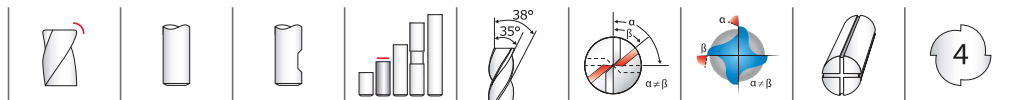


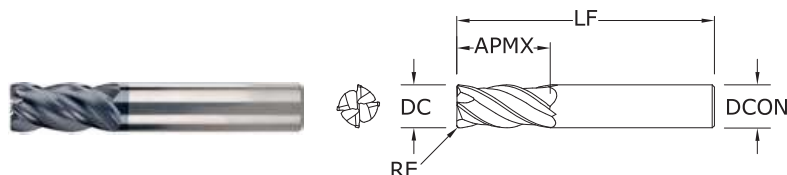
METRIC

Z-Carb-AP



Z1MPCR METRIC SERIES

- Variable rake geometry alters and controls the cutting dynamic taking chatter suppression to an unprecedented level
- Unequal helix design changes the cutting angle to improve harmonics
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)



CUTTING DIAMETER DC	LENGTH OF CUT APMX	mm			EDP NO.		
		OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-X	Ti-NAMITE-X W/FLAT	JetStream
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	13,0	57,0	6,0	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	46493
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	42719
14,0	26,0	83,0	14,0	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	—

TOLERANCES (mm)

<3 DIAMETER

DC = $+0,012/-0,012$
 DCON = h_6
 RE = $+0,000/-0,025$

3–6 DIAMETER

DC = $+0,000/-0,030$
 DCON = h_6
 RE = $+0,000/-0,050$

>6–10 DIAMETER

DC = $+0,000/-0,040$
 DCON = h_6
 RE = $+0,000/-0,050$

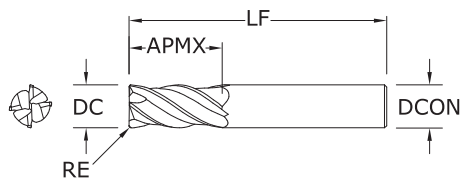
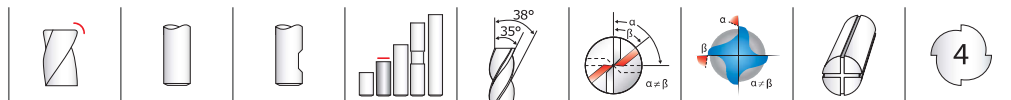
>10–25 DIAMETER

DC = $+0,000/-0,050$
 DCON = h_6
 RE = $+0,000/-0,050$

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS
TITANIUM

For patent
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continued on next page



Z1MPCR
METRIC SERIES

TOLERANCES (mm)

<3 DIAMETER

DC = +0,012/-0,012

DCON = h_6

RE = +0,000/-0,025

3-6 DIAMETER

DC = +0,000/-0,030

DCON = h_6

RE = +0,000/-0,050

>6-10 DIAMETER

DC = +0,000/-0,040

DCON = h_6

RE = +0,000/-0,050

>10-25 DIAMETER

DC = +0,000/-0,050

DCON = h_6

RE = +0,000/-0,050

STEELS

STAINLESS STEELS

CAST IRON

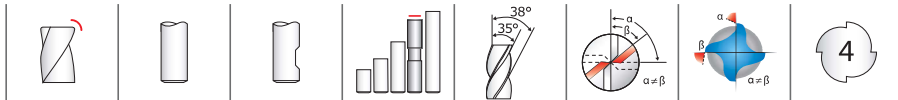
HIGH TEMP ALLOYS

TITANIUM

For patent
information visit
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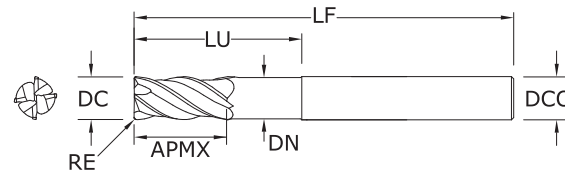
mm					EDP NO.		
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-X	Ti-NAMITE-X W/FLAT	JetStream
16,0	32,0	92,0	16,0	2,0	46899	46919	—
16,0	32,0	92,0	16,0	2,5	46900	46920	—
16,0	32,0	92,0	16,0	3,0	46864	46921	42721
16,0	32,0	92,0	16,0	4,0	46867	46944	—
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	42723
20,0	38,0	104,0	20,0	4,0	46868	46945	—
20,0	38,0	104,0	20,0	5,0	46869	46946	—
25,0	38,0	104,0	25,0	1,0	46866	46927	46498

CONTINUED



Z1MPIC • Z1MPLC

METRIC SERIES



- Variable rake geometry alters and controls the cutting dynamic taking chatter suppression to an unprecedented level
- Unequal helix design changes the cutting angle to improve harmonics
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Long reach design allows for deeper and faster cuts
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	mm				EDP NO.	
			SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-X	Ti-NAMITE-X W/FLAT
6,0	8,0	75,0	6,0	24,0	5,49	0,5	46821	—
8,0	10,0	75,0	8,0	32,0	7,49	1,0	46822	—
8,0	10,0	75,0	8,0	32,0	7,49	2,0	46823	—
10,0	12,0	100,0	10,0	40,0	9,50	1,0	46824	—
10,0	12,0	100,0	10,0	40,0	9,50	2,0	46825	—
12,0	15,0	100,0	12,0	48,0	11,48	1,0	46826	46928
12,0	15,0	100,0	12,0	48,0	11,48	1,5	46827	46929
12,0	15,0	100,0	12,0	48,0	11,48	2,0	46828	46930
12,0	15,0	100,0	12,0	48,0	11,48	3,0	46829	46931
12,0	26,0	83,0	12,0	36,0	11,48	2,5	—	42731
12,0	26,0	83,0	12,0	36,0	11,48	3,0	—	42732
12,0	26,0	83,0	12,0	36,0	11,48	4,0	—	42733
16,0	32,0	92,0	16,0	42,0	15,49	2,5	—	42734
16,0	32,0	92,0	16,0	42,0	15,49	4,0	—	42735
16,0	32,0	92,0	16,0	42,0	15,49	6,0	—	42736
16,0	20,0	115,0	16,0	65,0	15,49	1,0	46830	46932
16,0	20,0	115,0	16,0	65,0	15,49	1,5	46831	46933
16,0	20,0	115,0	16,0	65,0	15,49	2,0	46832	46934
16,0	20,0	115,0	16,0	65,0	15,49	3,0	46833	46935
16,0	20,0	115,0	16,0	65,0	15,49	4,0	46834	46936
16,0	20,0	115,0	16,0	65,0	15,49	5,0	46835	46937
20,0	24,0	140,0	20,0	80,0	19,48	1,0	46836	46938
20,0	24,0	140,0	20,0	80,0	19,48	1,5	46837	46939
20,0	24,0	140,0	20,0	80,0	19,48	2,0	46838	46940
20,0	24,0	140,0	20,0	80,0	19,48	3,0	46839	46941
20,0	24,0	140,0	20,0	80,0	19,48	4,0	46840	46942
20,0	24,0	140,0	20,0	80,0	19,48	5,0	46841	46943
20,0	38,0	104,0	20,0	52,0	19,48	2,5	—	42737
20,0	38,0	104,0	20,0	52,0	19,48	4,0	—	42738
20,0	38,0	104,0	20,0	52,0	19,48	6,0	—	42739

TOLERANCES (mm)

6 DIAMETER

DC = $+0,000/-0,030$ DCON = h_6 RE = $+0,000/-0,050$

>6–10 DIAMETER

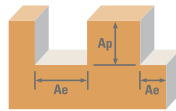
DC = $+0,000/-0,040$ DCON = h_6 RE = $+0,000/-0,050$

>10–20 DIAMETER

DC = $+0,000/-0,050$ DCON = h_6 RE = $+0,000/-0,050$

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS
TITANIUM
HARDENED STEELS

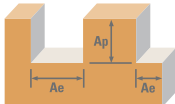
For patent
information visit
www.ksptpatents.com



Series Z1M, Z1MPCR, Z1MPIC, Z1MPLC Metric		Hardness		Ae x DC		Ap x DC		Vc (m/min)		DC • mm										
										1	3	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	Profile 	≤ 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		
		≤ 275 Bhn or ≤ 28 HRc	Slot 	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	≤ 375 Bhn or ≤ 40 HRc	Profile 	≤ 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		
		≤ 375 Bhn or ≤ 40 HRc	Slot 	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		
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ 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		
		≤ 275 Bhn or ≤ 28 HRc	Slot 	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	≤ 275 Bhn or ≤ 28 HRc	Profile 	≤ 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		
		≤ 275 Bhn or ≤ 28 HRc	Slot 	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		
	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		
		≤ 325 Bhn or ≤ 35 HRc	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		
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile 	≤ 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		
		≤ 220 Bhn or ≤ 19 HRc	Slot 	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		

continued on next page

Z-Carb-AP

Series Z1M, Z1MPCR, Z1MPIC, Z1MPLC Metric					Vc (m/min)	DC • mm									
Hardness	Ae x DC	Ap x DC	1	3		6	8	10	12	16	20	25			
K	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	 ≤ 260 Bhn or ≤ 26 HRc	Profile  ≤ 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	
		 ≤ 26 HRc	Slot  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	
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	
		 ≤ 32 HRc	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	
		 ≤ 43 HRc	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	
		 ≤ 38 HRc	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	
		 ≤ 47 HRc	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	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	 ≤ 375 Bhn or ≤ 40 HRc	Profile  ≤ 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	
		 ≤ 40 HRc	Slot  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	

Bhn (Brinell) HRc (Rockwell C)

rpm = (Vc x 1000) / (DC x 3.14)

mm/min = Fz x 4 x rpm

maximum Slotting Ap for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .25 x DC

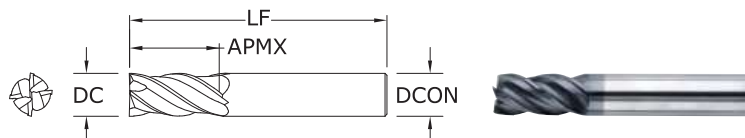
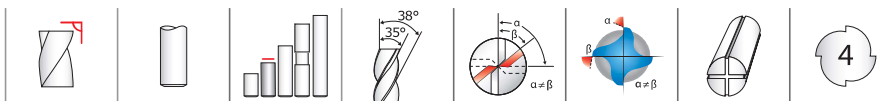
maximum Profile Ae for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .20 x DC

reduce speed and feed for materials harder than listed

reduce feed and Ae when finish milling (.02 x DC maximum)

feed rates listed have chip thinning adjustments included where applicable

refer to the SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)



Z1M
METRIC SERIES

TOLERANCES (mm)

3–6 DIAMETER

DC = +0,000/–0,030

DCON = h₆

>6–10 DIAMETER

DC = +0,000/–0,040

DCON = h₆

>10–25 DIAMETER

DC = +0,000/–0,050

DCON = h₆

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS
TITANIUM
HARDENED STEELS

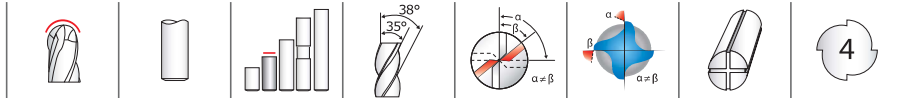
mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)	JetStream
3,0	8,0	57,0	6,0	46357	—
4,0	11,0	57,0	6,0	46358	—
5,0	13,0	57,0	6,0	46359	—
6,0	13,0	57,0	6,0	46360	—
8,0	19,0	63,0	8,0	46362	—
10,0	22,0	72,0	10,0	46364	—
12,0	26,0	83,0	12,0	46366	—
14,0	26,0	83,0	14,0	46368	46506
16,0	32,0	92,0	16,0	46370	46507
18,0	32,0	92,0	18,0	46372	46508
20,0	38,0	104,0	20,0	46374	46509
25,0	38,0	104,0	25,0	46376	46510

Refer to page 47 for speed & feed recommendations

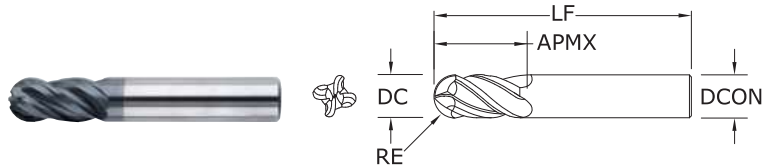
- Variable rake geometry alters and controls the cutting dynamic taking chatter suppression to an unprecedented level
- Unequal helix design reduces damaging harmonics by changing the angle at which each cutting edge enters and exits the material
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Optimal material removal rates through increased feed and depths of cut
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

For patent information visit
www.ksptpatents.com

METRIC Z-Carb



Z1MB METRIC SERIES



- Unequal helix design reduces damaging harmonics by changing the angle at which each cutting edge enters and exits the material
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Optimal material removal rates through increased feed and depths of cut
- Ball nose design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)	JetStream
3,0	8,0	57,0	6,0	46354	—
4,0	11,0	57,0	6,0	46355	—
5,0	13,0	57,0	6,0	46356	—
6,0	13,0	57,0	6,0	46343	—
8,0	19,0	63,0	8,0	46344	—
10,0	22,0	72,0	10,0	46345	—
12,0	26,0	83,0	12,0	46346	—
14,0	26,0	83,0	14,0	46347	46518
16,0	32,0	92,0	16,0	46348	46519
18,0	32,0	92,0	18,0	46349	46520
20,0	38,0	104,0	20,0	46350	46521
25,0	38,0	104,0	25,0	46351	46522

RE = 1/2 Cutting Diameter (DC)

TOLERANCES (mm)

3–6 DIAMETER

DC = $+0,000/-0,030$
DCON = h_6

RE = $+0,000/-0,015$

>6–10 DIAMETER

DC = $+0,000/-0,040$

DCON = h_6

RE = $+0,000/-0,020$

>10–25 DIAMETER

DC = $+0,000/-0,050$

DCON = h_6

RE = $+0,000/-0,025$

STEELS

STAINLESS STEELS

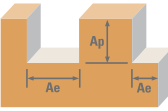
CAST IRON

HIGH TEMP ALLOYS

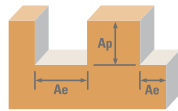
TITANIUM

HARDENED STEELS

For patent
information visit
www.ksptpatents.com

Series Z1MB Metric					Vc (m/min)	DC • mm							
		Hardness	Ae x DC	Ap x DC		3	6	8	10	12	16	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	 Profile ≤ 0.5 ≤ 1.5 ≤ 275 Bhn or ≤ 28 HRc		169	RPM	17934	8967	6725	5380	4484	3363	2690	2152
				(135-203)	Fz	0.009	0.024	0.041	0.051	0.060	0.079	0.086	0.088
				Feed (mm/min)	654	861	1091	1090	1076	1067	927	753	
		 Slot 1 ≤ 1		134	RPM	14218	7109	5332	4265	3555	2666	2133	1706
				(107-161)	Fz	0.009	0.024	0.041	0.051	0.060	0.079	0.086	0.088
				Feed (mm/min)	519	682	865	864	853	846	735	597	
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	 Profile ≤ 0.5 ≤ 1.5 ≤ 375 Bhn or ≤ 40 HRc		96	RPM	10179	5089	3817	3054	2545	1909	1527	1221
				(77-115)	Fz	0.007	0.019	0.030	0.037	0.046	0.061	0.067	0.068
				Feed (mm/min)	274	391	456	456	464	469	407	330	
		 Slot 1 ≤ 1		76	RPM	8078	4039	3029	2424	2020	1515	1212	969
				(61-91)	Fz	0.007	0.019	0.030	0.037	0.046	0.061	0.067	0.068
				Feed (mm/min)	217	310	362	362	368	372	323	262	
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	 Profile ≤ 0.5 ≤ 1.5 ≤ 275 Bhn or ≤ 28 HRc		149	RPM	15834	7917	5938	4750	3958	2969	2375	1900
				(119-179)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064	0.063
				Feed (mm/min)	456	532	709	709	684	699	608	475	
		 Slot 1 ≤ 1		119	RPM	12602	6301	4726	3781	3151	2363	1890	1512
				(95-143)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064	0.063
				Feed (mm/min)	363	423	565	565	544	557	484	378	
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	 Profile ≤ 0.5 ≤ 1.5 ≤ 275 Bhn or ≤ 28 HRc		104	RPM	10987	5493	4120	3296	2747	2060	1648	1318
				(83-124)	Fz	0.005	0.014	0.023	0.029	0.034	0.046	0.051	0.050
				Feed (mm/min)	211	316	387	387	369	380	334	264	
		 Slot 1 ≤ 1		82	RPM	8725	4362	3272	2617	2181	1636	1309	1047
				(66-99)	Fz	0.005	0.014	0.023	0.029	0.034	0.046	0.051	0.050
				Feed (mm/min)	168	251	307	307	293	302	265	209	
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	 Profile ≤ 0.5 ≤ 1.5 ≤ 325 Bhn or ≤ 35 HRc		94	RPM	10017	5009	3756	3005	2504	1878	1503	1202
				(76-113)	Fz	0.005	0.014	0.023	0.029	0.034	0.046	0.051	0.050
				Feed (mm/min)	192	288	353	353	337	346	305	240	
		 Slot 1 ≤ 1		76	RPM	8078	4039	3029	2424	2020	1515	1212	969
				(61-91)	Fz	0.005	0.014	0.023	0.029	0.034	0.046	0.051	0.050
				Feed (mm/min)	155	233	284	284	271	279	246	194	
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	 Profile ≤ 0.5 ≤ 1.5 ≤ 220 Bhn or ≤ 19 HRc		136	RPM	14380	7190	5392	4314	3595	2696	2157	1726
				(109-163)	Fz	0.008	0.024	0.038	0.048	0.058	0.077	0.083	0.085
				Feed (mm/min)	483	690	828	828	828	828	713	587	
		 Slot 1 ≤ 1		108	RPM	11471	5736	4302	3441	2868	2151	1721	1377
				(87-130)	Fz	0.008	0.024	0.038	0.048	0.058	0.077	0.083	0.085
				Feed (mm/min)	385	551	661	661	661	661	569	468	

continued on next page



Series Z1MB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)	DC • mm									
						3	6	8	10	12	16	20	25		
K	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRC	Profile 	≤ 0.5	≤ 1.5	104	RPM	10987	5493	4120	3296	2747	2060	1648	1318
						(83-124)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064	0.063
						Feed (mm/min)	316	369	492	492	475	485	422	330	
		≤ 300 Bhn or ≤ 32 HRC	Slot 	1	≤ 1	82	RPM	8725	4362	3272	2617	2181	1636	1309	1047
						(66-99)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064	0.063
						Feed (mm/min)	251	293	391	391	377	385	335	262	
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	2585	1293	969	776	646	485	388	310
						(20-29)	Fz	0.005	0.010	0.017	0.021	0.024	0.033	0.037	0.038
						Feed (mm/min)	55	50	66	53	62	65	58	47	
		≤ 400 Bhn or ≤ 43 HRC	Slot 	1	≤ 1	20	RPM	2100	1050	788	630	525	394	315	252
						(16-24)	Fz	0.005	0.010	0.017	0.021	0.024	0.033	0.037	0.038
						Feed (mm/min)	40	40	54	54	50	52	47	38	
	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	2003	1002	751	601	501	376	301	240
						(15-23)	Fz	0.002	0.007	0.011	0.013	0.017	0.020	0.024	0.025
						Feed (mm/min)	19	29	32	32	34	31	29	24	
		≤ 350 Bhn or ≤ 38 HRC	Slot 	1	≤ 1	15	RPM	1583	792	594	475	396	297	238	190
						(12-18)	Fz	0.002	0.007	0.011	0.013	0.017	0.020	0.024	0.025
						Feed (mm/min)	15	23	25	25	27	24	23	19	
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRC	Profile 	≤ 0.5	≤ 1.5	66	RPM	6947	3474	2605	2084	1737	1303	1042	834
						(52-79)	Fz	0.005	0.012	0.021	0.027	0.031	0.041	0.045	0.045
						Feed (mm/min)	133	167	222	222	217	213	189	150	
		≤ 440 Bhn or ≤ 47 HRC	Slot 	1	≤ 1	52	RPM	5493	2747	2060	1648	1373	1030	824	659
						(41-62)	Fz	0.005	0.012	0.021	0.027	0.031	0.041	0.045	0.045
						Feed (mm/min)	105	132	176	176	171	169	149	119	
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRC	Profile 	≤ 0.5	≤ 1.5	23	RPM	2424	1212	909	727	606	454	364	291
						(18-27)	Fz	0.005	0.012	0.021	0.027	0.031	0.041	0.045	0.045
						Feed (mm/min)	47	58	78	78	76	74	66	52	
		≤ 375 Bhn or ≤ 40 HRC	Slot 	1	≤ 1	18	RPM	1939	969	727	582	485	364	291	233
						(15-22)	Fz	0.005	0.012	0.021	0.027	0.031	0.041	0.045	0.045
						Feed (mm/min)	37	47	62	62	60	60	53	42	
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRC	Profile 	≤ 0.5	≤ 1.5	56	RPM	5978	2989	2242	1793	1495	1121	897	717
						(45-68)	Fz	0.005	0.012	0.021	0.027	0.031	0.041	0.045	0.045
						Feed (mm/min)	115	143	191	191	186	184	163	129	
		≤ 375 Bhn or ≤ 40 HRC	Slot 	1	≤ 1	44	RPM	4686	2343	1757	1406	1171	879	703	562
						(35-53)	Fz	0.005	0.012	0.021	0.027	0.031	0.041	0.045	0.045
						Feed (mm/min)	90	112	150	150	146	144	127	101	

Bhn (Brinell) HRc (Rockwell C)

rpm = (Vc x 1000) / (DC x 3.14)

mm/min = Fz x 4 x rpm

reduce speed and feed for materials harder than listed

reduce feed and Ae when finish milling (.02 x DC maximum)

feed rates listed have chip thinning adjustments included where applicable

refer to the SGS Tool Wizard® for complete technical information (www.kyocera-sgstool.com)