

E Technical Information for Laser Mill

Longer tool life is achieved due to the excellent insert grades' cutting performance

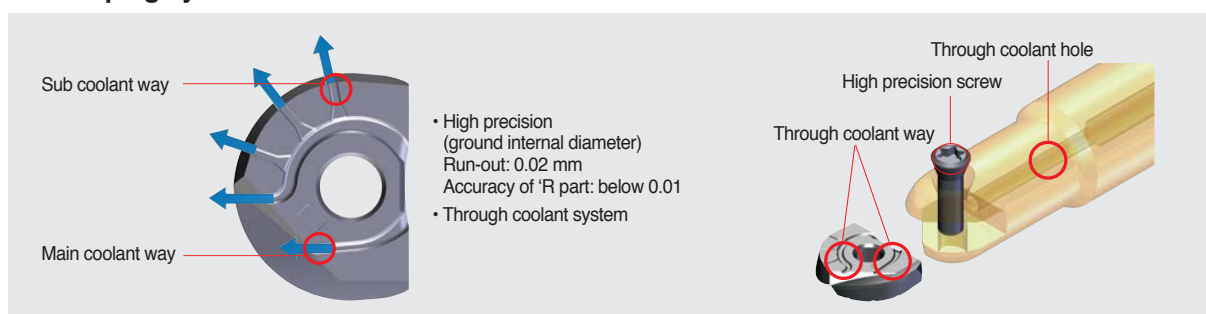
Laser Mill

- Long tool life has been achieved due to the excellent cutting performance of the insert grade
- Optimum machining of molds has been achieved with the MQL available system
- Easy clamping with simple screw on system
- Various holder line up: steel shank, carbide shank, modular type
- High accuracy indexable endmills for mold finishing



- Environmental friendly system
- Decreased coolant cost
- Lubrication of cutting-edge
- Improved chip control property
- Increased tool life & improved surface quality

Clamping system



Features



- Six types of inserts are available with one holder
- Single screw for clamping of insert: Easy clamping system
- Various types of holders (Steel shank, Carbide shank, Modular type)
- MQL applicable- environmentally responsible with longer tool life & improved surface quality.

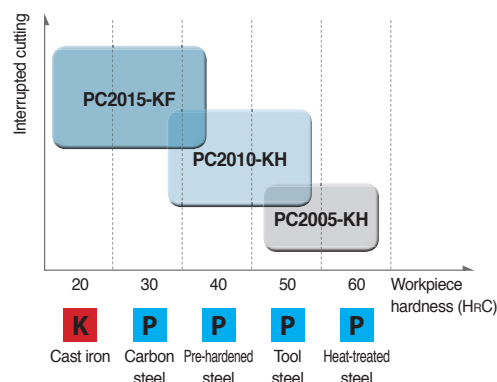
LBS, LR Order-made items

LBH-Ball	LRH-Corner radius	LFH-High feed	LCF-Chamfer	LBS-Ball type	LR-Corner R type
• Helical cutting-edge • Suitable for harder material with high feed	• Helical cutting-edge • Variety of nose -R	• Helical cutting-edge • Suitable for high feed	• Straight cutting-edge • Center drilling and chamfering	• Straight cutting-edge • Suitable for precise	• Straight cutting-edge • Variety of nose-R

Features of Laser Mill grades

PC2005	• Extremely high hardness grade • The harmony between improved blade design and strong chip breaker • Optimized for machining heat-treated steel and high hardness steel
PC2010	• High wear resistance and excellent toughness • The harmony between excellent thermal shock resistance and strong cutting-edges. • Optimized for machining tool steel and pre-hardened steel
PC2015	• High welding resistance and excellent toughness • The harmony between tough grade and excellent cutting-edge design • Optimized for machining carbon steel

Application guideline per workpiece



Features of KF/KH chip breaker

- KF: Exclusive chip breaker for stable machining of carbon steel with its characteristics of high wear resistance at center part and improved blade design
- KH: Stronger insert with the combination of rake angle and relief angle that are ideal for machining high hardness workpiece

Type	Shape comparison			
Standard (For general cutting)				 SECTION A-A
KH (For high hardness steel)				 SECTION A-A
KF (For carbon steel)				 SECTION A-A

Recommended cutting condition

Workpiece				Grades	Chip breaker	Recommended cutting conditions			
ISO	Material	HB (HRC)				vc (m/min)	fz (mm/t)	ap (mm)	ae (mm)
K	Gray cast iron	GC250	180 (8)	PC2015 PC2010 PC2005	KF	130~210	0.2~0.5	0.07D	0.07D
	Ductile cast iron	GCD600	250 (24)			170~250	0.2~0.5	0.07D	0.07D
P	Carbon steel	S20C~S50C	150	PC2010 PC2015 PC210F	KH	130~210	0.1~0.3	0.7D	0.7D
	Alloy steel	SCM21~SCM5H	270 (28)			100~160	0.1~0.3	0.5D	0.5D
		KP4M	300 (32)						
		NIMAX	370 (40)						
		CENA1	370 (40)						
		NAK80	400 (43)						
		STAVAX	510 (52)						
	High speed tool steel	SKH51~SKH59	550 (55)	PC2005 PC2010	KH	80~130	0.1~0.2	0.3D	0.3D
	Alloy tool steel	STD61 (Hot forging) STD11 (Cold forging)	630 (60)			70~120	0.1~0.2	0.3D	0.3D

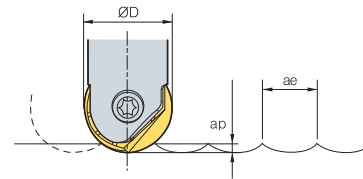
Overhang	vc (m/min)	fz (mm/t)
Under 3D	100%	100%
3D~5D	70%	70%
5D~8D	60%	60%
8D~10D	50%	50%



E Technical Information for Laser Mill

➤ Cutting condition formula for milling

Practical cutting speed	RPM
$v_{ce} = \frac{\pi \times D_e \times n}{1000} \text{ (m/min)}$	$n = \frac{v_{ce} \times 1000}{\pi \times D_e} \text{ (min}^{-1}\text{)}$
Feed per tooth	Feed per minute
$fz = \frac{vf}{z \times n} \text{ (mm/t)}$	$vf = fz \times z \times n \text{ (mm/min)}$
Chip removal amount	Power requirement
$Q = \frac{ap \times ae \times vf}{1000} \text{ (cm}^3\text{/min)}$	$P_{kw} = \frac{Q \times kc}{60 \times 102 \times \eta} \text{ (kW)}$
	$P_{hp} = \frac{P_{kw}}{0.75} \text{ (hp)}$



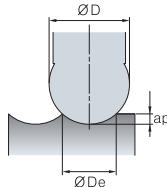
v_c = Cutting speed (m/min)	P_{kw} = Power requirement (kW)
v_{ce} = Practical cutting speed (m/min)	P_{hp} = Horsepower requirement (hp)
n = Revolution per Minute (min^{-1})	Q = Chip removal amount ($\text{cm}^3\text{/min}$)
D = Cutting diameter (mm)	ap = Depth of cut (mm)
D_e = Actual diameter (mm)	ae = Width of cut (mm)
vf = Feed per minute (mm/min)	kc = Specific cutting resistance (kg/mm^2)
fz = Feed per tooth (mm/t)	η = Mechanical efficiency (%)
z = Number of tooth	

➤ Practical cutting speed calculation formulas

1. Formula of actual diameter

• Formula
: Actual diameter

$$D_e = 2 \sqrt{ap(D - ap)}$$



2. θ° Using: Calculating cutting speed at P point
(Cutting speed according to depth of cut when ramping)

• Formula
: Practical cutting speed

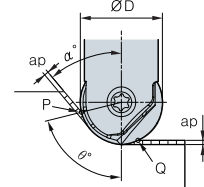
$$v_{ce} = \frac{\pi D \sin \theta \times n}{1000} \text{ (m/min)}$$

$$\theta = \cos^{-1} \left(\frac{D - 2ap}{D} \right) + (90 - \alpha^\circ)$$

3. In case of using ap : Calculating cutting speed at Q point

• Formula
: Practical cutting speed

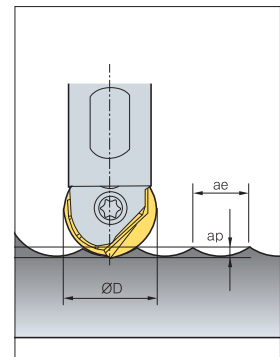
$$v_{ce} = \frac{2\pi n \sqrt{ap(D - ap)}}{1000}$$



➤ Practical cutting speed calculation formulas

h (surface roughness) (μm)										
$\frac{ae}{R} \text{ (mm)}$	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
5	0.3	1.0	2.3	4.0	6.3	9.0	12.3	16.0	20.3	25.0
6	0.2	0.8	1.9	3.3	5.2	7.5	10.2	13.3	16.9	20.8
8	0.2	0.6	1.4	2.5	3.9	5.6	7.7	10.0	12.7	15.6
10	0.1	0.5	1.1	2.0	3.1	4.5	6.1	8.0	10.1	12.5
12.5	0.1	0.4	0.9	1.6	2.5	3.6	4.9	6.4	8.1	10.0
15	0.1	0.3	0.8	1.3	2.1	3.0	4.1	5.3	6.8	8.3
16	0.1	0.3	0.7	1.3	2.0	2.8	3.8	5.0	6.3	7.8

• Formula of surface roughness: $h \text{ (surface finish)} = \frac{(ae)^2}{8R} \times 1000 \text{ (}\mu\text{m)}$



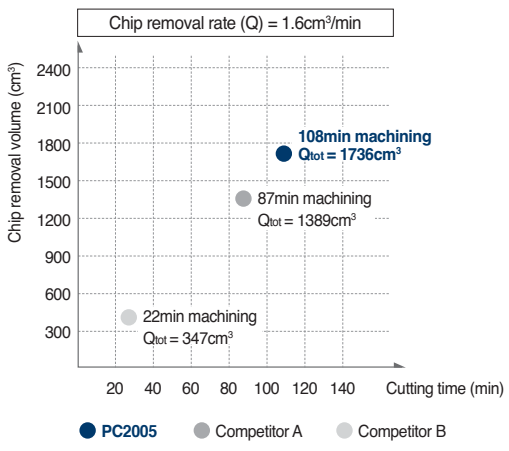
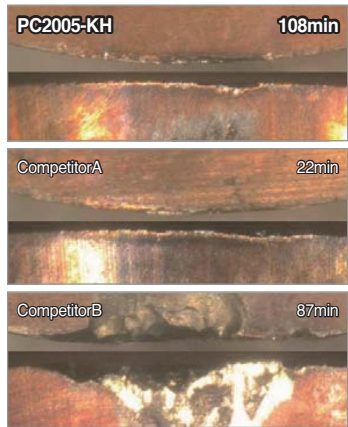
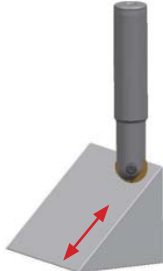
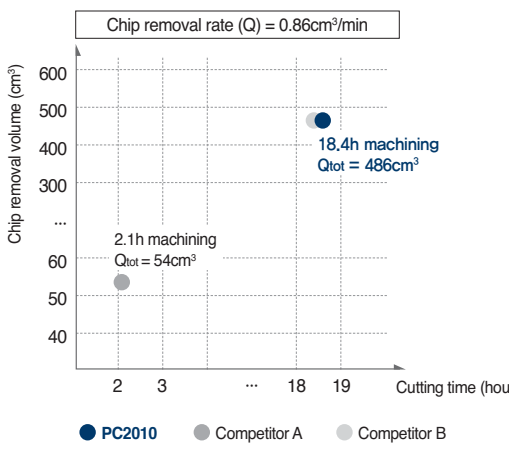
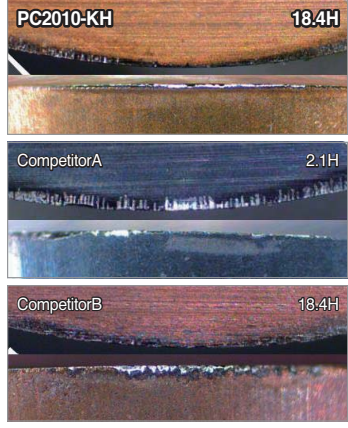
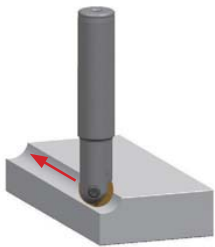
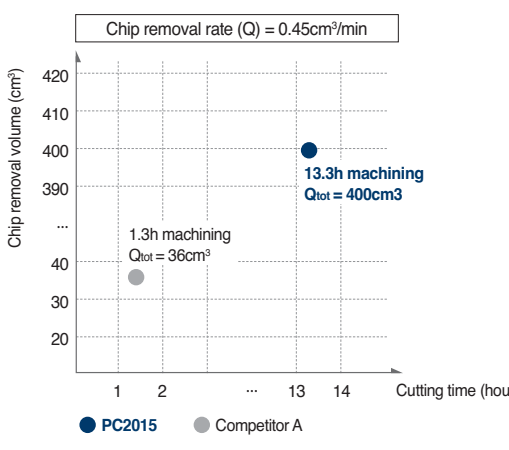
➤ Actual diameter data

$\frac{ap}{\phi D}$	Ø08	Ø10	Ø12	Ø16	Ø20	Ø25	Ø30	Ø32
0.1	1.8	2.0	2.2	2.5	2.8	3.2	3.5	3.6
0.2	2.5	2.8	3.1	3.6	4.0	4.5	4.9	5.0
0.3	3.0	3.4	3.7	4.3	4.9	5.4	6.0	6.2
0.5	3.9	4.4	4.8	5.6	6.2	7.0	7.7	7.9
1.0	5.3	6.0	6.6	7.7	8.7	9.8	10.8	11.1
1.5	6.2	7.1	7.9	9.3	10.5	11.9	13.1	13.5
2.0	6.9	8.0	8.9	10.6	12.0	13.6	15.0	15.5
2.5	7.4	8.7	9.7	11.6	13.2	15.0	16.6	17.2
3.0	7.7	9.2	10.4	12.5	14.3	16.2	18.0	18.7
3.5	7.9	9.5	10.9	13.2	15.2	17.3	19.3	20.0
4.0	8.0	9.8	11.3	13.9	16.0	18.3	20.4	21.2
5.0			11.8	14.8	17.3	20.0	22.4	23.2
6.0			12.0	15.5	18.3	21.4	24.0	25.0
7.0				15.9	19.1	22.4	25.4	26.5
8.0				16.0	19.6	23.3	26.5	27.7
10.0					20.0	24.5	28.3	29.7

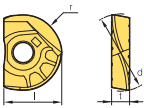
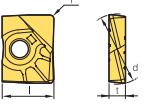
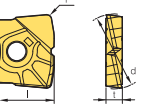
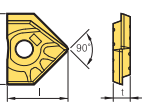
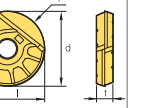
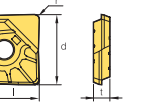


E Milling

Performance evaluation

PC2005 tool life test	High hardness heat-treated steel (X100CrMoV5 1, heat-treated HRC60)
 ■ Cutting conditions $vc = 140\text{m/min}$ $fz = 0.15\text{mm/t}$ $ap = 2\text{mm}$ $ae = 1.2\text{mm}$ Coolant (Air) ■ Tools Insert LBH120-KH (PC2005)	Chip removal rate (Q) = $1.6\text{cm}^3/\text{min}$  108min machining $Q_{\text{tot}} = 1736\text{cm}^3$ 87min machining $Q_{\text{tot}} = 1389\text{cm}^3$ 22min machining $Q_{\text{tot}} = 347\text{cm}^3$ ● PC2005 ● Competitor A ● Competitor B  PC2005-KH 108min CompetitorA 22min CompetitorB 87min
PC2010 tool life test	Pre-hardened steel (X40CrMnNiMo8-6-4)
 ■ Cutting conditions $vc = 276\text{m/min}$ $fz = 0.15\text{mm/t}$ $ap = 0.3\text{mm}$ $ae = 1.2\text{mm}$ Wet ■ Tools Insert LBH120-KH (PC2010)	Chip removal rate (Q) = $0.86\text{cm}^3/\text{min}$  18.4h machining $Q_{\text{tot}} = 486\text{cm}^3$ 2.1h machining $Q_{\text{tot}} = 54\text{cm}^3$ ● PC2010 ● Competitor A ● Competitor B  PC2010-KH 18.4H CompetitorA 2.1H CompetitorB 18.4H
PC2015 tool life test	Carbon steel (C45)
 ■ Cutting conditions $vc = 250\text{m/min}$ $fz = 0.35\text{mm/t}$ $ap = 0.3\text{mm}$ $ae = 0.3\text{mm}$ Coolant (MQL) ■ Tools Insert LBH120 (PC2015)	Chip removal rate (Q) = $0.45\text{cm}^3/\text{min}$  13.3h machining $Q_{\text{tot}} = 400\text{cm}^3$ 1.3h machining $Q_{\text{tot}} = 36\text{cm}^3$ ● PC2015 ● Competitor A  PC2015 13.3H CompetitorA 1.3H

Available inserts

	LBH (Ball type)	LRH (Corner radius type)	LFH (High feed type)	LCF (Chamfer type)	LBS (Ball type)	LR (Corner radius type)
Holders	 R accuracy ± 0.005	 Corner R ± 0.015	 Corner R ± 0.015	 30°	 R accuracy ± 0.005	 Corner R ± 0.015
LBE080	LBH080 LBH090 LBH080-KF LBH090-KF LBH080-KH LBH090-KH				LBS080 LBS090	
LBE100 LRE100	LBH100 LBH110 LBH100-KF LBH110-KF LBH100-KH LBH110-KH	LRH100-R05 LRH100-R20 LRH100-R10 LRH110-R05	LFH100		LBS100 LBS110	LR100-R05 LR100-R20 LR100-R10 LR110-R05
LBE120 LRE120	LBH120 LBH130 LBH120-KF LBH130-KF LBH120-KH LBH130-KH	LRH120-R05 LRH120-R20 LRH120-R10 LRH130-R05	LFH120		LBS120 LBS130	LR120-R05 LR120-R20 LR120-R10 LR130-R05
LBE160 LRE160	LBH160 LBH170 LBH160-KF LBH170-KF LBH160-KH LBH170-KH	LRH160-R05 LRH160-R30 LRH160-R10 LRH170-R05 LRH160-R20	LFH160	LCF160-D90	LBS160 LBS170	LR160-R05 LR160-R30 LR160-R10 LR170-R05 LR160-R20
LBE200 LRE200	LBH200 LBH210 LBH200-KF LBH210-KF LBH200-KH LBH210-KH	LRH200-R05 LRH200-R30 LRH200-R10 LRH210-R05 LRH200-R20	LFH200	LCF200-D90	LBS200 LBS210	LR200-R05 LR200-R30 LR200-R10 LR210-R05 LR200-R20
LBE250 LRE250	LBH250 LBH260 LBH250-KF LBH260-KF LBH250-KH LBH260-KH	LRH250-R05 LRH250-R30 LRH250-R10 LRH260-R05 LRH250-R20	LFH250	LCF250-D90	LBS250 LBS260	LR250-R05 LR250-R30 LR250-R10 LR260-R05 LR250-R20
LBE300 LRE300	LBH300 LBH310 LBH300-KF LBH310-KF LBH300-KH LBH310-KH	LRH300-R10 LRH300-R30 LRH300-R20 LRH310-R05	LFH300		LBS300 LBS310	LR300-R10 LR300-R30 LR300-R20 LR310-R05
LBE320 LRE320	LBH320 LBH320-KF LBH320-KH	LRH320-R10 LRH320-R30 LRH320-R20	LFH320		LBS320	LR320-R10 LR320-R30 LR320-R20

* LBH for general cutting, LBH-KF for carbon steel, and LBH-KH for high hardened steel.

Available inserts **E08, E09**



E Milling

Long tool life due to high hardness grade

GBE

- Indexable Ball nose Endmill for Molds in medium & roughing applications
- Long tool life with high hardness grade
- Helical high accuracy cutting-edge
- Optimized mold machining process with our internal coolant system
- Able to adjust to medium processing in middle & big roughing mold process
- Wide variety of holders in normal & long style holders

Holder code system

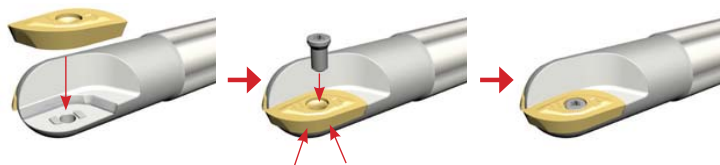
GBE	300	—	S	32
Product Name	Machining Dia.		Type	Shank Dia.
General Indexable Ball Endmill	Ø16, Ø18, Ø20, Ø22, Ø25, Ø26, Ø28, Ø30, Ø32, Ø40, Ø50		S: Standard shank L: Long shank	32: Ø32

Internal	External	
		• Ability to handle high accuracy & large depth of cut applications - Run-out: within 0.05 mm - R accuracy: within 0.05 mm • Various diameters (Ø16, 20, 25, 30, 32, 40, 50) • Minimal cutting resistance due to Helical cutting-edge • Anti-rotation of insert due to concave bottom & stable setting by flank support • Long tool life & better processing due to 2 cutting inserts • Better tool life with new grade
		
Flank support	Concave bottom	

				• Various diameters (Ø16, 20, 25, 30, 32, 40, 50) • Improved chip treatment with internal coolant (cutting-edge portion) • Long tool life & better processing • Easy insert setting with projection part to prevent vibration during processing
Multi-edge type	Single-edge type	Modular type	Projection	

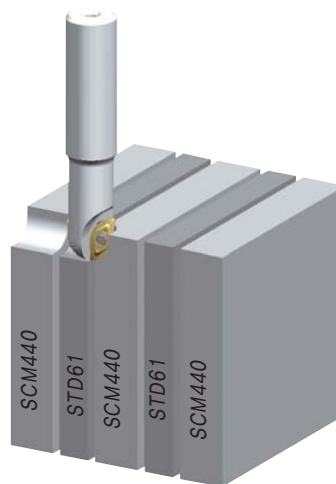
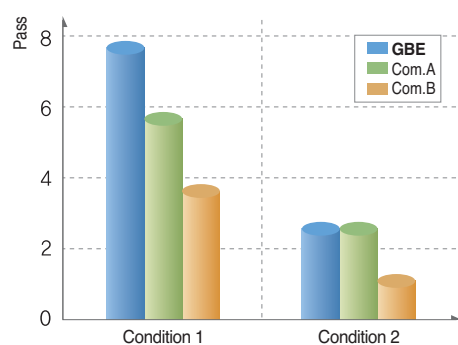
E Technical Information for GBE

How to set insert



1. Set the insert to the holder projection seat
2. Push the insert into the pocket as shown by red arrows and screw down with wrench

Performance evaluation



Cutting condition

Class.	Cutting speed (vc)	Feed (fz)	Depth of cut (ap)	Depth of cut (ae)	Workpiece	Etc.
Condition 1	150 m/min	0.15 mm/t	5 mm	8 mm	STD61 (HRC50) + SCM440 (HRC20)	Dry
Condition 2	100 m/min	0.1 mm/t	8 mm	8 mm		

Inserts/parts

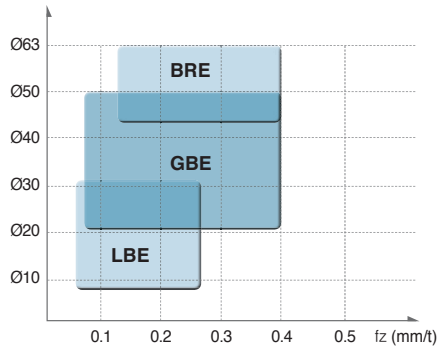
Type	Insert			Parts			
Dia.	Internal I/S	External I/S	External main I/S	Screw		Wrench	
				Int./Ext. type	Ext. main type	Int./Ext. type	Ext. main type
Ø16	ZPET080M-MM	ZPET080S-MM	-	FTKA02555S	-	TW08S	-
Ø18	ZPET090M-MM	ZPET090S-MM	-	FTKA0307	-	TW09S	-
Ø20	ZPET100M-MM	ZPET100S-MM	SPMT060304	FTKA0307	ETNA02506	TW09S	TW07P
Ø22	ZPET110M-MM	ZPET110S-MM	SPMT060304	FTKA0408	ETNA02506	TW15S	TW07P
Ø25	ZPET125M-MM	ZPET125S-MM	SPMT060304	FTKA0409	ETNA02506	TW15S	TW07P
Ø26	ZPET130M-MM	ZPET130S-MM	SDMT090308-MM	FTKA0409	ETNA0408	TW15S	TW15S
Ø28	ZPET140M-MM	ZPET140S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20	TW15S
Ø30	ZPET150M-MM	ZPET150S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20-100	TW15S
Ø32	ZPET160M-MM	ZPET160S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20-100	TW15S
Ø40	ZPET200M-MM	ZPET200S-MM	SPMT120408-MM	FTGA0614	ETNA0511	TW20-100	TW20S
Ø50	ZPET250M-MM	ZPET250S-MM	SPMT120408-MM	FTGA0818	ETNA0511	TW25S	TW20S



Recommended cutting condition

Workpiece	Machining type	Hardness (HRC)	vc (m/min)	fz (mm/t)	ap (mm)	ae (mm)
Carbon, Alloy steel	Flank	Under 25	160~250	0.1~0.5	0.3~0.5D	0.2~0.3D
	Groove		120~200	0.1~0.5	0.3~0.5D	-
	Deep flank		160~250	0.1~0.5	1.0~1.5D	0.1~0.2D
Carbon, Alloy steel	Flank	Under 45	120~200	0.1~0.5	0.3~0.5D	0.2~0.3D
	Groove		120~160	0.1~0.5	0.3~0.5D	-
	Deep flank		120~200	0.1~0.5	1.0~1.5D	0.1~0.2D
Mold Alloy steel	Flank	30~40	120~200	0.1~0.3	0.3~0.5D	0.2~0.3D
	Groove		120~160	0.1~0.3	0.3~0.5D	-
	Deep flank		120~200	0.1~0.3	1.0~1.5D	0.1~0.2D
Cast iron (GC, GCD)	Flank	20~30	150~300	0.2~0.7	0.3~0.5D	0.2~0.3D
	Groove		150~300	0.2~0.7	0.3~0.5D	-
	Deep flank		150~300	0.2~0.7	1.0~1.5D	0.1~0.2D
Heat-treated steel	Flank	50~60	40~100	0.1~0.3	0.3~0.5D	0.2~0.3D
	Groove		40~100	0.1~0.3	0.3~0.5D	-
	Deep flank		40~100	0.1~0.3	1.0~1.5D	0.1~0.2D

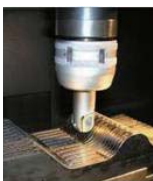
Line-up for indexable ball endmill



Type	Application				
	Machining Dignity	Machining Efficiency	Machining Dia. Equivalence	Economical	Flank Machining with Long Edge
Laser Mill	●	○	●	○	○
GBE	●	●	●	●	●
BRE	○	●	●	●	●

●: Very Good ○: Good ○: Normal

Test result for wear resistance

Cutting condition		Wear resistance photos				
 Cutting time : 4 Pass	■ Workpiece KP4M (HRC33), Dry ■ Condition vc = 280 m/min fz = 0.25 mm/t ap = 5~10 mm ae = 5~10 mm vf = 1,486 mm/min n = 2,971 rpm ■ Tool Holder: GBE300-S32 Insert: ZPET150M-MM (PC3500) ZPET150S-MM (PC3500)	Top	Internal	GBE	Com.A	Com.B
				External		
		Flank	Internal			
				External		
 Cutting time : 4 Pass	■ Workpiece STD11 (HRC20), Dry ■ Condition vc = 250 m/min fz = 0.2 mm/t ap = 5 mm ae = 5 mm vf = 1,062 mm/min n = 2,653 rpm ■ Tool Holder: GBE300-S32 Insert: ZPET150M-MM (PC3500) ZPET150S-MM (PC3500)	Top	Internal	GBE	Com.A	Com.B
				External		
		Flank	Internal			
				External		



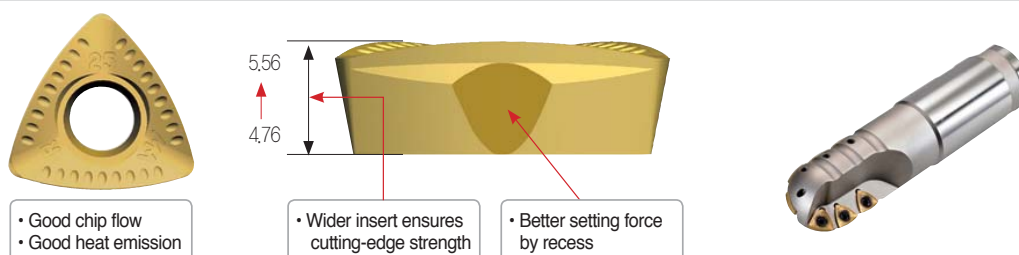
E Technical Information for BRE

Better tool life and anti-breakage with special surface treatment on the holder

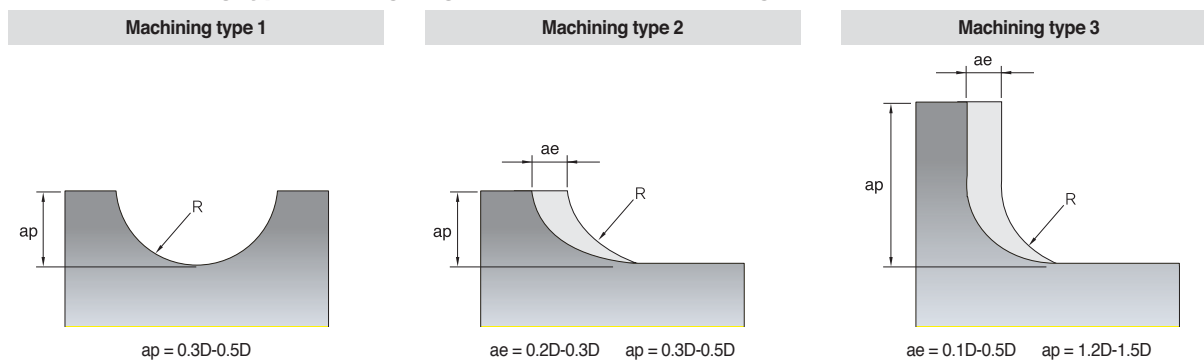
BRE

- Cutting performance: Good chip control & Superior cutting performance with optimal cutting-edge line
- High rigidity body: Better tool life and special surface treatment to strengthen the holder
Easy to set and good durability with TCRX screw
Good chip control with our 3D flute design & improved external quality
- Insert: Able to apply in high speed & feed applications due to special grade which has wear & breakage resistance and stable cutting performance with high cutting-edge toughness & high rake angle chip breaker

Multi-edge holder ISO View



➤ BRE machining type for roughing & Recommended cutting condition



Workpiece	Machining type	Cutting speed (m/min)	Feed (mm/t)	Grades
Carbon/alloy steel	1	120~220	0.1~0.4	NCM325
	2	120~220	0.2~0.4	NCM325
	3	100~180	0.1~0.3	NCM325
Alloy steel	1	100~200	0.1~0.4	NCM325
	2	100~200	0.2~0.4	NCM325
	3	80~160	0.1~0.3	NCM325
Tool steel	1	80~150	0.1~0.3	NCM325
	2	80~150	0.15~0.35	NCM325
	3	60~120	0.1~0.3	NCM325
High hardness material (HrC35~45)	1	60~120	0.1~0.3	NCM325
	2	60~120	0.1~0.3	NCM325
	3	50~80	0.1~0.2	NCM325
Cast iron	1	100~180	0.2~0.5	NCM325
	2	100~180	0.2~0.5	NCM325
	3	80~160	0.15~0.4	NCM325



LBE 08/10/12/16/20/25/30/32

Straight type

Carbide Shank (Ball type)

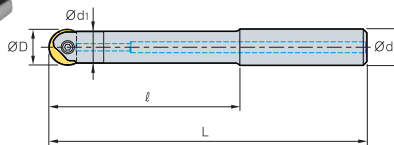


Fig. 1

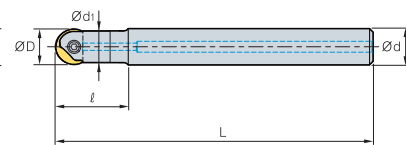


Fig. 2



(mm)

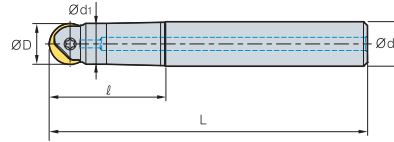
Designation		Dimensions					Parts		Available inserts (Ø)	Fig.
		ØD	Ød	Ød1	ℓ	L	Clamp screw	Wrench		
LBE	080080S-S08C	8, 9	8	7.5	80	136	ETND02506F	TWP07S	8,9	1
	080100S-S08C	8, 9	8	7.5	100	156				
	080020S-S08C-130	8, 9	8	7.5	20	130	ETND02506F	TWP07S	8,9	2
	080020S-S08C-150	8, 9	8	7.5	20	150				
	100080S-S10C	10, 11	10	9.5	80	136	ETND0307F	TWP08S	10, 11	1
	100120S-S10C	10, 11	10	9.5	120	176				
	100023S-S10C-130	10, 11	10	9.5	23	130	ETND0307F	TWP08S	10, 11	2
	100023S-S10C-170	10, 11	10	9.5	23	170				
	120100S-S12C	12, 13	12	11.5	100	156	ETND03509	TWP10S	12,13	1
	120150S-S12C	12, 13	12	11.5	150	206				
	120025S-S12C-150	12, 13	12	11.5	25	150	ETND03509	TWP10S	12,13	2
	120025S-S12C-200	12, 13	12	11.5	25	200				
	160100S-S16C	16, 17	16	15.5	100	160	ETND0413	TWP15S	16,17	1
	160150S-S16C	16, 17	16	15.5	150	210				
	160030S-S16C-160	16, 17	16	15.5	30	160	ETND0413	TWP15S	16,17	2
	160030S-S16C-210	16, 17	16	15.5	30	210				
	200120S-S20C	20, 21	20	19.5	120	190	ETKD0516	TWP20	20,21	1
	200170S-S20C	20, 21	20	19.5	170	240				
	200035S-S20C-190	20, 21	20	19.5	35	190	ETKD0516	TWP20	20,21	2
	200035S-S20C-240	20, 21	20	19.5	35	240				
	250140S-S25C	25, 26	25	24.5	140	220	ETKD0620	TWP25	25,26	1
	250170S-S25C	25, 26	25	24.5	170	250				
	250040S-S25C-220	25, 26	25	24.5	40	220	ETKD0620	TWP25	25,26	2
	250040S-S25C-250	25, 26	25	24.5	40	250				
	300140S-S32C	30, 31	32	29.5	140	230	ETGD0825	TWP40	30,31	1
	300170S-S32C	30, 31	32	29.5	170	260				
	300050S-S32C-230	30, 31	32	29.5	50	230	ETGD0825	TWP40	30,31	2
	300050S-S32C-260	30, 31	32	29.5	50	260				
	320140S-S32C	32	32	31.5	140	230	ETGD0825	TWP40	32	1
	320170S-S32C	32	32	31.5	170	260				
	320050S-S32C-230	32	32	31.5	50	230	ETGD0825	TWP40	32	2
	320050S-S32C-260	32	32	31.5	50	260				

Available inserts E08, E09

LBE 08/10/12/16/20/25/30/32

Taper type

Steel Shank (Ball type)



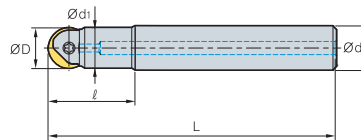
							(mm)		
Designation	Dimensions					Parts		Available inserts (Ø)	
	ØD	Ød	Ød ₁	ℓ	L	Clamp screw	Wrench		
LBE	080035T-S12	8, 9	12	7.5	35	91	ETND02506F	TWP07S	8, 9
	080055T-S12	8, 9	12	7.5	55	111			
	080075T-S12	8, 9	12	7.5	75	131			
	100035T-S12	10, 11	12	9.5	35	91	ETND0307F	TWP08S	10, 11
	100055T-S12	10, 11	12	9.5	55	111			
	100075T-S12	10, 11	12	9.5	75	131			
	120055T-S12	12, 13	12	10.4	55	111	ETND03509	TWP10S	12, 13
	120085T-S16	12, 13	16	11.5	85	145			
	160065T-S16	16, 17	16	14	65	125			
	160100T-S20	16, 17	20	15.5	100	170	ETND0413	TWP15S	16, 17
	200075T-S20	20, 21	20	17.5	75	145			
	200115T-S25	20, 21	25	19.5	115	195			
	250090T-S25	25, 26	25	22	90	170	ETKD0620	TWP25	25, 26
	250135T-S32	25, 26	32	24.5	135	225			
	300105T-S32	30, 31	32	29.5	105	195			
	300160T-S32	30, 31	32	29.5	160	250	ETGD0825	TWP40	30, 31
	320105T-S32	32	32	29	105	195			
	320160T-S32	32	32	29	160	250			

Available inserts E08, E09

LBE12/16/20/25/30/32

Straight type

Steel Shank (Ball type)





									(mm)
	Designation	Dimensions					Parts		Available inserts (Ø)
		ØD	Ød	Ød ₁	ℓ	L	Clamp screw	Wrench	
LBE	120035S-S12	12, 13	12	11.5	35	91	ETND03509	TWP10S	12,13
	160035S-S16	16, 17	16	15.5	35	95	ETND0413	TWP15S	16,17
	200040S-S20	20, 21	20	19.5	40	110	ETKD0516	TWP20	20,21
	250045S-S25	25, 26	25	24.5	40	125	ETKD0620	TWP25	25,26
	300055S-S32	30, 31	32	29.5	55	145	ETGD0825	TWP40	30,31
	320055S-S32	32	32	31.5	55	145	ETGD0825	TWP40	32

Available inserts E08, E09



LRE 10/12/16/20/25/30/32

Carbide Shank (Corner R type)

Straight type

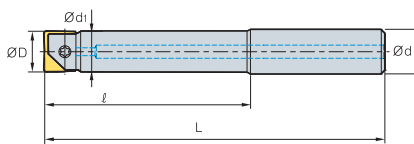


Fig. 1

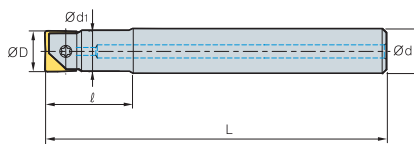


Fig. 2



(mm)

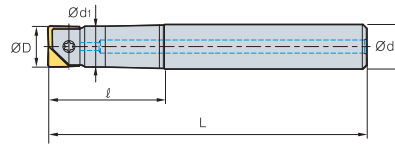
	Designation	Dimensions					Parts		Available inserts (Ø)	Fig.
		ØD	Ød	Ød1	l	L	Clamp screw	Wrench		
LRE	100080S-S10C	10, 11	10	9.5	80	136	ETND0307F	TWP08S	10, 11	1
	100120S-S10C	10, 11	10	9.5	120	176				
	100023S-S10C-130	10, 11	10	9.5	23	130				
	100023S-S10C-170	10, 11	10	9.5	23	170	ETND0307F	TWP08S	10, 11	2
	120100S-S12C	12, 13	12	11.5	100	156	ETND03509	TWP10S	12,13	1
	120150S-S12C	12, 13	12	11.5	150	206				
	120025S-S12C-150	12, 13	12	11.5	25	150				
	120025S-S12C-200	12, 13	12	11.5	25	200	ETND03509	TWP10S	12,13	2
	160100S-S16C	16, 17	16	15.5	100	160				
	160150S-S16C	16, 17	16	15.5	150	210	ETND0413	TWP15S	16,17	1
	160030S-S16C-160	16, 17	16	15.5	30	160				
	160030S-S16C-210	16, 17	16	15.5	30	210	ETND0413	TWP15S	16,17	2
	200120S-S20C	20, 21	20	19.5	120	190				
	200170S-S20C	20, 21	20	19.5	170	240	ETKD0516	TWP20	20,21	1
	200035S-S20C-190	20, 21	20	19.5	35	190				
	200035S-S20C-240	20, 21	20	19.5	35	240	ETKD0516	TWP20	20,21	2
	250140S-S25C	25, 26	25	24.5	140	220				
	250170S-S25C	25, 26	25	24.5	170	250	ETKD0620	TWP25	25,26	1
	250040S-S25C-220	25, 26	25	24.5	40	220				
	250040S-S25C-250	25, 26	25	24.5	40	250	ETKD0620	TWP25	25,26	2
	300140S-S32C	30, 31	32	29.5	140	230	ETGD0825	TWP40	30,31	1
	300170S-S32C	30, 31	32	29.5	170	260				
	300050S-S32C-230	30, 31	32	29.5	50	230				
	300050S-S32C-260	30, 31	32	29.5	50	260	ETGD0825	TWP40	30,31	2
	320140S-S32C	32	32	31.5	140	230				
	320170S-S32C	32	32	31.5	170	260	ETGD0825	TWP40	32	1
	320050S-S32C-230	32	32	31.5	50	230				
	320050S-S32C-260	32	32	31.5	50	260	ETGD0825	TWP40	32	2

Available inserts E08, E09

LRE 10/12

Steel Shank (Corner R type)

Taper type



(mm)

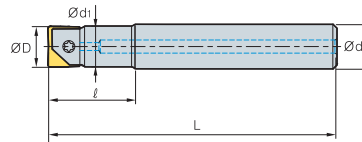
Designation		Dimensions					Parts		Available inserts (Ø)
		ØD	Ød	Ød₁	ℓ	L	Clamp screw	Wrench	
LRE	100025T-S12	10, 11	12	9.5	25	111	ETND0307F	TWP08S	10,11
	100050T-S12	10, 11	12	9.5	50	150			
	120060T-S16	12, 13	16	11.5	60	160	ETND03509	TWP10S	12,13

Available inserts E08, E09

LRE 12/16/25/30/32

Steel Shank (Corner R type)

Straight type



(mm)

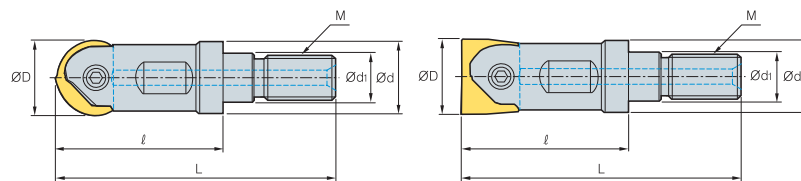
Designation		Dimensions					Parts		Available inserts (Ø)
		ØD	Ød	Ød ₁	ℓ	L	Clamp screw	Wrench	
LRE	120030S-S12	12, 13	12	11.5	30	111	ETND03509	TWP10S	12, 13
	160050S-S16	16, 17	16	15.5	50	131	ETND0413	TWP15S	16, 17
	160060S-S16	16, 17	16	15.5	60	160			
	200060S-S20	20, 21	20	19.5	60	145	ETKD0516	TWP20	20, 21
	200080S-S20	20, 21	20	19.5	80	180			
	250070S-S25	25, 26	25	24.5	70	145	ETKD0620	TWP25	25, 26
	250100S-S25	25, 26	25	24.5	100	225			
	300070S-S32	30, 31	32	29.5	70	160	ETGD0825	TWP40	30, 31
	300100S-S32	30, 31	32	29.5	100	225			
	320080S-S32	32	32	31.5	80	160	ETGD0825	TWP40	32
320100S-S32	32	32	31.5	100	225				

Available inserts E08, E09



E Milling

LBE-MHD



(mm)

Designation	Dimensions						Parts		Available inserts (Ø)
	M	ØD	L	ℓ	Ød	Ød ₁	Clamp screw	Wrench	
LBE 100-MHD-M06	M06	10, 11	40	25	9.5	6.5	ETND0307F	TWP08S	10, 11
120-MHD-M06	M06	12, 13	40	25	11	6.5	ETND03509	TWP10S	12, 13
160-MHD-M08	M08	16, 17	47	30	14.5	8.5	ETND0413	TWP15S	16, 17
200-MHD-M10	M10	20, 21	56	35	18	10.5	ETKD0516	TWP20	20, 21
250-MHD-M12	M12	25, 26	69	45	22.5	12.5	ETKD0620	TWP25	25, 26
300-MHD-M16	M16	30, 31	77	50	28	17	ETGD0825	TWP40	30, 31
320-MHD-M16	M16	32	77	50	29	17	ETGD0825	TWP40	32

Available inserts **E08, E09** Available adaptors **E342~E343**

Designation: LBE320-MHD-M16
Modular head threading measure size (M16)

=

Adaptor spec.: MAT-M16-035-S32S
Adaptor threading measure (M16)

BFE

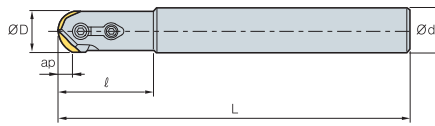


Fig. 1

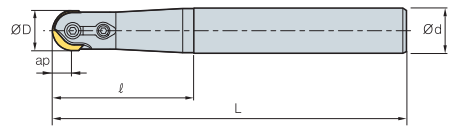


Fig. 2



(mm)

Designation	ØD	Ød	l	L	ap		Fig.	Available inserts
BFE	16-S	16	36	140	8.0	0.2	1	RC16
	16-M	16	20	65	8.0	0.3	2	
	16-L	16	25	65	8.0	0.5	2	
	20-S	20	20	45	10.0	0.4	1	RC20
	20-M	20	25	80	10.0	0.6	2	
	20-L	20	25	80	10.0	0.8	2	
	25-S	25	25	45	12.5	0.7	1	RC25
	25-M	25	32	90	12.5	1.1	2	
	25-L	25	32	90	12.5	1.7	2	
	30-S	30	32	65	15.0	0.9	2	RC30
	30-M	30	32	100	15.0	1.4	2	
	30-L	30	32	100	15.0	2.0	2	
	32-S	32	32	56	16.0	0.9	1	RC32
	32-M	32	32	100	16.0	1.4	1	
	32-L	32	32	100	16.0	2.0	1	

Available inserts

RC		
		
Designation	Coated PC210F	page
RC 16	●	E15
20	●	
25	●	
30	●	
32	●	

Recommended cutting condition

Workpiece		Cutting condition	
		vc (m/min)	fz (mm/t)
P	General steel (SS41, SM25C) Over HB180	150~250	0.10~0.30
	Alloy steel (SM55C, SCM) Under HB300	100~200	0.10~0.20
K	Cast iron Under HB300	100~200	0.10~ 0.30

Parts

Specification					
Ø16	FTGA0513	CBH4.5R1	CTX04513	ER03	TW20
Ø20	FTGA0517	CBH4.5R2	CTX04513	ER03	TW20
Ø25	FTGA0621	CBH5R1	CTX0517	ER04	TW20
Ø30, 32	FTGA0826	CBH6R1	CTX0621	ER05	TW25

Available inserts E15



GBE (Single-edge)

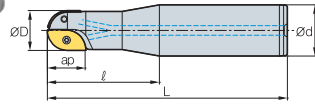


Fig. 1

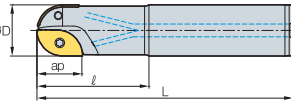


Fig. 2

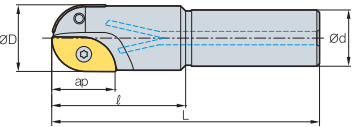


Fig. 3



(mm)

Designation		Dimensions					Available inserts		Parts		Fig.
		ØD	Ød	ℓ	L	ap	Internal	External	Screw	Wrench	
									Int./Ext. type	Ext. main type	
GBE	160-S20	16	20	50	130	15	ZPET080M-MM	ZPET080S-MM	FTKA02555S	TW08S	1
	160-L20	16	20	90	200	15	ZPET080M-MM	ZPET080S-MM	FTKA02555S	TW08S	
	180-S20	18	20	60	130	17	ZPET090M-MM	ZPET090S-MM	FTKA0307	TW09S	
	180-L20	18	20	80	200	17	ZPET090M-MM	ZPET090S-MM	FTKA0307	TW09S	
	200-S25	20	25	60	140	18	ZPET100M-MM	ZPET100S-MM	FTKA0307	TW09S	
	200-L25	20	25	80	250	18	ZPET100M-MM	ZPET100S-MM	FTKA0307	TW09S	
	220-S25	22	25	70	140	21	ZPET110M-MM	ZPET110S-MM	FTKA0408	TW15S	
	220-L25	22	25	100	250	21	ZPET110M-MM	ZPET110S-MM	FTKA0408	TW15S	
	250-S32	25	32	70	150	23	ZPET125M-MM	ZPET125S-MM	FTKA0409	TW15S	
	250-L32	25	32	100	300	23	ZPET125M-MM	ZPET125S-MM	FTKA0409	TW15S	
	260-S32	26	32	70	150	24.5	ZPET130M-MM	ZPET130S-MM	FTKA0409	TW15S	
	260-L32	26	32	100	300	24.5	ZPET130M-MM	ZPET130S-MM	FTKA0409	TW15S	
	280-S32	28	32	70	150	26	ZPET140M-MM	ZPET140S-MM	FTGA0511-P	TW20	
	280-L32	28	32	120	300	26	ZPET140M-MM	ZPET140S-MM	FTGA0511-P	TW20	
	300-S32	30	32	70	160	27	ZPET150M-MM	ZPET150S-MM	FTGA0511-P	TW20-100	
	300-L32	30	32	120	350	27	ZPET150M-MM	ZPET150S-MM	FTGA0511-P	TW20-100	
	320-S32	32	32	70	160	28	ZPET160M-MM	ZPET160S-MM	FTGA0511-P	TW20-100	2
	320-L32	32	32	120	350	28	ZPET160M-MM	ZPET160S-MM	FTGA0511-P	TW20-100	
	400-S42	40	42	100	200	37	ZPET200M-MM	ZPET200S-MM	FTGA0614	TW20-100	
	400-L42	40	42	150	350	37	ZPET200M-MM	ZPET200S-MM	FTGA0614	TW20-100	
	500-S42	50	42	100	200	47	ZPET250M-MM	ZPET250S-MM	FTGA0818	TW25-100	3
	500-L42	50	42	100	350	47	ZPET250M-MM	ZPET250S-MM	FTGA0818	TW25-100	

Available inserts E31

GBE-M (Multi-edge)

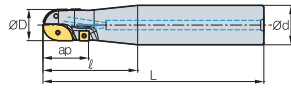


Fig. 1

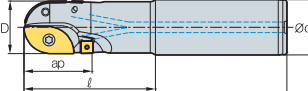


Fig. 2

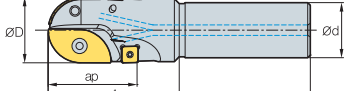


Fig. 3

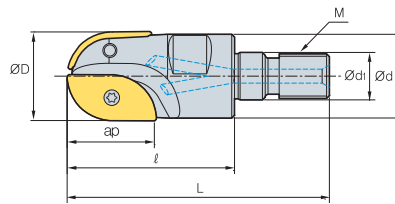


(mm)

Designation		Dimensions					Available inserts			Parts				Fig.
		ØD	Ød	ℓ	L	ap	Internal	External	Ext. main	Screw		Wrench		
										Int./Ext. type	Ext. main type	Int./Ext. type	Ext. main type	
GBE	200M-S25	20	25	70	150	28	ZPET100M-MM	ZPET100S-MM	SPMT060304	FTKA0307	ETNA02506	TW09S	TW07P	1
	200M-L25	20	25	70	250	28	ZPET100M-MM	ZPET100S-MM	SPMT060304	FTKA0307	ETNA02506	TW09S	TW07P	
	220M-S25	22	25	80	150	31	ZPET110M-MM	ZPET110S-MM	SPMT060304	FTKA0408	ETNA02506	TW15S	TW07P	
	220M-L25	22	25	80	250	31	ZPET110M-MM	ZPET110S-MM	SPMT060304	FTKA0408	ETNA02506	TW15S	TW07P	
	250M-S32	25	32	80	180	33	ZPET125M-MM	ZPET125S-MM	SPMT060304	FTKA0409	ETNA02506	TW15S	TW07P	
	250M-L32	25	32	80	300	33	ZPET125M-MM	ZPET125S-MM	SPMT060304	FTKA0409	ETNA02506	TW15S	TW07P	
	260M-S32	26	32	80	180	39	ZPET130M-MM	ZPET130S-MM	SDMT090308-MM	FTKA0409	ETNA0408	TW15S	TW15S	
	260M-L32	26	32	80	300	39	ZPET130M-MM	ZPET130S-MM	SDMT090308-MM	FTKA0409	ETNA0408	TW15S	TW15S	
	280M-S32	28	32	80	180	41	ZPET140M-MM	ZPET140S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20	TW15S	
	280M-L32	28	32	80	300	41	ZPET140M-MM	ZPET140S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20	TW15S	
	300M-S32	30	32	100	200	41	ZPET150M-MM	ZPET150S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20-100	TW15S	
	300M-L32	30	32	100	350	41	ZPET150M-MM	ZPET150S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20-100	TW15S	
	320M-S32	32	32	100	200	42	ZPET160M-MM	ZPET160S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20-100	TW15S	
	320M-L32	32	32	100	350	42	ZPET160M-MM	ZPET160S-MM	SDMT090308-MM	FTGA0511-P	ETNA0408	TW20-100	TW15S	
	400M-S42	40	42	100	200	56	ZPET200M-MM	ZPET200S-MM	SPMT120408-MM	FTGA0614	ETNA0511	TW20-100	TW20S	
	400M-L42	40	42	100	350	56	ZPET200M-MM	ZPET200S-MM	SPMT120408-MM	FTGA0614	ETNA0511	TW20-100	TW20S	
500M-S42	50	42	100	200	67	ZPET250M-MM	ZPET250S-MM	SPMT120408-MM	FTGA0818	ETNA0511	TW25-100	TW20S		
500M-L42	50	42	100	350	67	ZPET250M-MM	ZPET250S-MM	SPMT120408-MM	FTGA0818	ETNA0511	TW25-100	TW20S		
														3

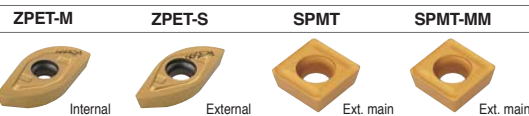
Available inserts E25, E31



GBEM

(mm)

Designation		Dimensions							Available inserts	
		ØD	Ød	Ød ₁	l	L	M	ap	Internal	External
GBEM	160-M08	16	15	8.5	30	47	M08	15	ZPET080M-MM	ZPET080S-MM
	200-M10	20	18.6	10.5	35	56	M10	18	ZPET100M-MM	ZPET100S-MM
	250-M12	25	23.2	12.5	45	69	M12	23	ZPET125M-MM	ZPET125S-MM
	300-M16	30	27.8	17	50	77	M16	27	ZPET150M-MM	ZPET150S-MM
	320-M16	32	29.8	17	50	77	M16	28	ZPET160M-MM	ZPET160S-MM

Available inserts

Designation		Coated				Page	Designation		Coated				Page
		NCM325	PC3500	PC5300	PC3545				NCM325	PC3500	PC5300	PC3545	
SPMT	060304	●				E25	ZPET	080S-MM					E31
	120408-MM		●	●	●	E25		090S-MM					
SDMT	090308-MM	●	●	●		E18		100S-MM		●	●		
ZPET	080M-MM					E31		110S-MM					
	090M-MM							125S-MM		●	●		
	100M-MM		●	●				130S-MM					
	110M-MM							140S-MM					
	125M-MM		●	●				150S-MM		●	●		
	130M-MM							160S-MM		●	●		
	140M-MM							200S-MM		●			
	150M-MM		●	●				250S-MM					
	160M-MM		●	●									
	200M-MM		●										
	250M-MM												

Parts

Specification	Screw		Wrench	
	Int./Ext. type	Ext. main type	Int./Ext. type	Ext. main type
Ø16	FTKA02555	-	TW08S	-
Ø20	FTKA0307	ETNA02506	TW09S	TW07P
Ø25	FTKA0409	ETNA02506	TW15S	TW07P
Ø30	FTGA0511-P	ETNA0408	TW20-100	TW15S
Ø32	FTGA0511-P	ETNA0408	TW20-100	TW15S

Designation: GBEM320-M16
Modular head threading measure size (M16)

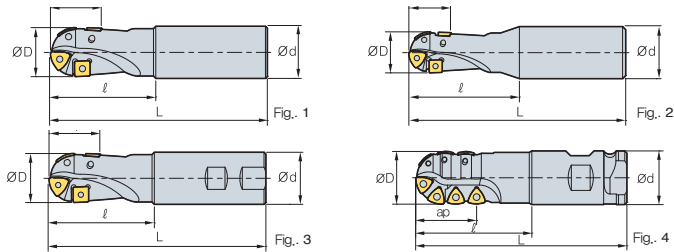
II

Adaptor spec.: MAT-M16-035-S32S
Adaptor threading measure (M16)

Available inserts E18, E25, E31 Available adaptors E342~E343



BRE



(mm)

Designation	Dimensions						Available inserts		Parts		Fig.
	ØD	Ød	ℓ	L	ap		Internal	External	Screw	Wrench	
BRE	20R-S	20	20	50	125	20	ZDMT080310R-MM	SPMT060304	ETNA02506	TW07P	1
	20R-M	20	20	75	150	20					2
	20R-L	20	25	100	200	20					3
	20R-SL	20	25	65	125	20					
	25R-S	25	25	70	150	23	ZDMT110312.5R-MM	SPMT060304	ETNA02506	TW07P	1
	25R-M	25	25	95	175	23					2
	25R-L	25	32	100	200	23					3
	25R-SL	25	25	75	135	23					
	32R-S	32	32	85	175	31	ZDMT130416R-MM	SDMT090308-MM	ETNA0408	TW15S	1
	32R-M	32	32	100	200	31					2
	32R-L	32	32	150	250	31					3
	32R-SL	32	32	75	150	31					

Available inserts

SDMT-MM SPMT ZDMT-R-MM



Designation	Coated						page
	NCM325	PC3500	PC5300	PC3525	PC3545	PC6510	
SDMT 090308-MM		●	●				E18
SPMT 060304	●						E25
ZDMT 080310R-MM		●	●				E30
110312.5R-MM		●	●				
130416R-MM		●	●				

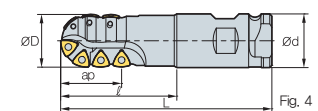
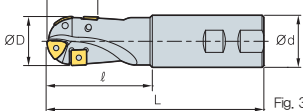
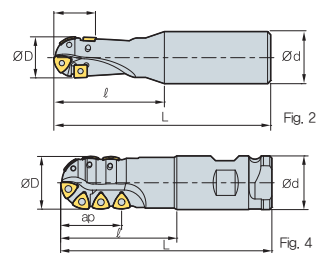
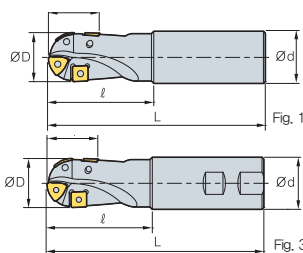
Parts

Specification	 Screw	 Wrench	 Wrench
Ø20~Ø25	ETNA02506	-	TW07P
Ø32	ETNA0408	TW15S	-

Available inserts E18, E25, E30



BRE



- AR: 0°~10°
- RR: -3°~0°

(mm)												
Designation		Dimensions					Available inserts		Parts			Fig.
		ØD	Ød	ℓ	L	ap	Main	Ext. main	Screw	Wrench		
BRE	40R-S	40	42	85	175	41	ZPMT160520R-MM	SPMT120408-MM SPMT120508-MMN	ETNA0511	TW20-100	1.3	1
	40R-S-40	40	42	85	175	41						
	40R-M	40	42	100	200	41						
	40R-M-40	40	42	100	200	41						
	40R-L	40	42	150	250	41						
	40R-L-40	40	42	150	250	41						
	40R-SL	40	42	80	160	41						
	40R-SL-40	40	42	80	160	41						
	50R-S	50	42	100	200	45	ZPMT160525R-MM	SPMT120408-MM SPMT120508-MMN	ETNA0511	TW20-100	2.6	1
	50R-S-40	50	42	100	200	45						
	50R-L	50	42	100	300	45						
	50R-L-40	50	42	100	300	45						
	50R-SL	50	42	100	250	45						
	50R-SL-40	50	42	100	250	45						
	63R-S	63	42	100	200	52	ZPMT160531.5R-MM	SPMT120408-MM SPMT120508-MMN	ETNA0511	TW20-100	3.0	1
	63R-S-40	63	42	100	200	52						
	63R-L	63	42	100	300	52						
	63R-L-40	63	42	100	300	52						
	63R-SL	63	42	100	250	52						
	63R-SL-40	63	42	100	250	52						
	40XR-SC40	40	40	110	200	54	ZPMT160520R-MM		ETNA0511	TW20-100	1.4	4
	40XR-LC40	40	40	150	250	54	1.9					
	50XR-SC50.8	50	50.8	110	200	57	ZPMT160525R-MM ZPMT160525R-MR		ETNA0511	TW20-100	2.3	4
	50XR-LC50.8	50	50.8	150	250	57	3.0					

Available inserts

SPMT-MM

ZPMT-R-MM

ZPMT-R-MR



Designation		Coated						page
		NCM325	PC3500	PC5300	PC3525	PC3545	PC6510	
SPMT	120408-MM		●	●		●		E25
	120508-MMN							
ZPMT	160520R-MM		●	●				E31
	160525R-MM		●	●				
	160525R-MR							
	160531.5R-MM			●				

Parts

Specification	 Screw	 Wrench
Ø20~Ø63	ETNA0511	TW20-100

Available inserts E25, E31