



**WORLDIA**

# Indexable PCD and PCBN Milling Cutters

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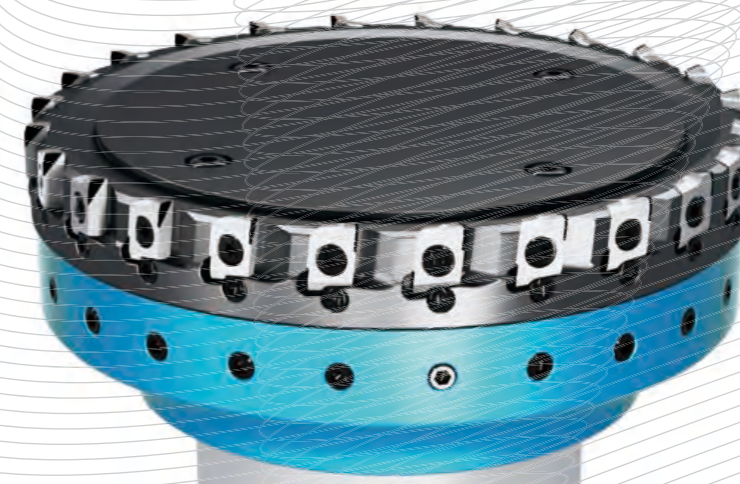
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# MANANOVA<sup>®</sup> Standard Program

Easy Choice – Fast Delivery

MANANOVA is the name for Worldia's stock-keeping standard product portfolio. It provides best-in-class high-quality products within a wide range of most-common applications at very attractive prices. Each item has an inventory code which simplifies the order process.

MANANOVA products will be delivered directly from our warehouses to any global destination within max. 1 week. MANANOVA product range currently covers PCD and PCBN ISO inserts as well as indexable PCD and PCBN milling cutters with associated inserts.



## Worldia PCD and PCBN Indexable Milling Cutters Product Selection



	Shell Milling Cutters - Fine Pitch	Shell Milling Cutters - Light Weight/ Coarse Pitch	Shank and Screw-On Milling Cutters	Disc Milling Cutters	Shell Milling Cutters
Specification	FMP-BE	FMP-BE	FMP-BE	FMP-BE	FMP-SD
Picture					
Processes	Face + Shoulder Milling  	Face + Shoulder Milling  	Face + Shoulder Milling  	Side Milling LH, RH, Slotting   	Face Milling 
Workpiece Material	<b>N K H</b>	<b>N K H</b>	<b>N K H</b>	<b>N K H</b>	<b>K H</b>
Cutting Material	PCD/PCBN	PCD/PCBN	PCD/PCBN	PCD/PCBN	PCBN
Insert Type	BEHW1204	BEHW1204	BEHW1204	BEHW1204	SDHN07T3
Cutting Edges/ Insert	1 or 2	1 or 2	1 or 2	1 or 2	4
Max. DOC/ Ap (mm)	11	11	11	11/21	0.5
Standard Cutter Diameter (mm)	40 - 250	80 - 160	25 - 32	100 - 200	50 - 250
Cutter Material	40 - 63: Steel 80 - 250: Aluminium + Steel	Aluminium + Steel	Steel	Steel	Steel
Lead Angle	90°	90°	90°	90°	88°
Axially Adjustable	Yes, 2 µm within 0,1 mm range	Yes, 2 µm within 0,1 mm range	Yes, 2 µm within 0,1 mm range	Yes, 2 µm within 0,1 mm range	Yes, 5 µm within 0,3 mm range
Adjustable Tooth Number	All	All	All	All	All
Fix Pocket Runout (mm)	0,02 - 0,04	0,02 - 0,04	0,02 - 0,04	0,02 - 0,04	0,02 - 0,04
HSC Capability	Yes	Yes	Yes	Yes	Yes
Internal Coolant	Yes	Yes	Yes	Yes	Yes
Standard	ISO, INCH	ISO	ISO	ISO	ISO
Page Cutters	7 - 8	9	10	11	15
Page Inserts	21-23	21-23	21-23	21-23	24





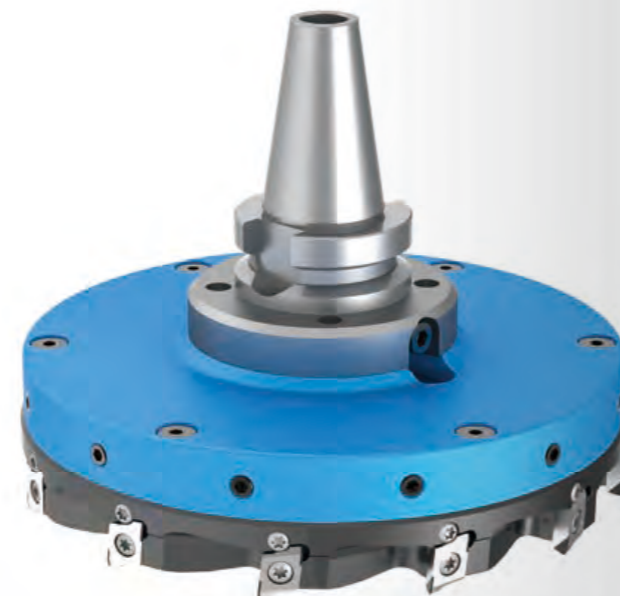
## Main Applications

Worldia FMP-BE Milling Cutters were developed for high-speed machining of light metal on even small-size machining centers with precision spindles.

Thanks to innovative Bimetal Aluminium/ Steel body design, requirements for low weight, low inertia and precise balancing to allow high spindle acceleration, high strength and wear resistance are met at the same time.

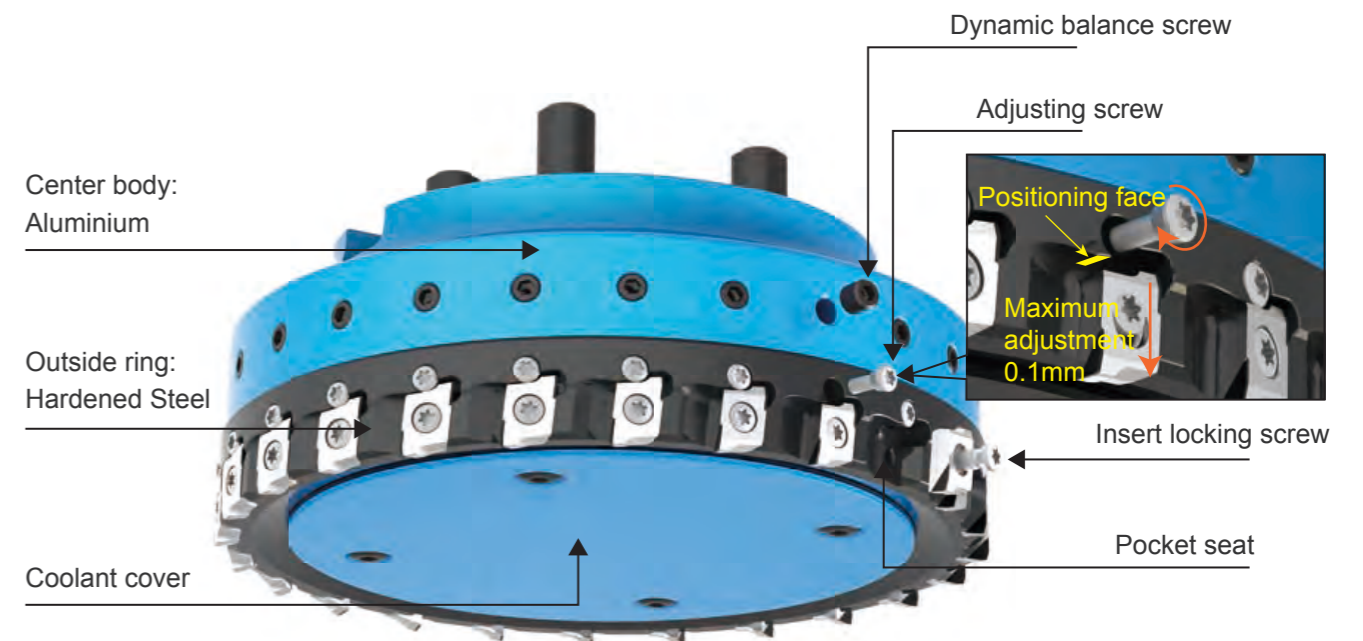
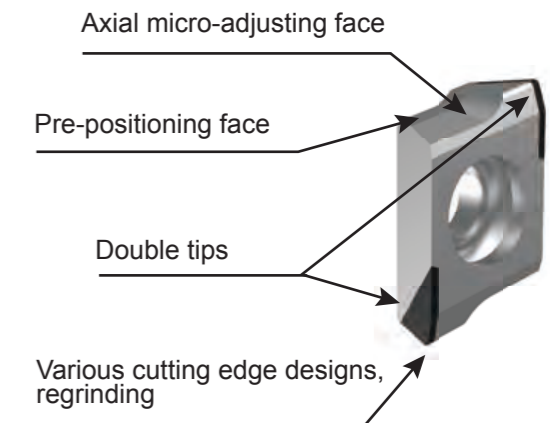
Cutters from diameter 80 to 160 mm can be mounted to the same adaptor, whereas e.g. the weight of a diameter 160 mm cutter with BT30 adaptor does not exceed 3 kg.

All Worldia FMP-BE cutters have 1 standard insert pocket that allows usage of different combinations of BEHW1204 PCD- and PCBN-tipped inserts, adjustable or non-adjustable, for a comprehensive range of roughing and finishing applications including hatch milling.



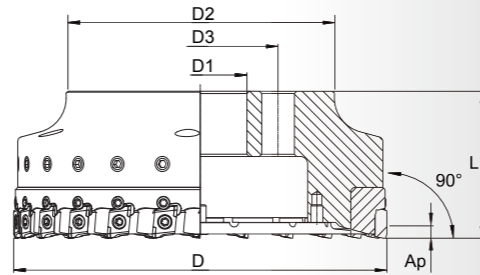
## Design Features

- Aluminium Alloy/ Steel Bimetal design
  - Al center body for weight reduction
  - Hardened Steel ring for high rigidity and wear resistance, therefore longer cutter life versus cutters with Aluminium body
- High precision insert pocket seats keeping 0,02 mm axial runout without insert adjustment
- As a standard, each pocket can also be adjusted to 2 µm axial runout within a 0,1 mm range
- BEHW inserts are available in a variety of cutting materials, lead angles, wiper and corner designs for many different applications in face and shoulder milling, roughing and finishing
- Separation between insert positioning face and cutting edge to protect cutting edge and to simplify the use of relapped or retipped inserts
- Inserts with 2 cutting edges and relap/ retip service to reduce tooling cost per part
- Internal coolant through the cutter body



# FMP-BE Shell Milling Cutters – Fine Pitch

ISO **MANANOVA** Easy Choice – Fast Delivery



Inventory	
Code	In stock. MANANOVA
○	Made to order

ISO

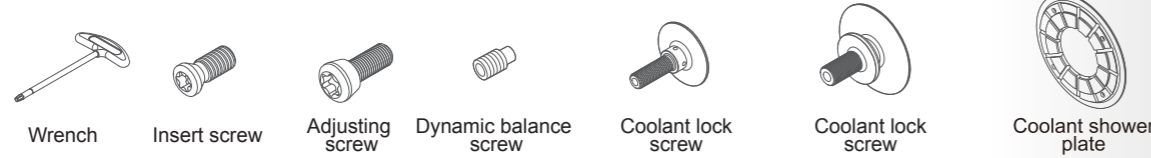
Inserts see page 21-23

Specification	Inventory	D	D1	D2	D3	L	Ap max	Z	kg	max RPM	Material
FMP040SA16-BE12-06	040401060013	40	16	36	—	40	11	6	0.36	40000	Steel
FMP050SA22-BE12-08	040401060005	50	22	45	—	40	11	8	0.55	35100	Steel
FMP063SA22-BE12-10	040401060006	63	22	45	—	40	11	10	0.75	30200	Steel
FMP080SA27-BE12-12	040401060007	80	27	50	—	50	11	12	0.96	27500	Steel+Aluminium
FMP100SB32-BE12-16	040401060008	100	32	70	—	50	11	16	1.45	23800	Steel+Aluminium
FMP125SB40-BE12-20	040401060009	125	40	90	—	63	11	20	2.40	19100	Steel+Aluminium
FMP160SC40-BE12-24	040401060010	160	40	115	66.7	63	11	24	3.00	14900	Steel+Aluminium
FMP200SC60-BE12-30	040401060011	200	60	150	101.6	63	11	30	4.25	11900	Steel+Aluminium
FMP250SC60-BE12-36	040401060012	250	60	200	101.6	63	11	36	6.50	9550	Steel+Aluminium

Cutters delivered assembled with spare parts, but without inserts, dynamically balanced to G2.5 at 25000 RPM

unit: mm

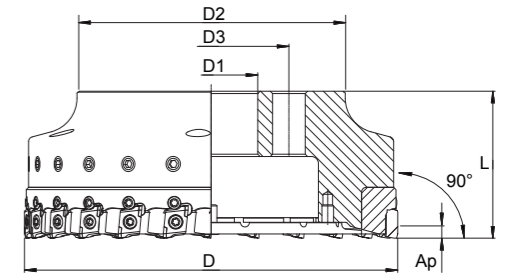
## Spare Parts



D	Wrench	Insert screw	Adjusting screw	Dynamic balance screw	Coolant lock screw	Coolant lock screw	Coolant shower plate
40	15IP	S40120J	S30110G	0204010265	FMP040SA16-BE12-06.02	—	—
50	15IP	S40120J	S30110G	0204010265	FMP050SA22-BE12-08.02	—	—
63	15IP	S40120J	S30110G	0204010265	FMP063SA22-BE12-10.02	—	—
80	15IP	S40120J	S30110G	B03400252	FMP080SA27-BE12-12.03	—	—
100	15IP	S40120J	S30110G	B03400252	—	FMP100SB32-BE12-16.03	—
125	15IP	S40120J	S30110G	B03400252	—	FMP125SB40-BE12-20.03	—
160	15IP	S40120J	S30110G	B03400252	—	—	FMP160SC40-BE12-24.03
200	15IP	S40120J	S30110G	B03400252	—	—	FMP200SC60-BE12-30.03
250	15IP	S40120J	S30110G	B03400252	—	—	FMP250SC60-BE12-36.03

# FMP-BE Shell Milling Cutters – Fine Pitch

INCH **MANANOVA** Easy Choice – Fast Delivery



Inventory	
Code	In stock. MANANOVA
○	Made to order

INCH

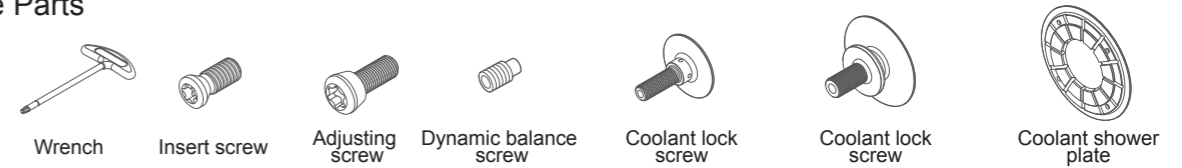
Inserts see page 21-23

Specification	Inventory	D	D1	D2	D3	L	Ap max	Z	kg	max RPM	Material
FMP2.00SA0.75-BE12-08	040401060049	2.00	0.75	1.772	—	1.575	0.45	8	0.48	35100	Steel
FMP2.50SA0.75-BE12-10	040401060050	2.50	0.75	1.772	—	1.575	0.45	10	0.71	30200	Steel
FMP3.00SA1.00-BE12-12	040401060051	3.00	1.00	1.969	—	1.969	0.45	12	0.75	27500	Steel+Aluminium
FMP4.00SB1.25-BE12-16	040401060044	4.00	1.25	2.756	—	1.969	0.45	16	1.32	23800	Steel+Aluminium
FMP5.00SB1.50-BE12-20	040401060048	5.00	1.50	3.543	—	2.480	0.45	20	2.31	19100	Steel+Aluminium

Cutters delivered assembled with spare parts, but without inserts, dynamically balanced to G2.5 at 25000 RPM

unit: in

## Spare Parts

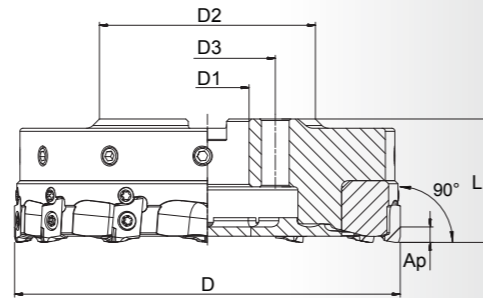


D	Wrench	Insert screw	Adjusting screw	Dynamic balance screw	Coolant lock screw	Coolant lock screw	Coolant shower plate
2.00	15IP	S40120J	S30110G	0204010265	FMP2.00SA0.75-BE12-08.02	—	—
2.50	15IP	S40120J	S30110G	0204010265	FMP2.50SA0.75-BE12-10.02	—	—
3.00	15IP	S40120J	S30110G	0204010265	FMP3.00SA1.00-BE12-12.03	—	—
4.00	15IP	S40120J	S30110G	B03400252	—	FMP4.00SB1.25-BE12-16.03	—
5.00	15IP	S40120J	S30110G	B03400252	—	FMP5.00SB1.50-BE12-20.03	—



# FMP-BE Shell Milling Cutters – Light Weight/ Coarse Pitch

ISO **MANANOVA** Easy Choice – Fast Delivery



ISO

Inserts see page 21-23

Inventory Code	In stock. MANANOVA
○	Made to order

Specification	Inventory	D	D1	D2	D3	L	Ap max	Z	kg	max RPM	Material
FMP080SB27-BE12-08	040401060029	80	27	70	—	40	11	8	0.78	27500	Steel+Aluminium
FMP100SB27-BE12-08	040401060028	100	27	70	—	40	11	8	1.12	23800	Steel+Aluminium
FMP125SC27-BE12-12	040401060027	125	27	70	54	40	11	12	1.43	19100	Steel+Aluminium
FMP160SC27-BE12-12	040401060026	160	27	70	54	40	11	12	2.00	14900	Steel+Aluminium

Cutters delivered assembled with spare parts, but without inserts, dynamically balanced to G2.5 at 25000 RPM

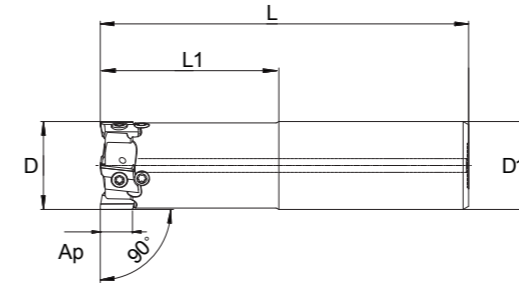
unit: mm

## Spare Parts

D	Wrench	Insert screw	Adjusting screw	Dynamic balance screw	Coolant lock screw	Coolant lock screw	Coolant shower plate
80	15IP	S40120J	S30110G	0204010265	—	FMP080SB27-BE12-08.03	—
100	15IP	S40120J	S30110G	0204010265	—	FMP100SB27-BE12-08.03	—
125	15IP	S40120J	S30110G	0204010265	—	—	FMP125SC27-BE12-12.03
160	15IP	S40120J	S30110G	B03400252	—	—	FMP160SC27-BE12-12.03

# FMP-BE Shank and Screw-On Milling Cutters

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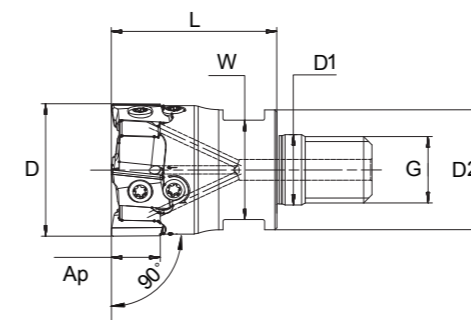


ISO

Inserts see page 21-23

Specification	Inventory	D	D1	D2	L	L1	Ap max	Z	kg	max RPM	Material
FMP025CS25-BE12-03	040401070087	25	25	—	130	50	11	3	0.50	25000	Steel
FMP032CS32-BE12-04	040401070005	32	32	—	130	50	11	4	0.80	25000	Steel

unit: mm



ISO

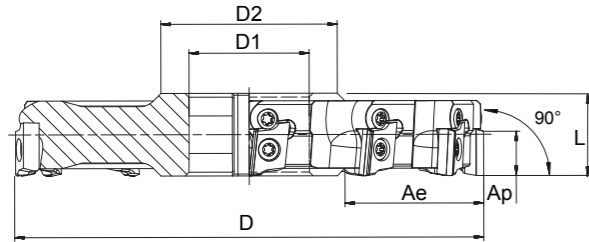
Inserts see page 21-23

Specification	Inventory	D	D1	D2	L	L1	G	W	Ap max	Z	kg	max RPM	Material
FMP025M12-BE12-03	040401070088	25	12.5	21	40	—	M12	17	11	3	0.13	25000	Steel
FMP032M16-BE12-04	040401070089	32	17	29	40	—	M16	24	11	4	0.23	25000	Steel

unit: mm

## Spare Parts

D	Wrench	Insert screw	Adjusting screw
25	15IP	S40090J	S30110G
32	15IP	S40090J	S30110G



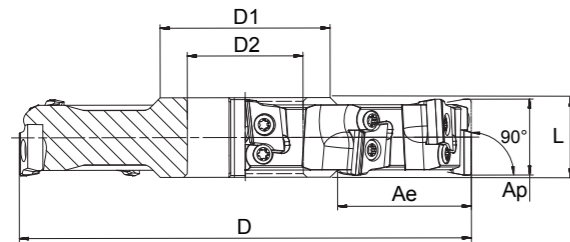
Inventory	
Code	In stock, MANANOVA
○	Made to order

ISO

Inserts see page 21-23

Specification	Inventory	D	D1	D2	L	Ap max	Ae max	Z <sub>eff</sub>	Z <sub>axial</sub>	kg	max RPM	Material
<b>RH cutting</b>												
SMP100CA32-BE12-10R	○	100	32	47	22	11	20	10	10	0.85	27000	Steel
SMP125CA32-BE12-12R	○	125	32	47	22	11	30	12	12	1.40	24000	Steel
SMP160CA40-BE12-14R	○	160	40	55	22	11	45	14	14	2.20	21300	Steel
SMP200CA40-BE12-16R	○	200	40	55	22	11	65	16	16	3.50	19100	Steel
<b>LH cutting</b>												
SMP100CA32-BE12-10L	○	100	32	47	22	11	20	10	10	0.85	27000	Steel
SMP125CA32-BE12-12L	○	125	32	47	22	11	30	12	12	1.40	24000	Steel
SMP160CA40-BE12-14L	○	160	40	55	22	11	45	14	14	2.20	21300	Steel
SMP200CA40-BE12-16L	○	200	40	55	22	11	65	16	16	3.50	19100	Steel

unit: mm



Inventory	
Code	In stock, MANANOVA
○	Made to order

ISO

Inserts see page 21-23

Specification	Inventory	D	D1	D2	L	Ap max	Ae max	Z <sub>eff</sub>	Z <sub>axial</sub>	kg	max RPM	Material
SMP100CA32-BE12-10N	○	100	32	47	22	21	20	5+5	5+5	0.85	27000	Steel
SMP125CA32-BE12-12N	○	125	32	47	22	21	30	6+6	6+6	1.40	24000	Steel
SMP160CA40-BE12-14N	○	160	40	55	22	21	45	7+7	7+7	2.20	21300	Steel
SMP200CA40-BE12-16N	○	200	40	55	22	21	65	8+8	8+8	3.50	19100	Steel

unit: mm

## Designed for

- Complex structures and special tool diameter, length and rigidity requirements
- Flexible machining of cavities, shoulders etc.

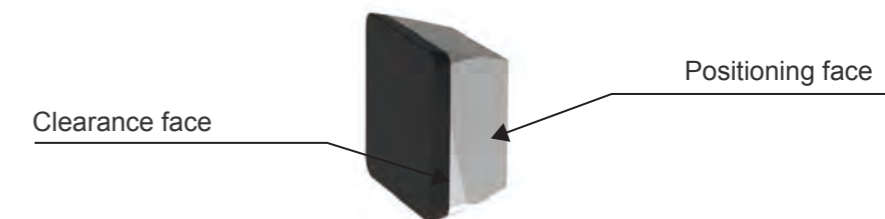
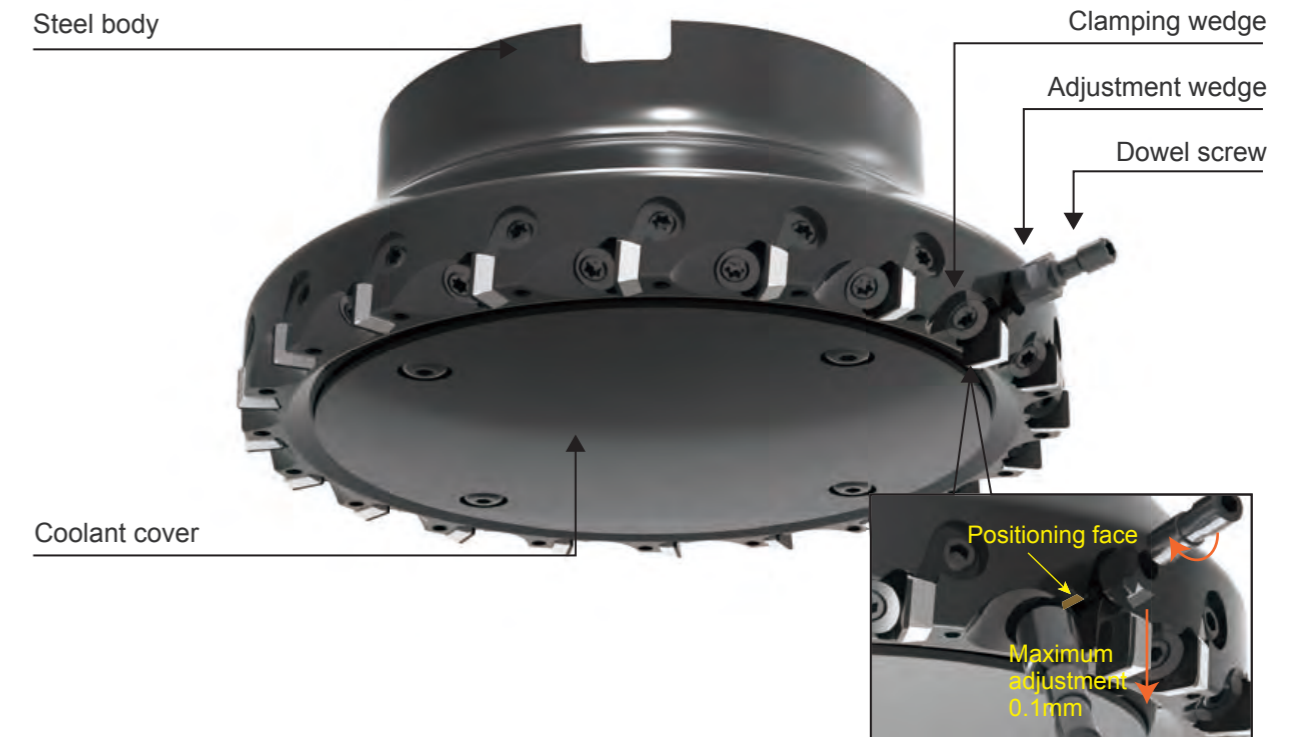


## Main Applications

High-speed semi-finish and finish face milling of cast iron and hardened materials with high requirements to surface finish and waviness.

## Design Features

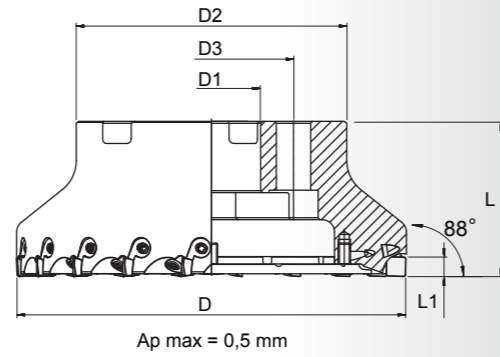
- Cutter body is made of hardened Steel-Alloy, machined by 5-axis hard milling
- High-precision insert pocket seats keeping 0,01 mm axial runout without insert adjustment
- As a standard, each pocket can also be adjusted to 2 µm axial runout within a 0,3 mm range
- Positive rake angles for smooth cutting and chip removal from surface
- Separation between insert positioning face and cutting edge to protect cutting edge and to simplify the use of relapped inserts
- Insert wedge clamping system allows easy exchange of inserts and reliable clamping
- SDHN inserts are available in a variety of wiper and corner designs for many different applications in semi-finish and finish face milling
- Full-face PCBN inserts with 4 cutting edges and regrinding option for low cutting tool cost
- Internal coolant through cutter body





# FMP-SD Shell Milling Cutters Specifications

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ISO

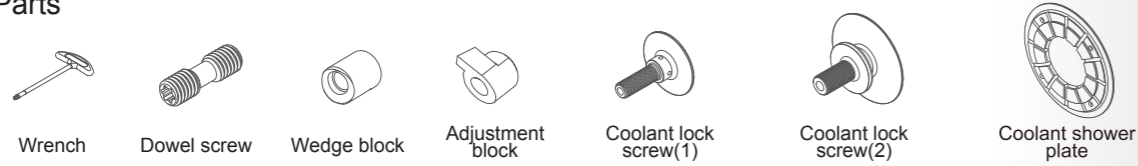
Inserts see page 24

Inventory	
Code	In stock. MANANOVA
○	Made to order

Specifications	Inventory	D	D1	D2	D3	L	L1	Z	kg	max RPM
FMP050SA22-SD07-05	040401060023	50	22	45	—	40	7.94	5	0.40	9500
FMP063SA22-SD07-08	040401060022	63	22	45	—	40	7.94	8	0.60	7500
FMP080SA27-SD07-10	040401060021	80	27	60	—	50	7.94	10	1.20	6000
FMP100SB32-SD07-12	040401060020	100	32	80	—	50	7.94	12	1.90	4700
FMP125SB40-SD07-16	040401060019	125	40	90	—	63	7.94	16	3.20	3800
FMP160SC40-SD07-20	040401060018	160	40	110	66.7	63	7.94	20	4.50	3000
FMP200SC60-SD07-24	040401060017	200	60	150	101.6	63	7.94	24	6.80	2300
FMP250SC60-SD07-32	040401060016	250	60	200	101.6	63	7.94	32	11.6	1900

unit: mm

## Spare Parts



D	Wrench	Dowel screw	Wedge block	Adjustment block	Coolant lock screw(1)	Coolant lock screw(2)	Coolant shower plate
50	15IP	M5*20	FMPSD07.01	FMPSD07.02	FMP050SA22-SD07-05.02	—	—
63	15IP	M5*20	FMPSD07.01	FMPSD07.02	FMP063SA22-SD07-08.02	—	—
80	15IP	M5*20	FMPSD07.01	FMPSD07.02	FMP080SA27-SD07-10.02	—	—
100	15IP	M5*20	FMPSD07.01	FMPSD07.02	—	FMP100SB32-SD07-12.02	—
125	15IP	M5*20	FMPSD07.01	FMPSD07.02	—	FMP125SB40-SD07-16.02	—
160	15IP	M5*20	FMPSD07.01	FMPSD07.02	—	—	FMP160SC40-SD07-20.02
200	15IP	M5*20	FMPSD07.01	FMPSD07.02	—	—	FMP200SC60-SD07-24.02
250	15IP	M5*20	FMPSD07.01	FMPSD07.02	—	—	FMP250SC60-SD07-30.02

# Customized FMP-SD Cutters



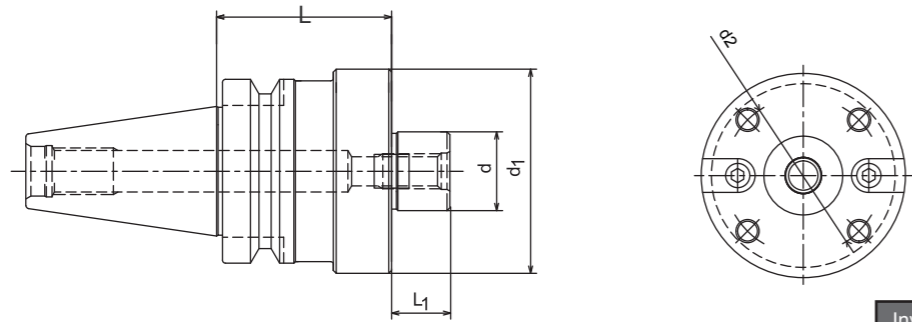
Designed for special applications including disc milling, rear face of machine guideways etc.



# Milling Adaptors BT / HSK



BT

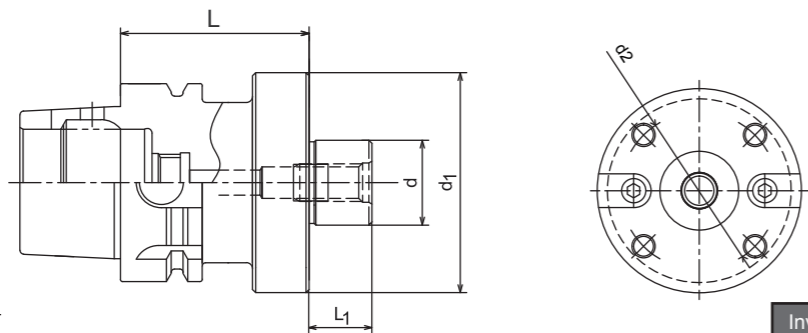


Inventory	
Code	Upon request

Specifications	Inventory	d	d1	d2	L1	L	kg
BT30-FMB16C-45	SC43129	16	34	—	18	45	0.70
BT30-FMB22C-45	SC40042	22	48	—	18	45	0.74
BT30-FMB27C-45	SC38061	27	60	—	20	45	1.10
BT40-FMB22C-45	SC38884	22	48	—	18	45	1.30
BT40-FMB27C-45	SC88885	27	60	—	20	45	1.50
BT40-FMB32C-50	SC39342	32	78	—	22	50	2.00
BT40-FMB40FC-60	SC43136	40	89	66.7	25	60	2.80
BT50-FMB40FC-75	SC43137	40	89	66.7	25	75	5.80
BT50-FMB60FC-75	SC40576	60	129	101.6	32	75	8.30

unit: mm

HSK



Inventory	
Code	Upon request

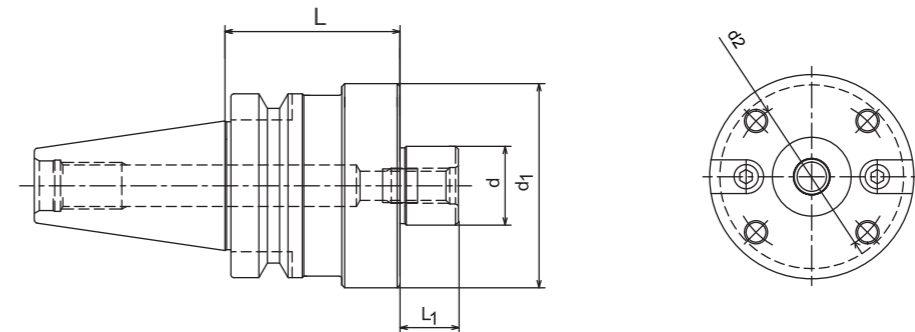
Specifications	Inventory	d	d1	d2	L1	L	kg
HSK63A-FMB16C-100	SC43126	16	35	—	16	100	1.80
HSK63A-FMB22C-50	SC39338	22	48	—	18	50	1.00
HSK63A-FMB27C-60	SC39339	27	60	—	20	60	1.50
HSK63A-FMB32C-60	SC39340	32	78	—	22	60	1.90
HSK63A-FMB40FC-60	SC39180	40	89	66.7	25	60	2.50
HSK100A-FMB40FC-75	SC43127	40	89	66.7	25	75	4.60
HSK100A-FMB60FC-70	SC43128	60	129	101.6	32	70	6.30

unit: mm

# Light Weight Milling Adaptors BT / HSK



BT

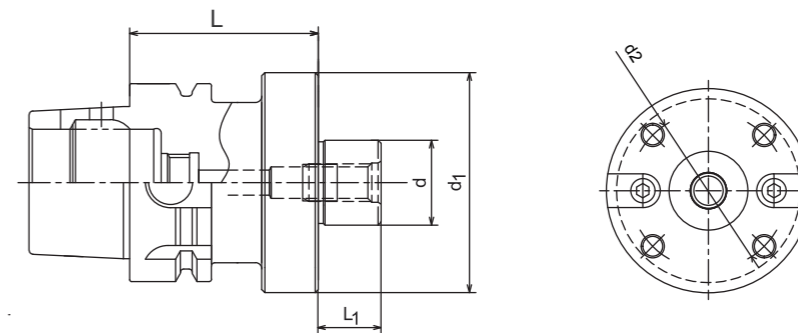


Inventory	
Code	Upon request

Specifications	Inventory	d	d1	d2	L1	L	Kg
BT30-FMB27FC-45	SC39069	27	70	54	20	45	1.20
BT40-FMB27FC-60	SC39799	27	70	54	20	60	2.50

unit: mm

HSK



Inventory	
Code	Upon request

Specifications	Inventory	d	d1	d2	L1	L	Kg
HSK63A-FMB27FC-60	SC39798	27	70	54	20	60	1.60

unit: mm



**B** **E** **H** **W** **12** **04** **EZ** **T** **R** **1**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

**S** **D** **H** **N** **07** **T3** **DE** **S** **R** **4**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

**-WG** **-R04CB05**

⑪ ⑫

**-WG**

⑪

① Shape		
Code	Shape	
O	Octagonal	
S	Square	
T	Triangle	
C	Diamond 80°	
L	Rectangular 90°	
B	Diamond 82°	
R	Round	
X	Special	—

② Clearance angle	
Code	Clearance Angle
C	7°
D	15°
E	20°
F	25°
G	30°
N	0°
P	11°
Z	Other clearance angle

③ Tolerance			
Code	Nose Height m (mm)	Inscribed Circle Diameter $\phi D1$ (mm)	Tolerance S1 (mm)
A	$\pm 0.005$	$\pm 0.025$	$\pm 0.025$
C	$\pm 0.013$	$\pm 0.025$	$\pm 0.025$
E	$\pm 0.025$	$\pm 0.025$	$\pm 0.025$
H	$\pm 0.013$	$\pm 0.013$	$\pm 0.025$
K*	$\pm 0.013$	$\pm 0.05 - \pm 0.15$	$\pm 0.025$
M*	$\pm 0.08 - \pm 0.18$	$\pm 0.05 - \pm 0.15$	$\pm 0.13$
N*	$\pm 0.08 - \pm 0.18$	$\pm 0.05 - \pm 0.15$	$\pm 0.025$

\*standard for no lapping on the side face.

④ Chip breaker r and Fixing type				
Code	Bore	Shape of Bore	Chip Breaker	Shape
W	With Bore	Cylindrical Bore + Single Side (40° - 60°)	Without	
T	With Bore		Single	
B	With Bore	Cylindrical Bore + Single Side (70° - 90°)	Without	
N	Without		Without	
R	Without	—	Single	
X	—	—	—	Special

⑤ Inscribed circle Dia.					
Code					Inscribed Circle (mm)
06	06	06			6.35
08	07	07			7.94
09	09	09			9.525
					10.00
					12.00
12	12	12			12.70
16	15	15			15.875
					20.00

⑥ Thickness	
Code	Thickness (mm)
T3	3.97
04	4.76
05	5.56
06	6.35

⑨ Cutting direction	
Code	Cutting Direction
L	Left Hand
N	Left & Right
R	Right Hand

⑩ Edges	
Code	Edges
1	1 edge
2	2 edge
4	4 edge

⑪ Cutting edge design	
Code	Design
WG	Wiper
UW	Universal
PT	Corner

⑦ Tip radius			
Code	Mark (mm)	Code	Mark (mm)
00	0.0	08	0.8
02	0.2	12	1.2
04	0.4	16	1.6

Tool cutting edge angle		Clearance angle of wiper	
Code	Mark	Code	Mark
A	45°	P	11°
D	60°	D	15°
E	75°	E	20°
P	90°	F	25°
Z	Other	Z	Other

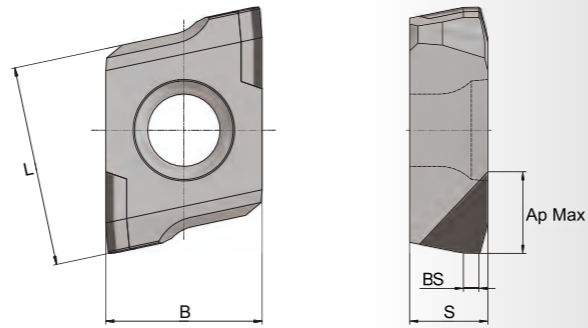
⑫ Corner Radius / Chamfer				Tip Length CB	
Code	Shape	Code	Mark (mm)	Code	Mark (mm)
R	Radius	03	0.3	05	5
C	Chamfer	04	0.4	08	8
		08	0.8	12	12

⑧ Cutting edge design	
Code	Cutting Edge Design
E	Honed
F	Sharp Edge
T	Chamfered
S	Chamfered + Honed
Z	Chamfered

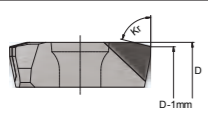
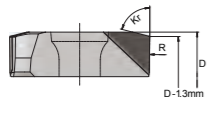
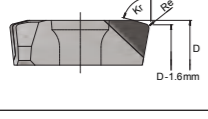
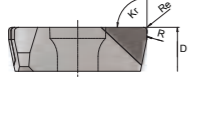
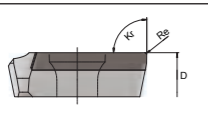
# BEHW PCD-tipped Milling Inserts for Light and Medium Applications



PCD-tipped milling inserts with various angles, wipers and corner radii for face and shoulder milling applications with higher depth of cut and Si-content  $\leq 10\%$ .  
Please see page 27-29 for application recommendations.



Dimensions		
L (mm)	B (mm)	S (mm)
12.2	9.525	4.76

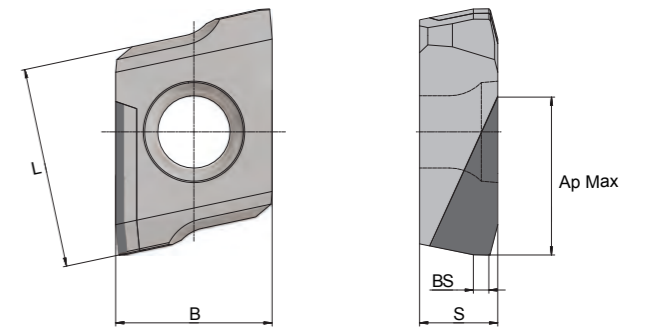
Figure	Cutter diameter		Specification	Cutting Edge	Dimensions					N	
	25 - 40 mm	>40 mm			Cutting Tips	BS (mm)	Ap Max (mm)	Kr (°)	Re (mm)	PD10E	PD32E
Standard 75° 		✓	BEHW1204EZFR1 C03CB05	F	1	1	4	75	—	HS03050	○
	✓		BEHW1204EZFR1B C03CB05	F	1	1	4	75	—	HS03615	○
		✓	BEHW1204EZFR2 C03CB05	F	2	1	4	75	—	HS03665	○
Wiper 75° 		✓	BEHW1204EZFR1-WG C03CB05	F	1	4	4	75	—	HC03020	○
	✓		BEHW1204EZFR1B-WG C03CB05	F	1	4	4	75	—	HC07955	○
		✓	BEHW1204EZFR2-WG C03CB05	F	2	4	4	75	—	HS05456	○
Corner 75° 		✓	BEHW1204EZFR1-PT R04CB05	F	1	-	4	75	0.4	HS01342	○
	✓		BEHW1204EZFR1B-PT R04CB05	F	1	-	4	75	0.4	HC03861	○
		✓	BEHW1204EZFR2-PT R04CB05	F	2	-	4	75	0.4	HC01106	○
Universal 90° 		✓	BEHW1204PZFR1-UW R04CB05	F	1	1.5	4	90	0.4	HC02033	○
		✓	BEHW1204PZFL1-UW R04CB05	F	1	1.5	4	90	0.4	○	○
	✓		BEHW1204PZFR1B-UW R04CB05	F	1	1.5	4	90	0.4	HS03185	○
		✓	BEHW1204PZFR2-UW R04CB05	F	2	1.5	4	90	0.4	HS03630	○
Full Length 90° 		✓	BEHW1204PZFR1 R04CB12	F	1	1.5	11	90	0.4	HS01810	○
		✓	BEHW1204PZFL1 R04CB12	F	1	1.5	11	90	0.4	○	○
	✓		BEHW1204PZFR1B R04CB12	F	1	1.5	11	90	0.4	HC03161	○

Inventory	Delivery Time	
Code	In stock, MANANOVA	max.1 week
○	Semi-standard, made to order	approx.5 weeks
C	Customized, made to order	approx.8 weeks

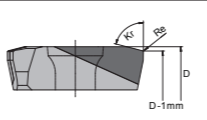
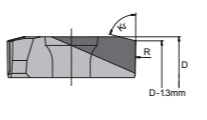
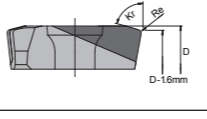
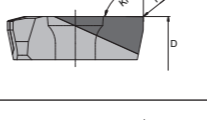
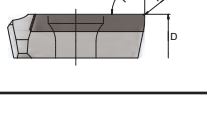
# BEHW PCD-tipped Milling Inserts for Heavy Duty Applications



PCD-tipped milling inserts with various angles, wipers and corner radii for face and shoulder milling applications with higher depth of cut and Si-content  $\geq 10\%$ .  
Please see page 27-29 for application recommendations.



Dimensions		
L (mm)	B (mm)	S (mm)
12.2	9.525	4.76

Figure	Cutter diameter		Specification	Cutting Edge	Dimensions					N	
	25 - 40 mm	>40 mm			Cutting Tips	BS (mm)	Ap Max (mm)	Kr (°)	Re (mm)	PD10E	PD32E
Standard 75° 		✓	BEHW1204EZTR1 R04CB08	T1	1	1	7	75	0.4	HC01763	○
	✓		BEHW1204EZTR1B R04CB08	T1	1	1	7	75	0.4	HC02636	○
Wiper 75° 		✓	BEHW1204EZTR1-WG C03CB08	T1	1	4	7	75	—	HC03136	○
	✓		BEHW1204EZTR1B-WG C03CB08	T1	1	4	7	75	—	HS05491	○
Corner 75° 		✓	BEHW1204EZTR1-PT R04CB08	T1	1	-	7	75	0.4	HC02508	○
	✓		BEHW1204EZTR1B-PT R04CB08	T1	1	-	7	75	0.4	HC14492	○
Universal 90° 		✓	BEHW1204PZTR1-UW R04CB08	T1	1	1.5	7	90	0.4	HC04256	○
		✓	BEHW1204PZTL1-UW R04CB08	T1	1	1.5	7	90	0.4	○	○
	✓		BEHW1204PZTR1B-UW R04CB08	T1	1	1.5	7	90	0.4	HC04156	○
Full Length 90° 		✓	BEHW1204PZTR1 R04CB12	T1	1	1	11	90	0.8	HC02296	○
		✓	BEHW1204PZTL1 R04CB12	T1	1	1	11	90	0.8	○	○
	✓		BEHW1204PZTR1B R04CB12	T1	1	1	11	90	0.8	HC14044	○

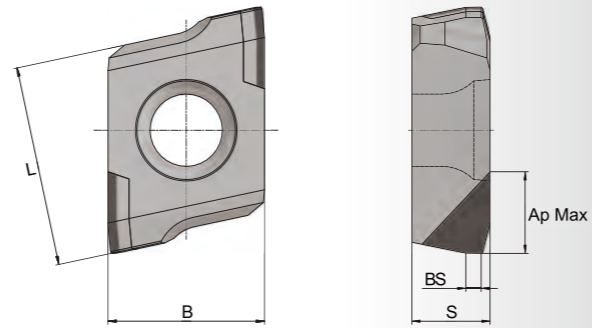
Inventory	Delivery Time	
Code	In stock, MANANOVA	max.1 week
○	Semi-standard, made to order	approx.5 weeks
C	Customized, made to order	approx.8 weeks



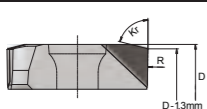
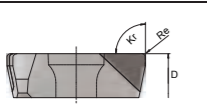
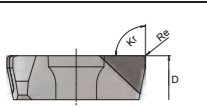
# BEHW PCBN-tipped Milling Inserts for Face and Shoulder Milling Applications



PCBN-tipped milling inserts with various angles, wipers and corner radii for face and shoulder milling applications of cast iron and hardened materials with higher depth of cut. Please see page 30 for application recommendations.



Dimensions		
L (mm)	B (mm)	S (mm)
12.2	9.525	4.76

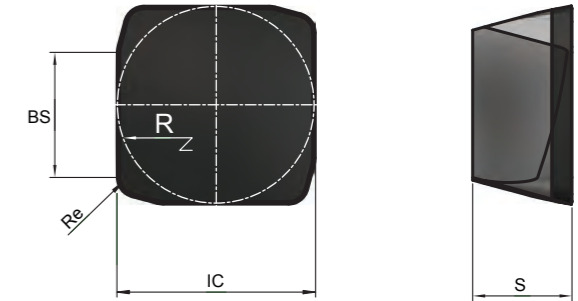
Figure	Cutter diameter		Specification	Cutting Edge	Dimensions					K	H
	25 - 40 mm	>40 mm			Cutting Tips	BS (mm)	Ap Max (mm)	Kr (°)	Re (mm)		
Wiper 75° 		✓	BEHW1204EZSR1-WG C03CB05	S8	1	4	0.5	75	—	○	○
	✓		BEHW1204EZSR1B-WG C03CB05	S8	1	4	0.5	75	—	○	○
		✓	BEHW1204EZSR2-WG C03CB05	S8	2	4	0.5	75	—	○	○
Universal 90° 		✓	BEHW1204PZSR1-UW R04CB05	S11	1	1.5	0.5	90	0.4	○	○
	✓		BEHW1204PZSR1B-UW R04CB05	S11	1	1.5	0.5	90	0.4	○	○
		✓	BEHW1204PZSR2-UW R04CB05	S11	2	1.5	0.5	90	0.4	○	○
Universal 90° 		✓	BEHW1204PZSR1-UW R08CB05	S11	1	1.5	0.5	90	0.8	○	○
	✓		BEHW1204PZSR1B-UW R08CB05	S11	1	1.5	0.5	90	0.8	○	○
		✓	BEHW1204PZSR2-UW R08CB05	S11	2	1.5	0.5	90	0.8	○	○

Inventory	Delivery Time
<b>Code</b> In stock, MANANOVA	max.1 week
○ Semi-standard, made to order	approx.5 weeks
<b>C</b> Customized, made to order	approx.8 weeks

# SDHN Full-Face PCBN Milling Inserts for Finish Face Milling Applications



PCBN full-face milling inserts with various angles and wipers for finish face milling of cast iron and hardened materials. Please see page 30 for application recommendations.



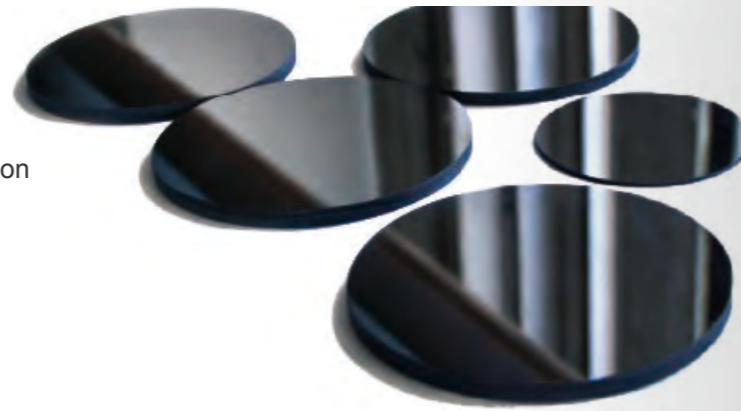
Dimensions	
IC (mm)	S (mm)
7.94	3.97

Figure	Specification	Cutting Edge	Dimensions				K
			Cutting Edges	BS (mm)	Ap Max (mm)	Re (mm)	
Corner Radius 	SDHN07T308	S12	4	-	0.5	0.8	PNK3003 HS09895
Standard 	SDHN07T3PPSR4	S12	4	1.5	0.5	0.8	HS09896
Universal 	SDHN07T3PPSR4-UW	S12	4	1.5	0.5	0.8	HS09897
Wiper 	SDHN07T3DPSR4-WG	S8	4	5	0.5	0.8	HS10976

Inventory	Delivery Time
<b>Code</b> In stock, MANANOVA	max.1 week
○ Semi-standard, made to order	approx.5 weeks
<b>C</b> Customized, made to order	approx.8 weeks

## WORLDIA® PCD Grades

Worldia's portfolio comprises of a variety of different PCD and CVD materials that will be selected based on your specific application requirements. Below grades are a selection that covers the most common applications.

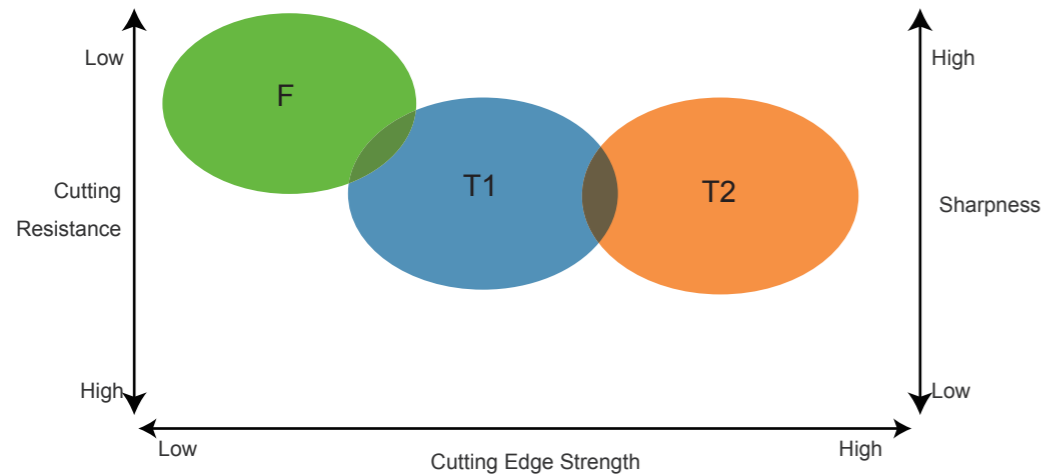


## Application Recommendations

### Grades

Workpiece Material	Grade	Grain size (µm)	Characteristics	Application
N	PD10E	10	PD10E is the universal grade in the market. It's the first choice for many applications where a good balance of toughness and wear resistance are required.	This grade is commonly used for non-ferrous finishing applications. Other successful applications include machining of wood, MDF, low-medium content silicon aluminium alloys, carbide, hard rubber, graphite and so on.
	PD32E	2~30	PD32E has a unique combination of wear resistance, edge strength and edge quality. It contains a carefully selected mix of micron diamond (between 2 - 30 µm). The combination of these particle sizes and a specifically developed high pressure sintering process produces a structure with extreme abrasion resistance and good thermal stability.	Application areas include the machining of abrasive workpieces such as MMC, high silicon aluminium alloys as well as machining of carbide, hard rubber, graphite and other materials.

### Cutting Edge

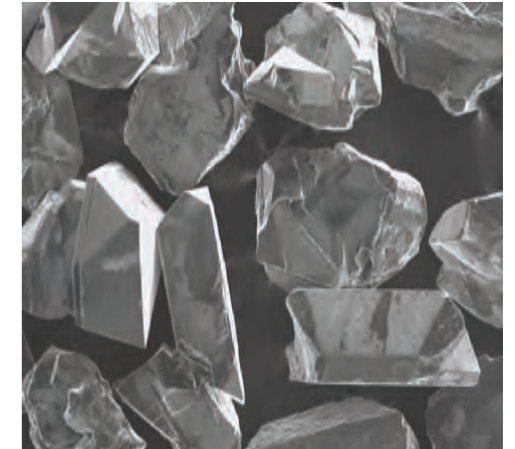


## WORLDIA® PCBN Grades

PCBN is considerably better abrasive resistant than tungsten carbide and ceramics. PCBN will not have any chemical reaction with ferrous material at 1200-1300 °C .

So PCBN material is unique for dry cutting ferrous material. The principal application areas for PCBN cutting tools are hardened steels, cast irons and sintered irons as well as powder metallurgy components.

Below grades are our recommendations for most milling applications. However, based on analysis of your specific requirements, we will suggest the most appropriate grade for your application from our comprehensive portfolio.



## Application Recommendations

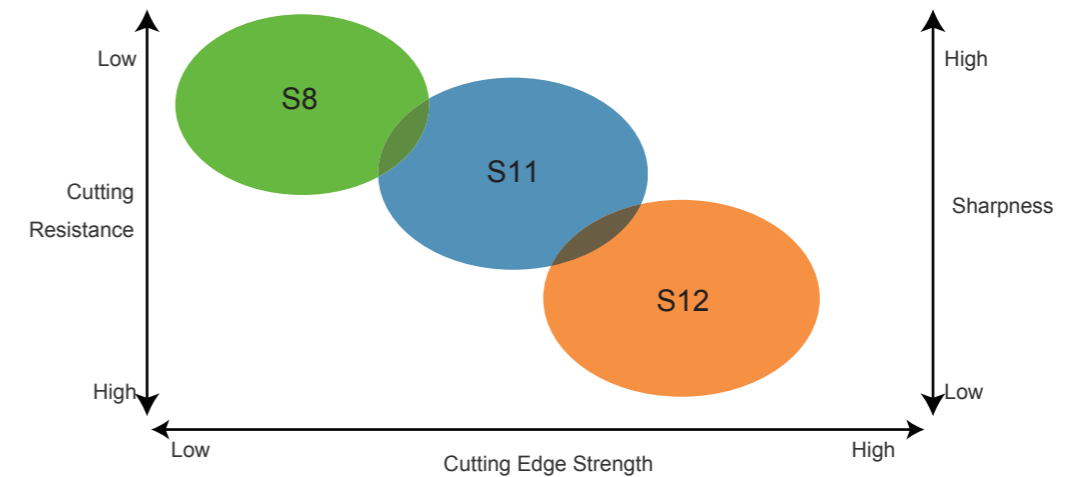
### Grades

Workpiece Material	Grade	Content %	Grain Size (µm)	Hardness	Characteristic	Application
K	PNK3003	90~95	1~3	3700~3900	Combination of wear resistance and impact resistance	Cast iron, sintered iron
H	PNH2019	65~70	1	2700~2900	Combination of wear resistance and impact resistance	Hardened steel

### Cutting Data Recommendations

PCBN Grade	Cutting Data Recommendations									
	Cutting Speed,vc (m/min)				Feed Rate,fn (mm/r)				Cutting Depth,AP (mm)	
PNK3003	300	600	800	1200	0.03	0.08	0.12	0.3	0.05	0.5
PNH2019	100	150	220	250	0.03	0.08	0.1	0.12	0.05	0.3

### Cutting Edge





## New Energy Vehicle Components


Figure	Processing conditions	Processing parameters		
	Workpiece: Motor end cover			
	Material: Aluminum alloy			
	Spindle: Single spindle			
	Maximum speed: 16000RPM			
	Adaptor: BT40			
	Surface finish: Ra1.25			
			Previous	Worldia
			Cutter	FMP100SB32-BE12-16
			Insert	BEHW1204PZFR1-UW 12 pcs BEHW1204EZFR1-WG 4 pcs
			Grade	PD10E
			Cutter diameter (mm)	φ100
			Number of teeth	6
			Cutting length (mm)	580
			Cutting speed (m/min)	2200
		Feed per tooth (mm/z)	0.1	
		Depth of cut (mm)	4.2	
		Milling time roughing (s)	7.73	
		Milling time finishing (s)	8.70	
		Total (s)	16.43	
		Productivity	4.7 X	


Figure	Processing conditions	Processing parameters		
	Workpiece: Gearbox housing for commercial vehicles			
	Material: Aluminum alloy			
	Spindle: Single spindle			
	Maximum speed: 16000RPM			
	Adaptor: BT50			
	Surface finish: Ra1.25			
			Previous	Worldia
			Cutter	Integral PCD Milling Cutter
			Insert	BEHW1204PZFR1-UW 10 pcs BEHW1204EZFR1-WG 2 pcs
			Grade	PD10E
			Cutter diameter (mm)	φ80
			Number of teeth	8
			Cutting length (mm)	960
			Cutting speed (m/min)	2010
		Feed per tooth (mm/z)	0.1	
		Depth of cut (mm)	4.5	
		Milling time roughing (s)	7.63	
		Milling time finishing (s)	9.60	
		Total (s)	17.23	
		Productivity	3 X	

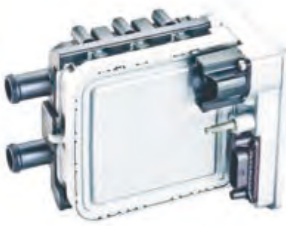
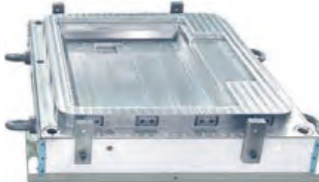

Figure	Processing conditions	Processing parameters		
	Workpiece: Integrate valve of heat pump			
	Material: Aluminum alloy			
	Spindle: Single spindle			
	Maximum speed: 16000RPM			
	Adaptor: BT40			
	Surface finish: Ra0.8			
			Previous	Worldia
			Cutter	FMP125SB40-BE12-20
			Insert	BEHW1204PZFR1-UW 16 pcs BEHW1204EZFR1-WG 4 pcs
			Grade	PD10E
			Cutter diameter (mm)	φ60
			Number of teeth	6
			Cutting length (mm)	440
			Cutting speed (m/min)	1320
		Feed per tooth (mm/z)	0.1	
		Depth of cut (mm)	Ap1=2 AP2=0.2	
		Milling time roughing (s)	6.60	
		Milling time finishing (s)	6.60	
		Total (s)	13.20	
		Productivity	8 X	

Figure	Processing conditions	Processing parameters		
	Workpiece: Battery compartment			
	Material: Aluminum alloy			
	Spindle: Single spindle			
	Maximum speed: 16000RPM			
	Adaptor: HSK63A			
	Surface finish: Ra2.5			
			Previous	Worldia
			Cutter	FMP080SA27-BE12-12
			Insert	BEHW1204PZFR1-UW 10 pcs BEHW1204EZFR1-WG 2 pcs
			Grade	PD10E
			Cutter diameter (mm)	φ80
			Number of teeth	8
			Cutting length (mm)	960
			Cutting speed (m/min)	2011
		Feed per tooth (mm/z)	0.1	
		Depth of cut (mm)	4.5	
		Milling time roughing (s)	7.63	
		Milling time finishing (s)	9.60	
		Total (s)	17.23	
		Productivity	3 X	

## New Energy Vehicle Components

Figure	Processing conditions	Processing parameters		
	Workpiece: ESC			
	Material: ADC12			
	Spindle: Single spindle			
	Maximum speed: 12000RPM			
	Adaptors: BT40			
	Surface finish: Ra0.8			
			Previous	Worldia
			Cutter	FMP100SB32-BE12-16
			Insert	BEHW1204PZFR1-UW 12 pcs BEHW1204EZFR1-WG 4 pcs
			Grade	PCD
			Cutter diameter (mm)	φ100
			Number of teeth	6
			Cutting length (mm)	580
			Cutting speed (m/min)	2042 (rough) 2199 (finish)
		Feed per tooth (mm/z)	0.12 (rough) 0.10 (finish)	
		Depth of cut (mm)	AP1=4 AP2=0.2	
		Milling time roughing (s)	7.73	
		Milling time finishing (s)	8.70	
		Total (s)	16.43	
		Productivity	4.7 X	

## Combustion Engine Components



Figure	Processing conditions	Processing parameters		
	Workpiece: Cylinder head			
	Material: ALSi10MgCu			
	Spindle: Single spindle			
	Maximum speed: 12000RPM			
	Adaptor: HSK63			
	Processing type: Surface milling			
	Processing time: 1			
	Surface finish: Ra3.2			
			Previous	Worldia
			Cutter	100B08RP90BG15C2WPM
			Cutter diameter (mm)	φ100
			Number of teeth	10
			Inserts	BGHXI 5L1 5PCTRHET
			Grade	PCD
		Cutting speed (m/min)	2513	
		Feed per tooth (mm/z)	0.088	
		Depth of cut (mm)	4	
		Tool life	1.6 X	

Figure	Processing conditions	Processing parameters		
	Workpiece: Cylinder block			
	Material: Aluminum alloy + gray cast iron			
	Spindle: Single spindle			
	Maximum speed: 12000RPM			
	Adaptor: HSK63			
	Processing type: Surface milling			
	Processing time: 1			
	Surface finish: Rt10			
			Previous	Worldia
			Cutter	EcoFeed 7-06200-01
			Cutter diameter (mm)	φ200
			Number of teeth	28
			Inserts	BEHW1204EZFR1
			Grade	PCD
		Cutting speed (m/min)	785	
		Feed per tooth (mm/z)	0.051	
		Depth of cut (mm)	0.5	
		Tool life	2.35 X	

## Other Vehicle Components


Figure	Processing conditions	Processing parameters		
	Workpiece: Cylinder head cover Material: AISi9Cu3 Spindle: Single spindle Maximum speed: 10000RPM Adaptor: BT40 Processing type: Surface milling Surface finish: Ra3.2			
			Previous	Worldia
		Cutter	FTP063R050A	FMP63SA22-BE12-10
		Cutter diameter (mm)	φ63	φ63
		Number of teeth	5	10
		Inserts	TMCPA01RRB5	BEHW1204EZTR1
		Grade	Alloy (rough) PCD (finish)	PD10E
		Cutting tips	2	
		Cutting speed (m/min)	1484	1682
		Feed per tooth (mm/z)	0.125	0.071
Depth of cut (mm)	Ap1=5 (alloy) AP2=1 (PCD)	6		
Tools life		1.2 X		

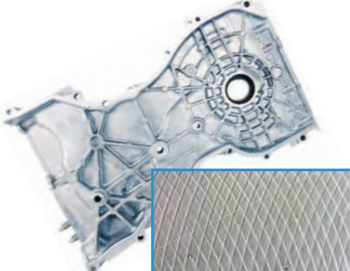



Figure	Processing conditions	Processing parameters		
	Workpiece: Timing chain housing cover Material: ADC12 Spindle: Single spindle Maximum speed: 12000 RPM Adaptor: BT40 Surface finish: RZ 8~20(gridline)			
			Worldia	
		Cutter	FMP63SA22-BE12-10	
		Inserts	BEHW1204PZFR1-UW 8 pcs BEHW1204EZFR1-PT 2 pcs	
		Grade	PD10E	
		Cutter diameter (mm)	63	
		Number of teeth	10	
		Cutting speed (m/min)	1188	
		Feed per tooth (mm/z)	0.1	
		Depth of cut(mm)	0.2	

Figure	Processing conditions	Processing parameters		
	Workpiece: Cylinder head Material: ALSi10MgCu Spindle: Single spindle Maximum speed: 16000RPM Machining process: Deck face rough milling Surface finish: Ra3.2 Small chips due to lasered chipbreaker, easy chip removal.			
			Worldia	
		Cutter	FMP125SB40-BE12-24	
		Inserts	BEHW1204PZTR1-CBR	
		Grade	PD10E	
		Cutter diameter (mm)	125	
		Number of teeth	24	
		Cutting speed (m/min)	1963 / 1571	
		Feed per tooth (mm/z)	0.058 / 0.072	
		Depth of cut (mm)	3.5	
				

## Cast Iron Components


Figure	Processing conditions	Processing parameters		
	Workpiece: Guideways Material: HT250 Spindle: Single spindle Maximum speed: 8000RPM Surface finish: Ra0.4 Hardness: HB180 Surface finish: Ra0.4 Processing time: 1			
			Previous	Worldia
		Cutter	CBN Milling cutter	FMP063SA2-BE12-08
		Cutter diameter (mm)	φ63	φ63
		Number of teeth	1	4
		Inserts	CBN cartridge	SDHN07T3PPSR4-UW
		Grade	CBN	PNK3003
		Cutting speed (m/min)	158	499
		Feed per tooth (mm/z)	0.25	0.08
		Depth of cut (mm)	0.2	0.2
Tool life		2.6 X		


Figure	Processing conditions	Processing parameters		
	Workpiece: Cylinder block Material: HT280 Adaptor: HSK100 Hardness: HB200-275 Processing : Bottom surface Processing type: Milling Processing time: 1 Surface finish: Ra3.2			
			Previous	Worldia
		Cutter	—	FMP160SB32-SD07-20
		Cutter diameter(mm)	φ160	φ160
		Number of teeth	17	16
		Inserts	Ceramic 14 pcs + PCBN wiper 3 pcs	SDHN07T3PPSR4-UW 12 pcs SDHN07T3PPSR4-WG 4 pcs
		Grade	CBN	PNK3003
		Cutting speed (m/min)	452	754
		Feed per tooth (mm/z)	0.099	0.063
		Depth of cut (mm)	0.5	0.5
Tool life		4.5 X		



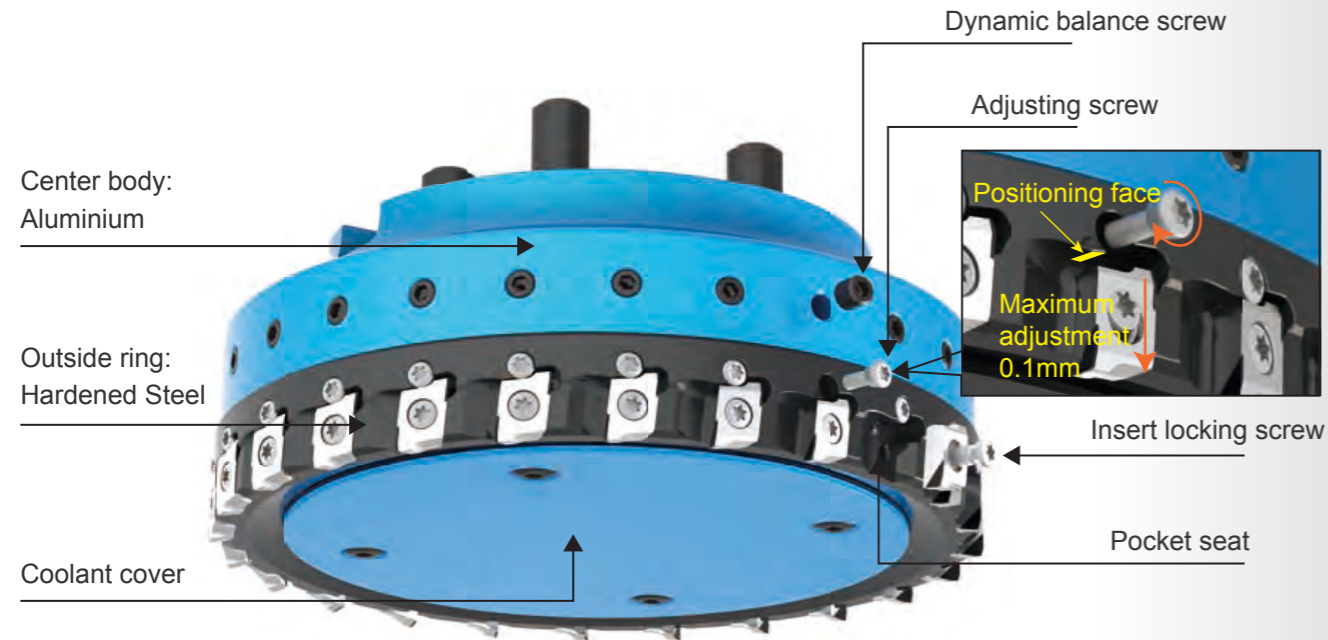
Figure	Processing conditions	Processing parameters		
	Workpiece: Cylinder block Material: HT300 Spindle: Single spindle Maximum speed: 6000RPM Adaptor: HSK100 Processing part: Front and rear Processing type: Milling Processing time: 2 Surface finish: Ra3.2			
			Previous	Worldia
		Cutter	—	FMP200SC60-SD07-24
		Cutter diameter (mm)	φ200	φ200
		Number of teeth	16	16
		Inserts	Ceramic 14 pcs + PCBN wiper 2 pcs	SDHN07T3PPSR4-UW 12 pcs SDHN07T3PPSR4-WG 4 pcs
		Grade	CBN	PNK3003
		Cutting speed (m/min)	628	754
		Feed per tooth (mm/z)	0.15 (rear) 0.144 (front)	0.167 (rear) 0.16 (front)
		Depth of cut (mm)	0.35/0.15 (rear) 0.25/0.25 (front)	0.35/0.15 (rear) 0.25/0.25 (front)
Cutting length (m)	1.8 (rear) 1 (front)	1.8 (rear) 1 (front)		
Tool life		2.5 X		

Figure	Processing conditions	Processing parameters		
	Workpiece: Pump body Material: QT500 Spindle: Single spindle Maximum speed: 8000RPM Adaptors: BT40 Processing type: Milling Processing time: 2 Surface finish: Ra1.6			
			Previous	Worldia
		Cutter	—	FMP125SB40-SD07-16
		Cutter diameter (mm)	φ125	φ125
		Number of teeth	1	5
		Inserts	APKT160408-1N (CBN)	SDHN07T3PPSR4-UW 4 pcs SDHN07T3ECSR4-WG 1 pcs
		Grade	CBN	PNK3003
		Cutting speed (m/min)	236	785
		Feed per tooth (mm/z)	0.083	0.038
		Depth of cut (mm)	0.5	0.5
Tool life		5 X		





### Assembly and Setting Instructions of PCD Milling Cutter

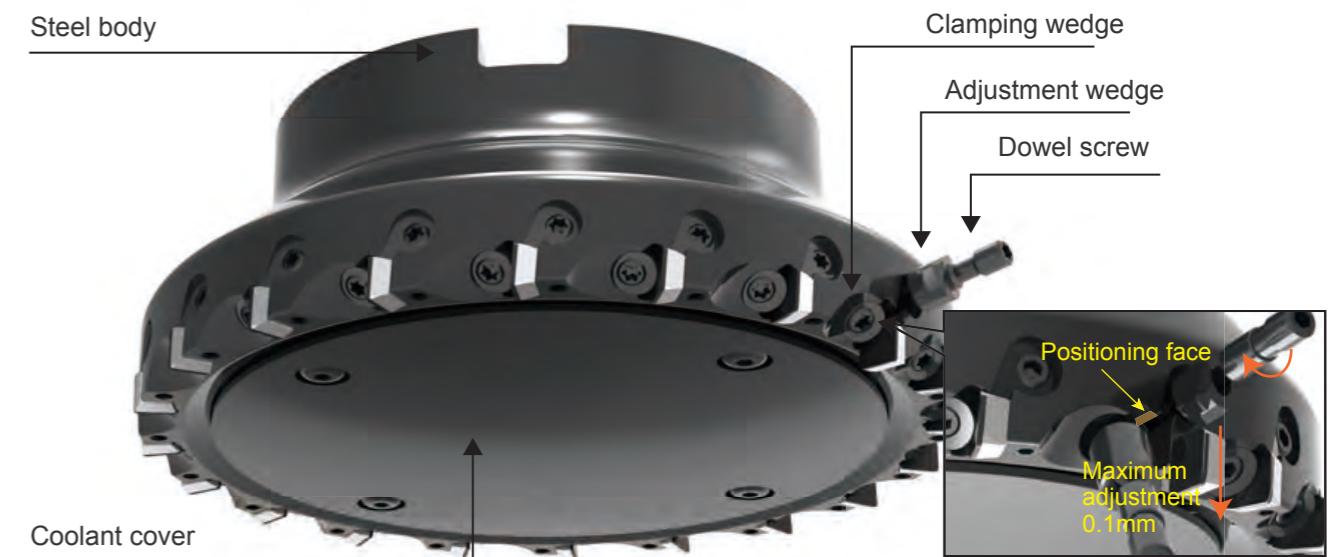
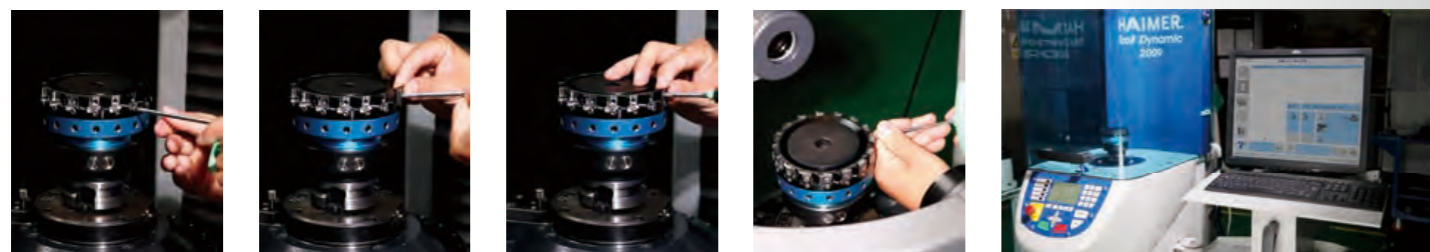
1. Fully unscrew (left-hand) the insert locking screw, and turn the adjusting screw to the left until the head stands out from the steel ring
2. Clean the insert and steel ring, then install the insert into the steel ring and confirm that the positioning face of the insert fits the pre-positioning face
3. Screw in (right-hand) locking screw and tighten to 2.5 Nm
4. Determine which insert is at the highest axial position, and the axial drop of all inserts is  $\leq 0.04$  mm
5. Turn (right-hand) the adjustment screw, adjust other inserts to move smoothly in the axial direction, and the maximum allowable axial runout error is  $2 \mu\text{m}$
6. Tighten the insert locking screw to 3.5 Nm, check again whether the axial runout of the insert is less than  $2 \mu\text{m}$ , if not, fine adjustment is necessary
7. If there is a combined insert, install the insert according to steps 1-5, adjust the position of the entire set to the required size, and the maximum allowable axial runout error of the insert is  $2 \mu\text{m}$

### Safety attention:

The cutter has been dynamically balanced before leaving the factory, thus the dynamic balance screw does not need to be adjusted. If you need to adjust the dynamic balance precisely after insert assembly, it is necessary to apply thread lock adhesives for protection!

Roughing: The screw should be replaced every fifth insert change

Finishing: The screw should be replaced every tenth insert change

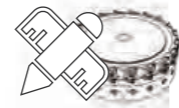


### Assembly and Setting Instructions of PCBN Milling Cutter

1. Left turn the screw to loosen the clamping wedge, then turn the dowel screw to the left to loosen the adjustment wedge
2. Install the insert into the cutter body, and confirm that the positioning face of the insert fits the pre-positioning face of the cutter body
3. (Pre-adjustment) Turn the screw to the right to drive the clamping wedge and tighten it to 0.5 Nm
4. (Pre-adjustment) Determine which insert is at the highest position in the insert axial direction
5. (Pre-adjustment) Drive the adjustment wedge to adjust the insert to move smoothly (observe the insert during the process, observe the axial, dimension, lead angle, step 3, 5), the maximum allowable axial runout error is  $5 \mu\text{m}$ , lead angle error is  $15'$
6. (Fine adjustment) Turn the screw to the right to drive the clamping wedge and tighten it to 5 Nm
7. (Fine adjustment) Determine which blade is at the highest position in axial direction
8. (Fine adjustment) Turn the screw to the right to drive the whole block to adjust the blade to move smoothly in axial direction, and the maximum allowable axial runout error is  $5 \mu\text{m}$
9. If there is a combined insert, install the insert according to steps 1-8, adjust the position of the entire set to the required size, and the maximum allowable axial runout error of the insert is  $2 \mu\text{m}$







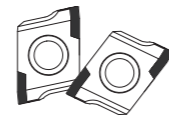
**Technology Consulting and Custom Tool Design**

After careful study of your requirements, our engineers suggest the most efficient cutting process and tools. If required, we design tools exactly to your needs.



**Tool Assembly and Setting**

If requested, we assemble the cutters with inserts and adjust them before delivery



**Insert Retipping and Relapping**

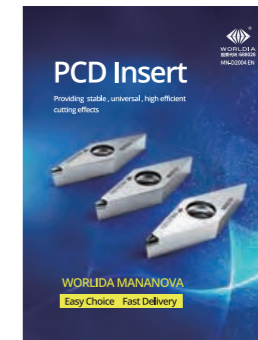
We offer retipping to same insert size and relapping at attractive conditions



01 Worldia Superhard Tools



02 Toolholders and Accessories



03 ManaNova PCD Inserts



04 ManaNova PCBN Inserts

