TEST DATA PROVES:

- Ti-NAMITE-X reduces edge wear by up to:
 - » 58% in Inconel
 - » 64% in Tool Steel
 - » 66% in Alloy Steel
- Z-Carb-AP reduces chatter by up to 68% compared to conventional end mills
- Z-Carb-AP experiences up to 70% less tool wear compared to conventional end mills
- Z-Carb-AP produces up to 321% smoother surface finish than conventional end mills

EDGE WEAR Inconel 718 / 20 HRc

Ti-NAMITE-X



AlTiN

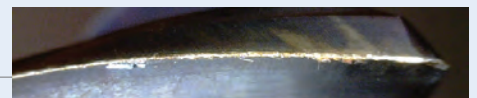


EDGE WEAR H13 / 49 HRc

Ti-NAMITE-X



AlTiN





Quotes and figures
from end users using
Z-Carb AP tools in
their shops and
*getting real results,
with real savings.*

They've exceeded so well...
I'm getting insane results here.

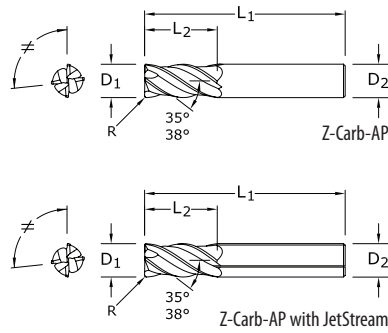
THEY HAVEN'T FAILED ME.

The Z-Carb AP tool saved
an end user almost 74%,
taking a cost per part
from \$1,073 to \$281!

I know you needed results for the
quarter, but I can't give you exact
data until this thing dies.

That is why I recommend you all around town.

***It isn't getting any better...
with straight endmilling.***



TOLERANCES (inch)

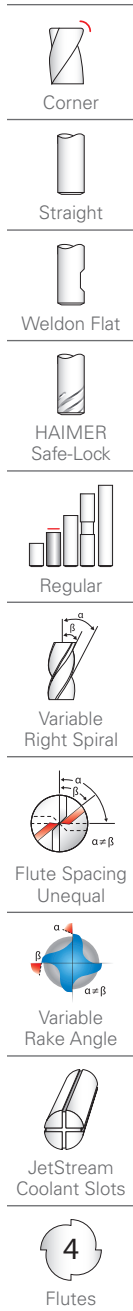
DIAMETER	D ₁	D ₂
< 1/8	+0.0005 / -0.0005	h6
1/8 - 1/4	+0.0000 / -0.0012	h6
> 1/4 - 3/8	+0.0000 / -0.0016	h6
> 3/8 - 1	+0.0000 / -0.0020	h6

CORNER RADIUS TOLERANCES (inch)

< 1/8	+0.0000 / -0.0010
≥ 1/8	+0.0000 / -0.0020

New Expanded Tools

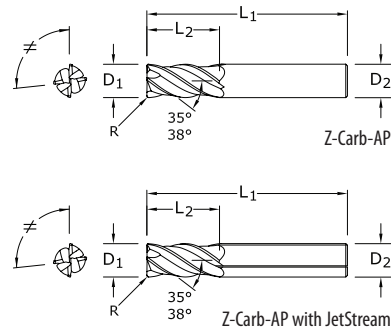
Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Corner Radius R	Ti-Namite-X EDP No. w/o Flat	Ti-Namite-X EDP No. w/ Flat	JetStream EDP No.
1/64	1/32	1-1/2	1/8	.003	36874	—	—
1/32	5/64	1-1/2	1/8	.005	36875	—	—
3/64	7/64	1-1/2	1/8	.005	36876	—	—
1/16	3/16	1-1/2	1/8	.005	36872	—	—
5/64	3/16	1-1/2	1/8	.005	36877	—	—
3/32	9/32	1-1/2	1/8	.010	36873	—	—
7/64	3/8	1-1/2	1/8	.010	36878	—	—
1/8	3/8	1-1/2	1/8	.010	36370	—	—
1/8	3/8	1-1/2	1/8	.015	36851	—	—
3/16	7/16	2	3/16	.010	36371	—	—
3/16	7/16	2	3/16	.015	36852	—	—
3/16	7/16	2	3/16	.030	36722	—	—
1/4	1/2	2-1/2	1/4	.010	36372	—	—
1/4	1/2	2-1/2	1/4	.015	36723	—	—
1/4	1/2	2-1/2	1/4	.020	36853	—	—
1/4	1/2	2-1/2	1/4	.030	36373	—	—
1/4	3/4	2-1/2	1/4	.010	36599	—	—
1/4	3/4	2-1/2	1/4	.015	36600	—	—
1/4	3/4	2-1/2	1/4	.020	36854	—	—
1/4	3/4	2-1/2	1/4	.030	36601	—	—
5/16	13/16	2-1/2	5/16	.015	36724	—	—
5/16	13/16	2-1/2	5/16	.020	36855	—	—
5/16	13/16	2-1/2	5/16	.030	36374	—	—
3/8	7/8	2-1/2	3/8	.010	36375	36701	—
3/8	7/8	2-1/2	3/8	.015	36725	36736	—
3/8	7/8	2-1/2	3/8	.020	36856	36864	—
3/8	7/8	2-1/2	3/8	.030	36376	36702	—
3/8	7/8	2-1/2	3/8	.060	36727	36738	—
7/16	1	2-3/4	7/16	.020	36857	36865	—
1/2	1	3	1/2	.010	36378	36704	36804
1/2	1	3	1/2	.015	36729	36740	36810
1/2	1	3	1/2	.030	36858	36866	36805
1/2	1	3	1/2	.060	36380	36706	36811
1/2	1	3	1/2	.090	36381	36707	36812
1/2	1	3	1/2	.125	36731	36742	36813
1/2	1-1/4	3-1/4	1/2	.010	36602	36603	—



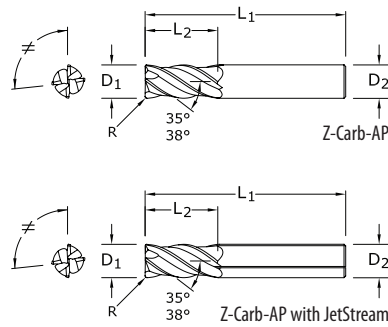
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TOLERANCES (inch)		
DIAMETER	D ₁	D ₂
< 1/8	+0.0005 / -0.0005	h6
1/8 - 1/4	+0.0000 / -0.0012	h6
> 1/4 - 3/8	+0.0000 / -0.0016	h6
> 3/8 - 1	+0.0000 / -0.0020	h6

CORNER RADIUS TOLERANCES (inch)		
< 1/8	+0.0000 / -0.0010	
≥ 1/8	+0.0000 / -0.0020	



	Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Corner Radius R	Ti-Namite-X EDP No. w/o Flat	Ti-Namite-X EDP No. w/ Flat	JetStream EDP No.
 Corner	1/2	1-1/4	3-1/4	1/2	.015	36604	36605	—
	1/2	1-1/4	3-1/4	1/2	.030	36859	36867	—
 Straight	1/2	1-1/4	3-1/4	1/2	.060	36610	36611	—
	1/2	1-1/4	3-1/4	1/2	.090	36612	36613	—
 Weldon Flat	1/2	1-1/4	3-1/4	1/2	.125	36614	36615	—
	9/16	1-1/8	3-1/2	9/16	.030	36860	36868	36806
 HAIMER Safe-Lock	5/8	1-1/4	3-1/2	5/8	.030	36383	36709	36814
	5/8	1-1/4	3-1/2	5/8	.040	36861	36869	36807
 Regular	5/8	1-1/4	3-1/2	5/8	.060	36384	36710	36815
	5/8	1-1/4	3-1/2	5/8	.090	36385	36711	36816
 Variable Right Spiral	5/8	1-1/4	3-1/2	5/8	.125	36733	36744	36817
	3/4	1-1/2	4	3/4	.030	36386	36712	36818
 Flute Spacing Unequal	3/4	1-1/2	4	3/4	.040	36862	36870	36808
	3/4	1-1/2	4	3/4	.060	36387	36713	36819
 Variable Rake Angle	3/4	1-1/2	4	3/4	.090	36388	36714	36820
	3/4	1-1/2	4	3/4	.125	36389	36715	36821
 JetStream Coolant Slots	1	1-1/2	4	1	.030	36390	36716	36822
	1	1-1/2	4	1	.040	36863	36871	36809
 4 Flutes	1	1-1/2	4	1	.060	36391	36717	36823
	1	1-1/2	4	1	.090	36392	36718	36824
	1	1-1/2	4	1	.125	36393	36719	36825



TOLERANCES (mm)

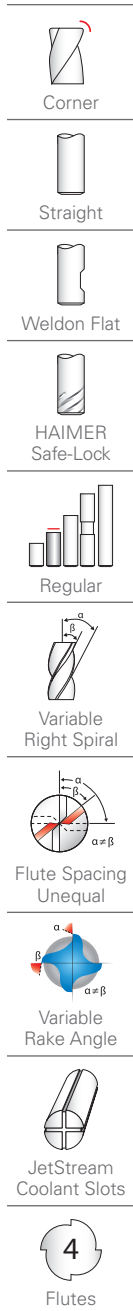
DIAMETER	D ₁	D ₂
< 3	+0,012 / -0,012	h6
3 - 6	+0,000 / -0,030	h6
> 6 - 10	+0,000 / -0,040	h6
> 10 - 25	+0,000 / -0,050	h6

CORNER RADIUS TOLERANCES (mm)

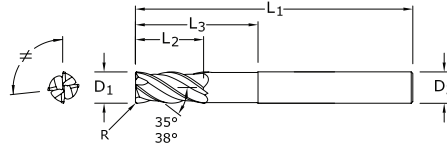
< 3	+0,000 / -0,025
≥ 3	+0,000 / -0,050

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 EDP No. w/o Flat	Ti-Namite-X EDP No. w/ Flat	JetStream EDP No.
1,0	3,0	57,0	6,0	0,1	46873	—	—
1,5	4,5	57,0	6,0	0,1	46849	—	—
2,0	6,0	57,0	6,0	0,2	46850	—	—
2,5	7,0	57,0	6,0	0,2	46874	—	—
3,0	8,0	57,0	6,0	0,3	46851	—	—
3,0	8,0	57,0	6,0	0,5	46880	—	—
4,0	11,0	57,0	6,0	0,3	46852	—	—
4,0	11,0	57,0	6,0	0,5	46881	—	—
5,0	6,0	57,0	13,0	0,3	46853	—	—
6,0	13,0	57,0	6,0	0,25	46882	—	—
6,0	13,0	57,0	6,0	0,5	46854	—	—
6,0	13,0	57,0	6,0	1,0	46855	—	—
6,0	13,0	57,0	6,0	1,5	46884	—	—
8,0	19,0	63,0	8,0	0,5	46856	—	—
8,0	19,0	63,0	8,0	1,0	46857	—	—
8,0	19,0	63,0	8,0	1,5	46886	—	—
8,0	19,0	63,0	8,0	2,0	46887	—	—
10,0	22,0	72,0	10,0	0,5	46858	—	—
10,0	22,0	72,0	10,0	1,0	46859	—	—
10,0	22,0	72,0	10,0	1,5	46889	—	—
10,0	22,0	72,0	10,0	2,0	46890	—	—
10,0	22,0	72,0	10,0	2,5	46891	—	—
12,0	26,0	83,0	12,0	0,5	46860	46909	—
12,0	26,0	83,0	12,0	0,75	46861	46910	—
12,0	26,0	83,0	12,0	1,0	46893	46911	—
12,0	26,0	83,0	12,0	1,5	46894	46912	—
12,0	26,0	83,0	12,0	2,0	46895	46913	—
12,0	26,0	83,0	12,0	2,5	46896	46914	—
12,0	26,0	83,0	12,0	3,0	42718	46915	—
14,0	14,0	83,0	26,0	1,0	46862	46916	46494
16,0	32,0	92,0	16,0	1,0	46863	46917	46495
16,0	32,0	92,0	16,0	1,5	46898	46918	—
16,0	32,0	92,0	16,0	2,0	46899	46919	—
16,0	32,0	92,0	16,0	2,5	46900	46920	—
16,0	32,0	92,0	16,0	3,0	46864	46921	—
20,0	38,0	104,0	20,0	1,0	46865	46922	46497
20,0	38,0	104,0	20,0	1,5	46903	46923	—
20,0	38,0	104,0	20,0	2,0	46904	46924	—
20,0	38,0	104,0	20,0	2,5	46905	46925	—
20,0	38,0	104,0	20,0	3,0	42722	46926	—
25,0	38,0	104,0	25,0	1,0	46866	46927	46498

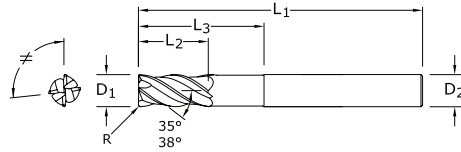


TOLERANCES (inch)		
DIAMETER	D ₁	D ₂
1/4	+0.0000 / -0.0012	h6
> 1/4 - 3/8	+0.0000 / -0.0016	h6
> 3/8 - 1	+0.0000 / -0.0020	h6
CORNER RADIUS TOLERANCES (inch)		
R = +0.0000 / -0.0020		



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 EDP No.
 Corner	1/4	1/2	2-1/2	1/4	1-1/8	.020	36447
	1/4	1/2	3-1/2	1/4	1-5/8	.020	36448
 Straight	1/4	1/2	4	1/4	1-1/4	.020	36450
	1/4	1/2	4	1/4	2-1/8	.020	36449
 HAIMER Safe-Lock	5/16	13/16	3	5/16	1-3/8	.020	36453
	5/16	13/16	4	5/16	1-5/8	.020	36452
	5/16	13/16	4	5/16	2	.020	36454
	3/8	7/8	3	3/8	1-5/8	.020	36457
	3/8	7/8	5	3/8	1-7/8	.030	36456
	3/8	7/8	4	3/8	2-3/8	.020	36458
 Long Reach Neck	7/16	1	6	7/16	2	.030	36460
	1/2	1	4	1/2	2	.030	36463
	1/2	1	6	1/2	2-1/4	.030	36462
	1/2	1	5	1/2	3	.030	36464
 Variable Right Spiral	9/16	1-1/8	6	9/16	2-1/2	.030	36466
	5/8	1-1/4	5	5/8	2-1/2	.040	36468
	5/8	1-1/4	6	5/8	3	.040	36470
	5/8	1-1/4	6	5/8	3-3/4	.040	36469
 Flute Spacing Unequal	3/4	1-1/2	6	3/4	3-1/2	.040	36472
	1	1-1/2	6	1	3	.040	36475
	1	1-1/2	6	1	4	.040	36474
 Variable Rake Angle							
 4 Flutes							



TOLERANCES (mm)

DIAMETER	D ₁	D ₂
6	+0,000 / -0,030	h6
> 6 - 10	+0,000 / -0,040	h6
> 10 - 20	+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	Reach L ₃	Corner Radius R	Ti-Namite-X EDP No.
6,0	8,0	75,0	6,0	24,0	0,5	46821
8,0	10,0	75,0	8,0	32,0	1,0	46822
8,0	10,0	75,0	8,0	32,0	2,0	46823
10,0	12,0	100,0	10,0	40,0	1,0	46824
10,0	12,0	100,0	10,0	40,0	2,0	46825
12,0	15,0	100,0	12,0	48,0	1,0	46826
12,0	15,0	100,0	12,0	48,0	1,5	46827
12,0	15,0	100,0	12,0	48,0	2,0	46828
12,0	15,0	100,0	12,0	48,0	3,0	46829
16,0	20,0	115,0	16,0	65,0	1,0	46830
16,0	20,0	115,0	16,0	65,0	1,5	46831
16,0	20,0	115,0	16,0	65,0	2,0	46832
16,0	20,0	115,0	16,0	65,0	3,0	46833
16,0	20,0	115,0	16,0	65,0	4,0	46834
16,0	20,0	115,0	16,0	65,0	5,0	46835
20,0	24,0	140,0	20,0	80,0	1,0	46836
20,0	24,0	140,0	20,0	80,0	1,5	46837
20,0	24,0	140,0	20,0	80,0	2,0	46838
20,0	24,0	140,0	20,0	80,0	3,0	46839
20,0	24,0	140,0	20,0	80,0	4,0	46840
20,0	24,0	140,0	20,0	80,0	5,0	46841



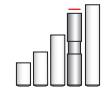
Corner



Straight



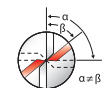
HAIMER
Safe-Lock



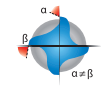
Long Reach
Neck



Variable
Right Spiral



Flute Spacing
Unequal

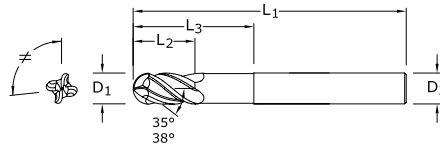


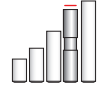
Variable
Rake Angle



4
Flutes

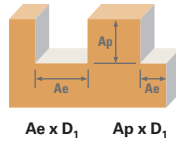
TOLERANCES (inch)		
DIAMETER	D ₁	D ₂
1/4	+0.0000 / -0.0012	h6
> 1/4 - 3/8	+0.0000 / -0.0016	h6
> 3/8 - 1	+0.0000 / -0.0020	h6



	Cutting Diameter D ₁	Length of Cut L ₂	Overall Length L ₁	Shank Diameter D ₂	Reach L ₃	Ti-Namite-X EDP No.
 Ball	1/4	1/2	4	1/4	1-1/4	36480
 Straight	5/16	13/16	4	5/16	1-5/8	36482
	3/8	7/8	5	3/8	1-7/8	36486
	7/16	1	6	7/16	2	38490
 HAIMER Safe-Lock	1/2	1	6	1/2	2-1/4	38492
	9/16	1-1/8	6	9/16	2-1/2	38496
	5/8	1-1/4	6	5/8	3	36500
	3/4	1-1/2	6	3/4	3-1/2	36502
 Long Reach Neck	1	1-1/2	6	1	4	36504
 Variable Right Spiral						
 Flute Spacing Unequal						
 Variable Rake Angle						
 4 Flutes						

Series
Z1PCR, Z1PLC,
Z1PLB
Fractional

Hardness



Ae x D₁

Ap x D₁

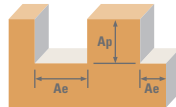
Vc
(SFM)

Diameter (D₁)
(inch)

1/64 1/8 1/4 3/8 1/2 5/8 3/4 1

							Diameter (D ₁) (inch)							
							1/64	1/8	1/4	3/8	1/2	5/8	3/4	1
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	Profile ≤ 275 Bhn or ≤ 28 HRC	≤ 0.5	≤ 1.5	555	RPM	135904	16961	8480	5654	4240	3392	2827	2120
					(444-666)	Fz	0.00005	0.00046	0.0012	0.0023	0.0031	0.0034	0.0037	0.0043
						Feed (ipm)	27.2	31.2	40.7	52.0	52.6	46.1	41.8	36.5
		Slot 1	1	≤ 1	440	RPM	107744	13446	6723	4482	3362	2689	2241	1681
					(352-528)	Fz	0.00005	0.00046	0.0012	0.0023	0.0031	0.0034	0.0037	0.0043
						Feed (ipm)	21.5	24.7	32.3	41.2	41.7	36.6	33.2	28.9
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	Profile ≤ 375 Bhn or ≤ 40 HRC	≤ 0.5	≤ 1.5	315	RPM	77135	9626	4813	3209	2407	1925	1604	1203
					(252-378)	Fz	0.00004	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (ipm)	12.3	13.1	17.3	21.8	22.1	20.0	18.0	15.4
		Slot 1	1	≤ 1	250	RPM	61218	7640	3820	2547	1910	1528	1273	955
					(200-300)	Fz	0.00004	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (ipm)	9.8	10.4	13.8	17.3	17.6	15.9	14.3	12.2
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	Profile ≤ 375 Bhn or ≤ 40 HRC	≤ 0.5	≤ 1.5	185	RPM	45301	5654	2827	1885	1413	1131	942	707
					(148-222)	Fz	0.00003	0.00028	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
						Feed (ipm)	5.4	6.3	7.9	10.6	10.2	9.0	8.3	7.3
		Slot 1	1	≤ 1	145	RPM	35506	4431	2216	1477	1108	886	739	554
					(116-174)	Fz	0.00003	0.00028	0.0007	0.0014	0.0018	0.0020	0.0022	0.0026
						Feed (ipm)	4.3	5.0	6.2	8.3	8.0	7.1	6.5	5.8
	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	Profile ≤ 220 Bhn or ≤ 19 HRC	≤ 0.5	≤ 1.5	445	RPM	108968	13599	6800	4533	3400	2720	2267	1700
					(356-534)	Fz	0.00005	0.00042	0.0011	0.0021	0.0028	0.0031	0.0034	0.0039
						Feed (ipm)	21.8	22.8	29.9	38.1	38.1	33.7	30.8	26.5
		Slot 1	1	≤ 1	355	RPM	86929	10849	5424	3616	2712	2170	1808	1356
					(284-426)	Fz	0.00005	0.00042	0.0011	0.0021	0.0028	0.0031	0.0034	0.0039
						Feed (ipm)	17.4	18.2	23.9	30.4	30.4	26.9	24.6	21.2
K	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	Profile ≤ 260 Bhn or ≤ 26 HRC	≤ 0.5	≤ 1.5	340	RPM	83256	10390	5195	3463	2598	2078	1732	1299
					(272-408)	Fz	0.00004	0.00031	0.0008	0.0016	0.0021	0.0023	0.0025	0.0029
						Feed (ipm)	13.3	12.9	17.5	22.2	21.8	19.1	17.3	15.1
		Slot 1	1	≤ 1	270	RPM	66115	8251	4126	2750	2063	1650	1375	1031
					(216-324)	Fz	0.00004	0.00031	0.0008	0.0016	0.0021	0.0023	0.0025	0.0029
						Feed (ipm)	10.6	10.2	13.9	17.6	17.3	15.2	13.8	12.0
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	Profile ≤ 275 Bhn or ≤ 28 HRC	≤ 0.5	≤ 1.5	490	RPM	119987	14974	7487	4991	3744	2995	2496	1872
					(392-588)	Fz	0.00004	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (ipm)	19.2	20.4	27.0	33.9	34.4	31.1	28.0	24.0
		Slot 1	1	≤ 1	390	RPM	95500	11918	5959	3973	2980	2384	1986	1490
					(312-468)	Fz	0.00004	0.00034	0.0009	0.0017	0.0023	0.0026	0.0028	0.0032
						Feed (ipm)	15.3	16.2	21.5	27.0	27.4	24.8	22.2	19.1
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	Profile ≤ 275 Bhn or ≤ 28 HRC	≤ 0.5	≤ 1.5	340	RPM	83256	10390	5195	3463	2598	2078	1732	1299
					(272-408)	Fz	0.00003	0.00027	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (ipm)	10.0	11.2	14.5	19.4	18.7	16.6	15.2	13.0
		Slot 1	1	≤ 1	270	RPM	66115	8251	4126	2750	2063	1650	1375	1031
					(216-324)	Fz	0.00003	0.00027	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (ipm)	7.9	8.9	11.6	15.4	14.9	13.2	12.1	10.3

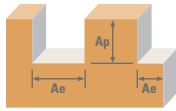
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Series Z1PCR, Z1PLC, Z1PLB Fractional		Hardness			Vc (SFM)	Diameter (D ₁) (inch)									
			Ae x D ₁	Ap x D ₁		1/64	1/8	1/4	3/8	1/2	5/8	3/4	1		
M	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	 Profile	≤ 0.5	≤ 1.5	310	RPM	75910	9474	4737	3158	2368	1895	1579	1184
						(248-372)	Fz	0.00003	0.00027	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (ipm)	9.1	10.2	13.3	17.7	17.1	15.2	13.9	11.8	
			 Slot	1	≤ 1	250	RPM	61218	7640	3820	2547	1910	1528	1273	955
						(200-300)	Fz	0.00003	0.00027	0.0007	0.0014	0.0018	0.0020	0.0022	0.0025
						Feed (ipm)	7.3	8.3	10.7	14.3	13.8	12.2	11.2	9.6	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	 Profile	≤ 0.5	≤ 1.5	80	RPM	19590	2445	1222	815	611	489	407	306
						(64-96)	Fz	0.00003	0.00025	0.0007	0.0013	0.0017	0.0019	0.0020	0.0024
						Feed (ipm)	2.4	2.4	3.3	4.2	4.2	3.7	3.3	2.9	
			 Slot	1	≤ 1	65	RPM	15917	1986	993	662	497	397	331	248
						(52-78)	Fz	0.00003	0.00025	0.0007	0.0013	0.0017	0.0019	0.0020	0.0024
						Feed (ipm)	1.9	2.0	2.7	3.4	3.4	3.0	2.7	2.4	
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	 Profile	≤ 0.5	≤ 1.5	62	RPM	15182	1895	947	632	474	379	316	237
						(50-74)	Fz	0.00002	0.00018	0.0005	0.0009	0.0012	0.0013	0.0014	0.0017
						Feed (ipm)	1.2	1.4	1.8	2.3	2.3	2.0	1.8	1.6	
			 Slot	1	≤ 1	50	RPM	12244	1528	764	509	382	306	255	191
						(40-60)	Fz	0.00002	0.00018	0.0005	0.0009	0.0012	0.0013	0.0014	0.0017
						Feed (ipm)	1.0	1.1	1.5	1.8	1.8	1.6	1.4	1.3	
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	 Profile	≤ 0.5	≤ 1.5	215	RPM	52647	6570	3285	2190	1643	1314	1095	821
						(172-258)	Fz	0.00003	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (ipm)	6.3	7.9	10.5	13.1	13.1	11.6	10.5	9.2	
			 Slot	1	≤ 1	170	RPM	41628	5195	2598	1732	1299	1039	866	649
						(136-204)	Fz	0.00003	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (ipm)	5.0	6.2	8.3	10.4	10.4	9.1	8.3	7.3	
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	 Profile	≤ 0.5	≤ 1.5	75	RPM	18365	2292	1146	764	573	458	382	287
						(60-90)	Fz	0.00003	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (ipm)	2.2	2.8	3.7	4.6	4.6	4.0	3.7	3.2	
			 Slot	1	≤ 1	60	RPM	14692	1834	917	611	458	367	306	229
						(48-72)	Fz	0.00003	0.0003	0.0008	0.0015	0.0020	0.0022	0.0024	0.0028
						Feed (ipm)	1.8	2.2	2.9	3.7	3.7	3.2	2.9	2.6	

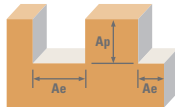
Bhn (Brinell) HRC (Rockwell C)
 $\text{rpm} = \text{Vc} \times 3.82 / D_1$
 $\text{ipm} = \text{Fz} \times 4 \times \text{rpm}$
 maximum Slotting Ap for Z1PCR < 1/8 diameter and all Z1PLC / Z1PLB is .25 x D₁
 maximum Profile Ae for Z1PCR < 1/8 diameter and all Z1PLC / Z1PLB is .20 x D₁
 reduce speed and feed for materials harder than listed
 reduce feed and Ae when finish milling (.02 x D₁ maximum)
 refer to the SGS Tool Wizard for complete technical information (www.sgstool.com)



www.sgstool.com

Series Z1MPCR, Z1MPLC Metric	Hardness (Brinell)			Vc (m/min)	Diameter (D ₁) (mm)										
		Ae x D ₁	Ap x D ₁		1	3	6	8	10	12	16	20	25		
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536		≤ 0.5	≤ 1.5	169	RPM	53803	17934	8967	6725	5380	4484	3363	2690	2152
					(135-203)	Fz	0.0030	0.0109	0.029	0.049	0.061	0.074	0.087	0.099	0.108
						Feed (mm/min)	646	782	1040	1318	1313	1327	1170	1065	930
			1	≤ 1	134	RPM	42654	14218	7109	5332	4265	3555	2666	2133	1706
					(107-161)	Fz	0.0030	0.0109	0.029	0.049	0.061	0.074	0.087	0.099	0.108
						Feed (mm/min)	512	620	825	1045	1041	1052	928	845	737
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100		≤ 0.5	≤ 1.5	96	RPM	30537	10179	5089	3817	3054	2545	1909	1527	1221
					(77-115)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
						Feed (mm/min)	281	330	448	550	550	560	511	458	391
			1	≤ 1	76	RPM	24235	8078	4039	3029	2424	2020	1515	1212	969
					(61-91)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
						Feed (mm/min)	223	262	355	436	436	444	406	364	310
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2		≤ 0.5	≤ 1.5	56	RPM	17934	5978	2989	2242	1793	1495	1121	897	717
					(45-68)	Fz	0.0018	0.0066	0.017	0.030	0.037	0.043	0.051	0.059	0.065
						Feed (mm/min)	129	158	203	269	265	257	229	212	187
			1	≤ 1	44	RPM	14057	4686	2343	1757	1406	1171	879	703	562
					(35-53)	Fz	0.0018	0.0066	0.017	0.030	0.037	0.043	0.051	0.059	0.065
						Feed (mm/min)	101	124	159	211	208	201	179	166	146
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile		≤ 0.5	≤ 1.5	136	RPM	43139	14380	7190	5392	4314	3595	2696	2157	1726
					(109-163)	Fz	0.0028	0.0099	0.026	0.045	0.056	0.067	0.079	0.091	0.098
						Feed (mm/min)	483	569	748	971	966	963	852	785	676
			1	≤ 1	108	RPM	34414	11471	5736	4302	3441	2868	2151	1721	1377
					(87-130)	Fz	0.0028	0.0099	0.026	0.045	0.056	0.067	0.079	0.091	0.098
						Feed (mm/min)	385	454	597	774	771	769	680	626	540
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile		≤ 0.5	≤ 1.5	104	RPM	32960	10987	5493	4120	3296	2747	2060	1648	1318
					(83-124)	Fz	0.0020	0.0074	0.020	0.034	0.043	0.050	0.059	0.067	0.074
						Feed (mm/min)	264	325	439	560	567	549	486	442	390
			1	≤ 1	82	RPM	26174	8725	4362	3272	2617	2181	1636	1309	1047
					(66-99)	Fz	0.0020	0.0074	0.020	0.034	0.043	0.050	0.059	0.067	0.074
						Feed (mm/min)	209	258	349	445	450	436	386	351	310
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F		≤ 0.5	≤ 1.5	149	RPM	47501	15834	7917	5938	4750	3958	2969	2375	1900
					(119-179)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
						Feed (mm/min)	437	513	697	855	855	871	796	713	608
			1	≤ 1	119	RPM	37807	12602	6301	4726	3781	3151	2363	1890	1512
					(95-143)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
						Feed (mm/min)	348	408	555	681	681	693	633	567	484
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L		≤ 0.5	≤ 1.5	104	RPM	32960	10987	5493	4120	3296	2747	2060	1648	1318
					(83-124)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
						Feed (mm/min)	237	281	374	494	488	472	420	389	332
			1	≤ 1	82	RPM	26174	8725	4362	3272	2617	2181	1636	1309	1047
					(66-99)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
						Feed (mm/min)	188	223	297	393	387	375	334	309	264

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	Series Z1MPCR, Z1MPLC Metric	Hardness (Brinell)			Vc (m/min)	Diameter (D ₁) (mm)										
			Ae x D ₁	Ap x D ₁		1	3	6	8	10	12	16	20	25		
M	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	 Profile	≤ 0.5	≤ 1.5	94	RPM	30052	10017	5009	3756	3005	2504	1878	1503	1202
						(76-113)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
						Feed (mm/min)	216	256	341	451	445	431	383	355	303	
			 Slot	1	≤ 1	76	RPM	24235	8078	4039	3029	2424	2020	1515	1212	969
						(61-91)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
						Feed (mm/min)	174	207	275	364	359	347	309	286	244	
S	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	 Profile	≤ 0.5	≤ 1.5	24	RPM	7755	2585	1293	969	776	646	485	388	310
						(20-29)	Fz	0.0018	0.0061	0.016	0.027	0.034	0.041	0.048	0.053	0.060
						Feed (mm/min)	56	63	83	105	105	106	93	82	74	
			 Slot	1	≤ 1	20	RPM	6301	2100	1050	788	630	525	394	315	252
						(16-24)	Fz	0.0018	0.0061	0.016	0.027	0.034	0.041	0.048	0.053	0.060
						Feed (mm/min)	45	51	67	85	86	86	76	67	60	
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	 Profile	≤ 0.5	≤ 1.5	19	RPM	6010	2003	1002	751	601	501	376	301	240
						(15-23)	Fz	0.0013	0.0043	0.011	0.019	0.024	0.028	0.033	0.037	0.042
						Feed (mm/min)	31	34	44	57	58	56	50	44	40	
			 Slot	1	≤ 1	15	RPM	4847	1616	808	606	485	404	303	242	194
						(12-18)	Fz	0.0013	0.0043	0.011	0.019	0.024	0.028	0.033	0.037	0.042
						Feed (mm/min)	25	28	36	46	47	45	40	36	33	
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	 Profile	≤ 0.5	≤ 1.5	66	RPM	20842	6947	3474	2605	2084	1737	1303	1042	834
						(52-79)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	167	197	264	333	333	333	292	267	233	
			 Slot	1	≤ 1	52	RPM	16480	5493	2747	2060	1648	1373	1030	824	659
						(41-62)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	132	156	209	264	264	264	231	211	185	
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	 Profile	≤ 0.5	≤ 1.5	23	RPM	7271	2424	1212	909	727	606	454	364	291
						(18-27)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	58	69	92	116	116	116	102	93	81	
			 Slot	1	≤ 1	18	RPM	5816	1939	969	727	582	485	364	291	233
						(15-22)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
						Feed (mm/min)	47	55	74	93	93	93	81	74	65	

Bhn (Brinell) HRC (Rockwell C)
 $rpm = (Vc \times 1000) / (D_1 \times 3.14)$
 $mm/min = Fz \times 4 \times rpm$
 maximum Slotting Ap for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .25 x D₁
 maximum Profile Ae for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .20 x D₁
 reduce speed and feed for materials harder than listed
 reduce feed and Ae when finish milling (.02 x D₁ maximum)
 refer to the SGS Tool Wizard for complete technical information (www.sgstool.com)



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Munroe Falls, Ohio 44262 U.S.A.
customer service -
US and Canada: (330) 686-5700
fax - US & Canada: (800) 447-4017
international fax: (330) 686-2146
e-mail: webmaster@sgstool.com

UNITED KINGDOM

SGS TOOL EUROPE LTD.

10 Ashville Way
Wokingham, Berkshire
RG41 2PL England
phone: (44) 1189-795-200
fax: (44) 1189-795-295
e-mail: sales@sgstool.eu

FRANCE

DOGA-SGS FRANCE

8, Avenue Gutenberg
78310 Maurepas
France
phone: +33 (0) 1 82 88 49 14
fax: +33 (0) 1 82 88 49 39
e-mail: sgsfrance@sgstool.eu

GERMANY

KADIGO TOOL SYSTEMS

Walramstrasse 27
65510 Idstein
Germany
phone: +49 (0) 212 645573-0
fax: +49 (0) 212 380 89 693
e-mail: info@kadigo-ts.com

POLAND

SGS TOOL POLAND

phone: +48 530 432 002
e-mail: infopolska@sgstool.pl

SPAIN

SGS TOOL IBERICA

e-mail: sgsiberica@sgstool.es

EASTERN EUROPE

SINTCOM

Sintcom Tools
95 Arsenalski Blvd.
1421 Sofia, Bulgaria
phone: (359) 283-64421
fax: (359) 286-52493
e-mail: sintcom@sintcomtools.com

RUSSIA

HALTEC

phone: (7) 495-252-05-00
e-mail: info@haltec.ru
web: www.haltec.ru

CHINA

SGS TOOL DIVISION

Unit 301, Building A, No.200,
Jin Su Road
Jinqiao Export Processing Zone,
Pudong New Area
Shanghai 201206
China
phone: (86) 21-50589822
fax: (86) 21-50817160
e-mail: china@sgstool.com
web: www.sgstool.com/china

sgstool.com