

2020
NEW
PRODUCT

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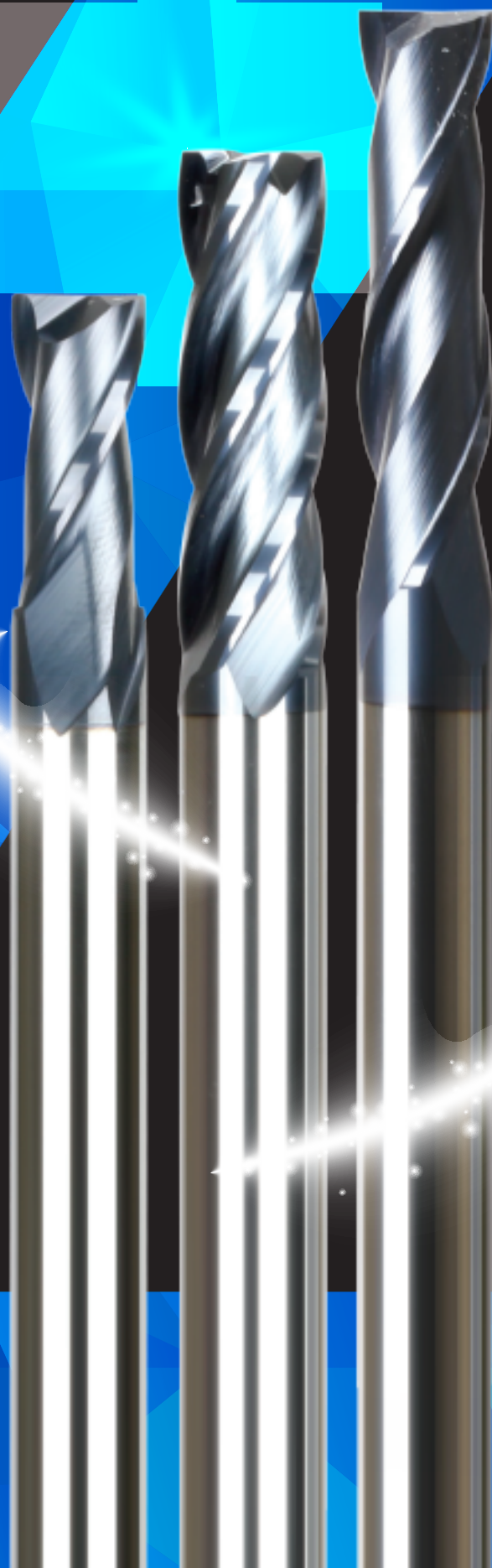
THUNDER+

A New Line of Metric Square End Mills

Optimum flute design to enhance performance
for general purpose machining.

Improved reliability and durability with new coating

Increased process ranges through
longer effective flute length



Thunder+ SERIES

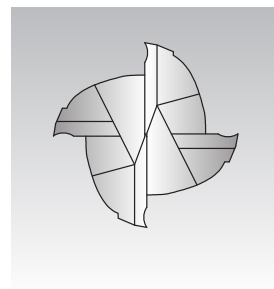
Thunder+ SERIES

01

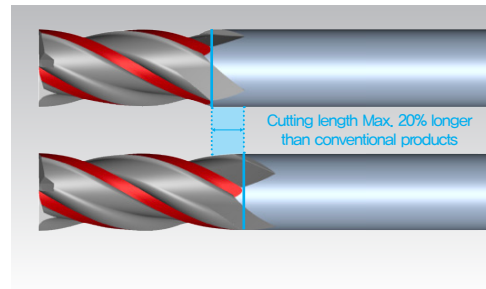
Special Feature

THUNDER+ Series

- Optimal performance up to HRC 40 for general purpose machining
- Improved tool performance reliability with new coating
- Optimize flute shape to assure efficient chip evacuation and surface finish on workpiece



End face shape



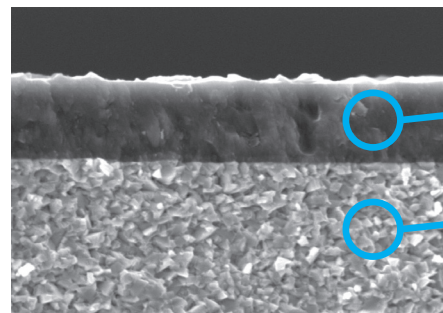
Side cutting edge

02

Improvement Points

THUNDER+ Series

- Enhanced wear resistance and increased tool life with new coating



New Coating

AlTiN

Improved wear resistance, chipping resistance applying PVD technology with excellent adhesion

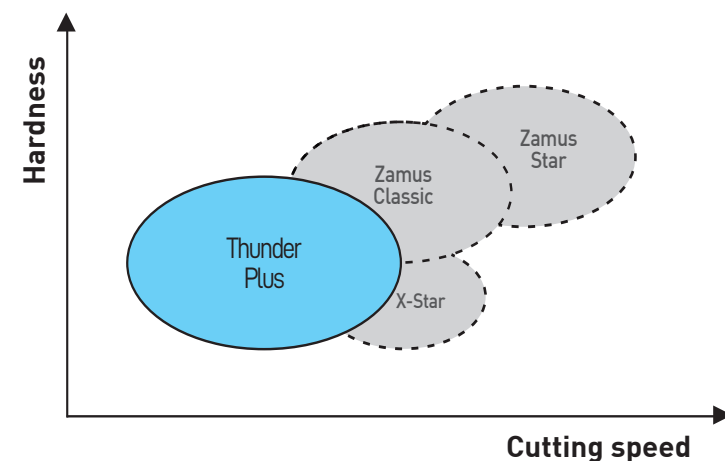
Applying wear resistance substrate

Improved hardness and wear resistance by applying a stable base of fine grain

03

Application

THUNDER+ Series



04

Cutting Condition

THUNDER+ Series

- Test tool : Conventional / THUNDER PLUS
- Test tool : S45C (ANSI 1040 / HB180)
- Cutting type : Side cutting
- Cutting condition : RPM 3,820 / Feed 917 / Ap 10.0, Ae 1.0

05

Case Study

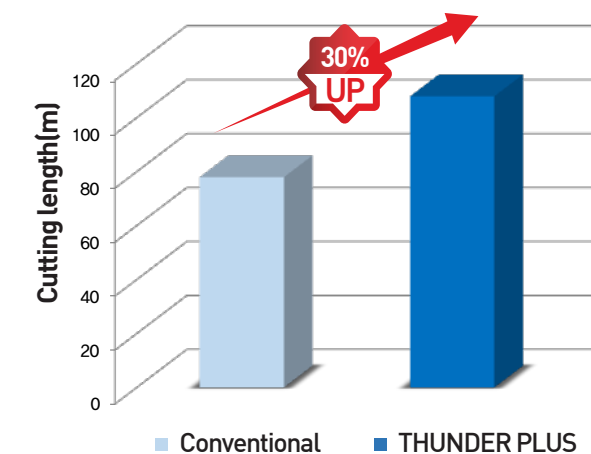
THUNDER+ Series

Case study		
	Conventional	THUNDER PLUS
Wear Appearance		
Chipping Appearance		

06

Test Result

THUNDER+ Series

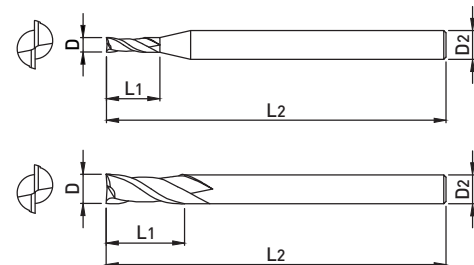


Thunder+ SERIES

Thunder+ SERIES



ZE302P



2 FLUTES, REGULAR LENGTH

- Designed for machine tool steel, alloy steel, mold steel and other hardened materials
- New coating application improves wear resistance and chipping resistance
- Improved tool life due to new flute designs and better coating

EDP No	D	L ₁	L ₂	D ₂
ZE302010P	1	2.5	50	6
ZE302015P	1.5	4	50	6
ZE302020P	2	6	50	6
ZE302025P	2.5	8	50	6
ZE302030P	3	10	50	6
ZE302035P	3.5	10	50	6
ZE302040P	4	12	50	6
ZE302045P	4.5	14	50	6
ZE302050P	5	15	60	6
ZE302055P	5.5	15	60	6
ZE302060P	6	15	60	6
ZE302065P	6.5	18	60	8
ZE302070P	7	20	65	8
ZE302075P	7.5	20	65	8
ZE302080P	8	20	65	8
ZE302085P	8.5	22	70	10
ZE302090P	9	22	70	10
ZE302095P	9.5	24	70	10
ZE302100P	10	25	70	10
ZE302105P	10.5	26	80	12
ZE302110P	11	30	80	12
ZE302115P	11.5	30	80	12
ZE302120P	12	30	80	12
ZE302130P	13	35	90	12
ZE302140P	14	35	100	14
ZE302150P	15	40	100	16
ZE302160P	16	40	100	16
ZE302180P	18	45	100	18
ZE302200P	20	45	100	20

■ Applicable Working Material

Carbon Steels (S45C, S55C...) ~ HB225	Alloy Steels (SCM, SK...) HB22 ~ 325	Prehardened Steels(NAK...) HRc30~50	Hardened Steels ~HRc55 SKD61	~HRc55 SKD11	Copper	Graphite	Cast Iron 500~	Aluminum	Stainless Steels
◎	◎	○							

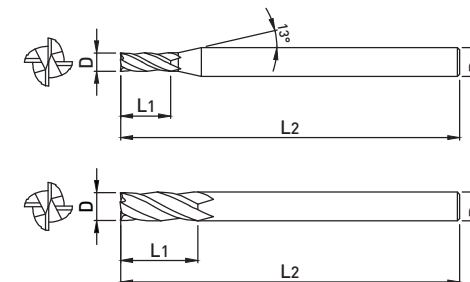
○:General Application ◎:The most suitable Application

■ Tolerance

D	D ₂
All	0 ~ -0.03mm h6



ZE304P



4 FLUTES, REGULAR LENGTH

- Designed for machine tool steel, alloy steel, mold steel and other hardened materials
- New coating application improves wear resistance and chipping resistance
- Improved tool life due to new flute designs and better coating

EDP No	D	L ₁	L ₂	D ₂
ZE304010P	1	2.5	50	6
ZE304015P	1.5	4	50	6
ZE304020P	2	6	50	6
ZE304025P	2.5	8	50	6
ZE304030P	3	10	50	6
ZE304035P	3.5	10	50	6
ZE304040P	4	12	50	6
ZE304045P	4.5	14	50	6
ZE304050P	5	15	60	6
ZE304055P	5.5	15	60	6
ZE304060P	6	15	60	6
ZE304065P	6.5	18	60	8
ZE304070P	7	20	65	8
ZE304075P	7.5	20	65	8
ZE304080P	8	20	65	8
ZE304085P	8.5	22	70	10
ZE304090P	9	22	70	10
ZE304095P	9.5	24	70	10
ZE304100P	10	25	70	10
ZE304105P	10.5	26	80	12
ZE304110P	11	30	80	12
ZE304115P	11.5	30	80	12
ZE304120P	12	30	80	12
ZE304130P	13	35	90	12
ZE304140P	14	35	100	14
ZE304150P	15	40	100	16
ZE304160P	16	40	100	16
ZE304180P	18	45	100	18
ZE304200P	20	45	100	20

■ Applicable Working Material

Carbon Steels (S45C, S55C...) ~ HB225	Alloy Steels (SCM, SK...) HB22 ~ 325	Prehardened Steels(NAK...) HRc30~50	Hardened Steels ~HRc55 SKD61	~HRc55 SKD11	Copper	Graphite	Cast Iron 500~	Aluminum	Stainless Steels
◎	◎	○							

○:General Application ◎:The most suitable Application

■ Tolerance

D	D ₂
All	0 ~ -0.03mm h6

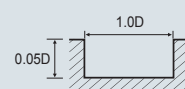
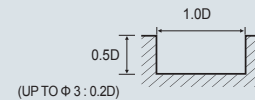
Technical Information

[ZE302P Series]

► GENERAL SPEED CUTTING

WORKPIECE	ALLOY STEELS, HEAT RESISTANT STEELS		HARDENED STEELS		STAINLESS STEELS	
HARDNESS	HRC30~40		HRC40~HRC50		-	
STRENGTH	1000 ~ 1250N / mm ²		1250 ~ 1750N / mm ²		-	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED
2	9,700	220	6,350	135	5,300	105
3	7,500	240	4,670	160	3,880	135
4	6,350	345	3,880	205	3,250	175
5	5,300	370	3,170	220	2,650	185
6	4,670	405	2,830	255	2,380	205
8	3,530	435	2,120	230	1,760	205
10	2,730	380	1,680	185	1,420	185
12	2,310	320	1,420	150	1,140	150
16	1,850	255	1,140	125	890	125
20	1,420	195	890	90	705	90

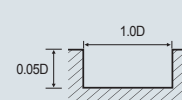
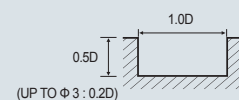
RPM = rev. / min.
FEED = mm / min.



► HIGH SPEED CUTTING

WORKPIECE	ALLOY STEELS, HEAT RESISTANT STEELS		HARDENED STEELS				STAINLESS STEELS	
HARDNESS	HRC30~40		HRC40~HRC50		HRC50~HRC55		-	
STRENGTH	1000 ~ 1250N / mm ²		1250 ~ 1750N / mm ²		1750 ~ 2000N / mm ²		-	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
2	18,000	665	11,800	415	8,700	175	9,800	345
3	11,000	655	6,800	435	5,600	185	6,200	370
4	10,300	725	6,300	430	4,300	185	5,300	370
5	9,350	715	5,570	420	3,700	185	4,620	355
6	8,200	750	4,930	470	3,250	185	4,100	390
8	6,300	770	3,780	410	2,470	185	3,120	355
10	4,830	750	2,940	360	2,000	160	2,470	310
12	4,100	750	2,520	345	1,680	160	2,100	300
16	3,260	715	2,000	355	1,890	150	1,940	290
20	2,520	665	1,580	310	1,680	150	1,630	275

RPM = rev. / min.
FEED = mm / min.

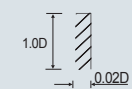
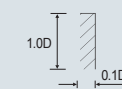


[ZE304P Series]

► GENERAL SPEED CUTTING

WORKPIECE	NON-ALLOY STEELS ALLOY STEELS · CAST IRON		HARDENED STEELS				STAINLESS STEELS	
HARDNESS	~HRC30		HRC30 ~ HRC45		HRC45 ~ HRC55		-	
STRENGTH	~1000N/mm2		1000 ~ 1500N/mm2		1500 ~ 2000N/mm2		-	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
2	12,100	320	7,900	195	2,700	47	6,600	160
3	9,400	370	5,840	230	2,000	58	4,850	195
4	7,900	655	4,850	405	1,500	58	4,070	320
5	6,600	690	3,970	415	1,300	58	3,320	345
6	5,830	760	3,530	470	1,150	58	2,980	380
8	4,410	815	2,650	435	880	58	2,200	405
10	3,420	700	2,100	345	720	46	1,760	345
12	2,880	600	1,760	290	590	46	1,430	275
16	2,310	470	1,430	230	460	29	1,150	230
20	1,760	370	1,110	185	340	29	880	175
25	1,430	290	880	150	270	23	715	140

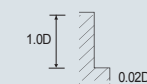
RPM = rev. / min.
FEED = mm / min.



► HIGH SPEED CUTTING

WORKPIECE	NON-ALLOY STEELS ALLOY STEELS · CAST IRON		HARDENED STEELS				STAINLESS STEELS	
HARDNESS	~HRC30		HRC30 ~ HRC45		HRC45 ~ HRC55		-	
STRENGTH	~1000N/mm2		1000 ~ 1500N/mm2		1500 ~ 2000N/mm2		-	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
2	31,400	1,230	23,500	520	12,600	275	21,600	465
3	19,300	1,210	13,600	735	8,900	390	13,500	660
4	18,100	1,330	12,600	865	7,090	465	11,800	775
5	16,400	1,310	11,100	1,010	6,040	530	10,300	910
6	14,400	1,380	9,900	1,100	5,300	580	9,100	990
8	11,000	1,430	7,600	1,090	3,990	575	6,900	980
10	8,500	1,380	5,880	1,110	3,150	580	5,420	1,000
12	7,200	1,380	5,040	1,090	2,620	575	4,600	985
16	5,700	1,320	3,990	1,010	2,000	535	3,590	910
20	4,400	1,270	3,150	930	1,580	490	2,840	840
25	3,500	1,170	2,520	755	1,260	390	2,270	680

RPM = rev. / min.
FEED = mm / min.



2020.05



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