

# H

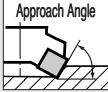





















# Indexable Endmills

H1 ~ H24



Selection Guide	"Wavemill" .....	H2 ~ 3
	According to Work Materials / Applications	
	"Wave Mill" <b>WEX</b> 2000 / 3000 <b>E/F</b> .....	H4 ~ 9
"Metal Slash" High Feed Multi-Function Mill	<b>New</b> <b>MSX</b> 06000/08000/12000/14000 <b>E/RS</b> .....	H8 ~11
"Wave Multi-Function Mill"	<b>WMM(H)</b> 2000 / 3000 .....	H12~13
"Wave Repeater Mill"	<b>WRM</b> 20 / 30 .....	H14~15
"Wave Mill" for Aluminium	<b>WAX</b> 3000 <b>E/RS</b> .....	H16~17
"Wave Ball-Mill" for Roughing	<b>WBMR</b> 2000 .....	H18~19
"Wave Ball-Mill" for Finishing	<b>WBMF</b> 1000 .....	H20~21
"Wave Radius Mill"	<b>New</b> <b>WRCX</b> 0800 / 1000 <b>E</b> .....	H22
SEC-Chamfering Endmill	<b>SCP</b> .....	H23

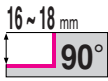
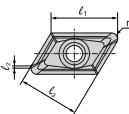
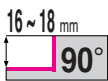

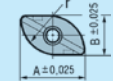

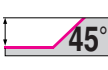
# Indexable Endmill Selection Guide

Application	Endmill Type	Series	Insert Type	Approach Angle Max. Depth of Cut (mm)	External Diameter (mm)	Application											Work Material						Ref. Page				
						General Purpose	Finishing	High Feed	Shoulder Milling	Slot Milling	Ramping	Copying	Chamfering	Boring	Finishing	Carbon Steel / Alloy Steel	Tempered Steel / Die Steel	Stainless Steel	Cast Iron / Ductile Cast Iron	Non-Ferrous Metal	Aluminium Alloy	Ti Alloy / Heat Resistant Alloy		Hardened Steel	HRC 45 ~ 55		
																											
Shoulder Milling	 WEX	WEX2000	AXMT123504PEER-G (WEX 2000 E/F)	 10 mm 90°	ø14 ~ ø63	○											◎	◎	◎	◎	◎	◎				H6 ~ H7	
		WEX3000		 14 mm 90°	ø25 ~ ø63													◎	◎	◎	◎	◎	◎				
	 WEX-F	WEX2000F	AXMT170508PEER-G (WEX 3000 E/F)	 10 mm 90°	ø40 ~ ø100	○												◎	◎	◎	◎	◎	◎				H6 ~ H7
		WEX3000F		 14 mm 90°	ø40 ~ ø100														◎	◎	◎	◎	◎	◎			
	 WRM-E	WRM 20E	APMT103504PDER-H APET 103504PDER-F 103504PDFR-S	 26 ~ 53 mm 90°	ø20 ~ ø40	○													◎	◎	◎	◎	◎				H15
		WRM 30E		 49 ~ 61 mm 90°	ø40 ~ ø50															◎	◎	◎	◎	◎			
 WRM-F	WRM 20F	APMT160508PDER-H APET 160508PDER-F 160508PDFR-S	 44 mm 90°	ø40	○													◎	◎	◎	◎	◎				H15	
	WRM 30F		 49 ~ 73 mm 90°	ø50 ~ ø80															◎	◎	◎	◎	◎				
Multi-Purpose	 WRCX <span>New</span>	WRCX08000 WRCX10000	QPMT 080330PPEN/H 10T335PPEN/H 120440PPEN/H 160660PPEN/H 200670PPEN/H QPET 10T350PPFR-S 120460PPFR-S 160680PPFR-S	 4 ~ 5 mm	ø12 ~ ø32	◎											◎	◎	◎	◎	◎					H22	
		WRCX12000RS WRCX16000RS WRCX20000RS		 6 ~ 10 mm	ø40 ~ ø160	◎													◎	◎	◎	◎	◎				G11
	 WMM(-H)	WMM(-H) 2000	APMT103504PDER-H APET 103504PDER-F 103504PDFR-S	 17 ~ 26 mm 90°	ø20 ~ ø25	◎													◎	◎	◎	◎	◎				H13
WMM(-H) 3000		APMT160508PDER-H APET 160508PDER-F 160508PDFR-S	 39 mm 90°	ø32 ~ ø40	◎														◎	◎	◎	◎	◎				H13
High Feed Milling	 MSX <span>New</span>	MSX06000 MSX08000 MSX12000 MSX14000	WDMT0603ZDTR (d=6,35) WDMT0804ZDTR (d=8,5) WDMT1205ZDTR (d=12) WDMT1406ZDTR (d=14)	 1,0 ~ 2,5 mm 20°	ø16 ~ ø63			○		○	○							◎	◎	◎	◎					H9	
		MSX08000RS MSX12000RS MSX14000RS		 1,5 ~ 2,5 mm 20°	ø40 ~ ø100															◎	◎	◎	◎				G12 H10

◎ : Best  
○ : Good

□ : Not recommended

# Indexable Endmill Selection Guide

Application	Endmill Type	Series	Insert Type	Approach Angle Max. Depth of Cut (mm)	External Diameter (mm)	Application													Work Material						Ref. Page			
						Face Milling			Shoulder Milling	Slot Milling	Ramping	Copying	Chamfering	Boring	Finishing	Carbon Steel / Alloy Steel	Tempered Steel / Die Steel	Stainless Steel	Cast Iron / Ductile Cast Iron	Non-Ferrous Metal	Aluminium Alloy	Ti Alloy / Heat Resistant Alloy	Hardened Steel HRC 45 ~ 55					
						General Purpose	Finishing	High Feed																P		M	K	N
Aluminium	WAX	WAX3000	AECT160404PEFRA		ø20 ~ ø40	○				◎	◎	◎	◎															H17
	WAX-RS	WAX3000RS			ø50 ~ ø125	○				◎	◎	◎	◎															
3D Profiling	WBMR	WBMR2000	ZNMT 1804100-C		R10 (ø20) ~ R25 (ø50)										◎	◎	◎	◎										H19
		WBMR2000L	2004100-S																									
	WBMF	WBMF1000	ZPGU 1551050		R5 (ø10) ~ R15 (ø30)										◎	◎	◎	◎										H21
Chamfering	SCP	SCP	SDMA 090308		ø8 ~ ø32																							H23

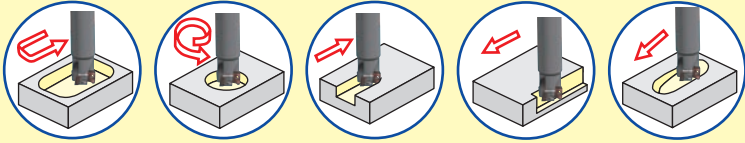
◎ : Best  
○ : Good  
□ : Not recommended

# Wavemill Series WEX Type

For the Smooth and Reliable Cutting Action



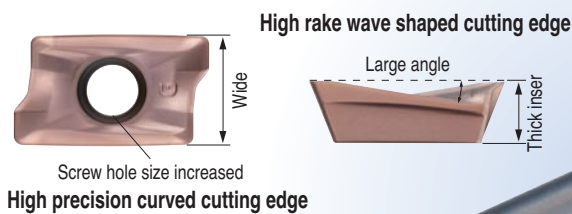
## Wide Application Range



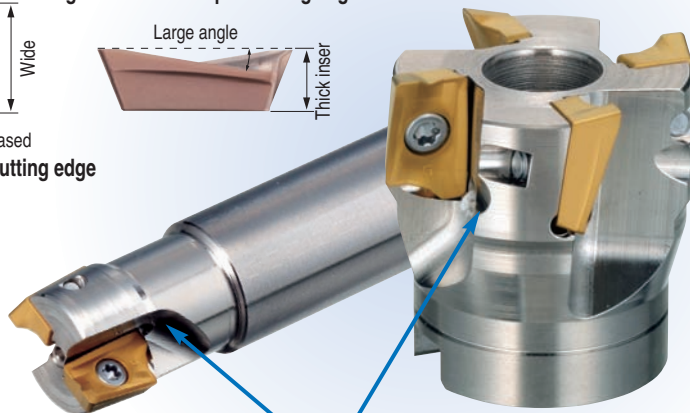
### General Features

Precision insert with strong cutting edge and low cutting force

- Wave shaped cutting edge lowers cutting force – improves edge strength
- High quality surface finish from precision tolerance cutting edge
- Smooth cutting action even when deep grooving
- Suitable for low rigidity machines



High precision curved cutting edge



Internal coolant hole

- Improves chip evacuation suitable for air or coolant

Wide variety of inserts

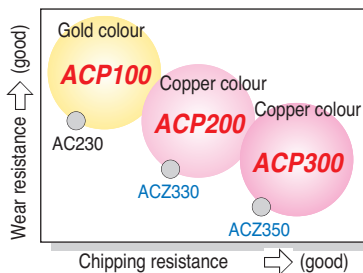
- 3 types of chipbreaker (L, G and H type)
- 5 new milling grades for wide application range
- Auroracoat DLC (diamond like carbon) anti weld coated inserts for Aluminium machining

Highly durable body

- Special surface treatment improves corrosion resistance and scratch resistance.
- Increased screw size improves clamping force and durability.

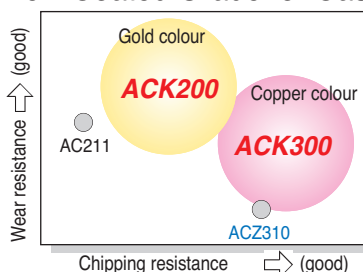
Indexable Endmills

### New Coated Grade for Steel



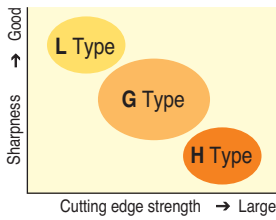
Steel (P), Stainless Steel (M)					Grade	Characteristic · Application
P 01	P 10 (M 10)	P 20 (M 20)	P 30 (M 30)	P 40 (M 40)	<b>ACP100</b>	Excellent wear and thermal crack resistance with new CVD coating contains fine grain Ti-based layer
General to high speed and wet cutting					<b>ACP200</b>	Excellent balance of wear and chipping resistance from new PVD coating with Cr on tough new carbide substrate
General grade for steel					<b>ACP300</b>	Excellent toughness from new PVD coating with Cr on extremely tough new carbide substrate
Very tough grade for steel						

### New Coated Grade for Cast Iron



Cast Iron (K) (GG, GGG)					Grade	Characteristic · Application
K 01	K 10	K 20	K 30	K 40	<b>ACK200</b>	Excellent wear resistance from fine Ti base and tough etc etc
General cutting					<b>ACK300</b>	Excellent toughness from fine grain carbide substrate and new PVD coating with added Cr improves hardness and resistance to oxidation
General to heavy cutting						

## Chipbreaker Selection Map

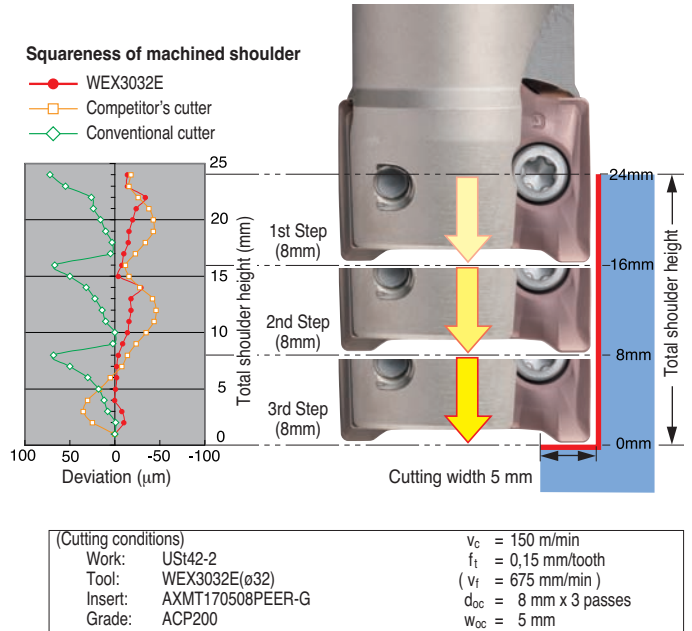


Work	Steel, Stainless Steel, Cast Iron		
Breaker	L Type	G Type	H Type
Feature	Low cutting force	General Purpose	Strong Edge
Figure			
Application	Light cut, low rigidity milling and less burr	General - Interrupted milling	Roughing, heavy interrupted and high hard material milling

## Cutting Performance

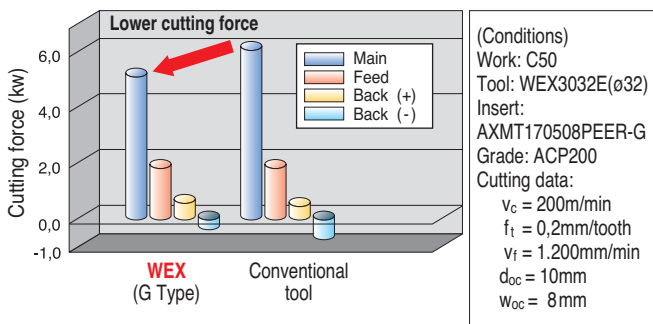
### 1 Shoulder Milling

Precision cutting edges double the accuracy of a 90 degree square shoulder reducing the usual step marks to just witness marks.



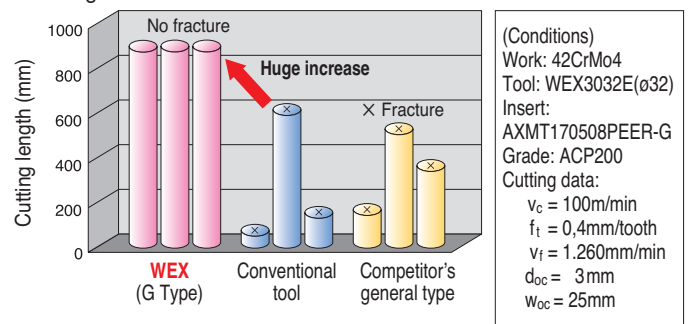
### 2 Cutting Force

Main Force is 15% lower than a conventional tool.



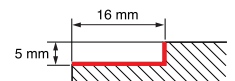
### 3 Fracture Resistance

Huge increase in fracture resistance with improved cutting edge strength.



## Recommended Cutting Conditions

Tool: WEX 3032 E (φ32)  
 Insert: AXMT170508PEER-G

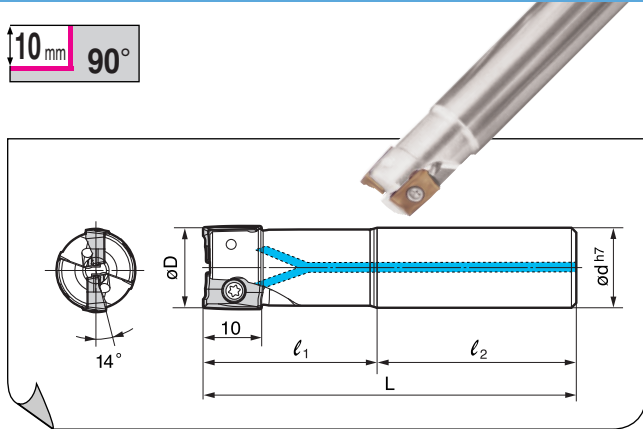


ISO	Material	HB	Geometry	Coated Carbide						"Diamond Like Carbon" Coated Carbide								
				ACP100		ACP200		ACP300		ACK200		ACK300		DL1000				
				0,12	0,25	0,35	0,12	0,25	0,35	0,12	0,25	0,35	0,12	0,25	0,35	0,05	0,12	0,25
P	Unalloyed steel, <0,15%C, annealed	125	G	400	370	350	370	350	330	350	330	310						
	" , <0,45%C, annealed	190	G	300	270	250	270	250	230	250	230	210						
	" , <0,45%C, tempered	250	G	250	220	200	220	200	180	200	180	160						
	" , <0,75%, annealed	270	G	200	170	150	180	160	140	160	140	120						
	" , <0,75%, tempered	300	G	150	120	100	120	100	80	100	80	60						
	Low alloyed steel , annealed	180	G	280	250	230	250	230	210	230	210	190						
	" , tempered	275	G	180	150	130	160	140	120	140	120	100						
	" , tempered	300	G	160	130	110	140	120	100	120	100	80						
	" , tempered	350	G	130	100	80	110	90	70	90	70	50						
	High alloyed and tool steel, annealed	200	G	250	220	200	220	200	180	200	180	160						
" , tempered	325	G	130	100	80	100	80	60	80	60	40							
M	Stainless steel, ferritic/martensitic, annealed	200	G	210	180	160	180	160	140	160	140	120						
	Martensitic, tempered	240	G	180	150	130	150	130	110	130	110	90						
	Austenitic, plunged	180	G	230	200	180	200	180	160	180	160	140						
K	Gray cast iron	180	G							300	270	250	270	250	230			
	Nodular cast iron	250	G							200	170	150	170	150	130			
S	High temperature resist. alloys, Fe base, annealed	200	G							50	30		50	30				
	" hardened	280	G							50	30		50	30				
N	Aluminium wrought alloy	60	S													1200	800	600
	Aluminium alloy < 12% Si	90	S													600	400	250

Indexable Endmills



# Wavemill Series WEX 2000E/EW Type



## Body (Short Type "E")

Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 2014 E	●	14	16	25	55	80	1
	WEX 2016 E	●	16	16	25	75	100	2
	WEX 2018 E		18	16	25	75	100	2
	WEX 2020 E	●	20	20	30	80	110	3
	WEX 2022 E		22	20	30	80	110	3
	WEX 2025 E	●	25	25	35	85	120	4
	WEX 2028 E		28	25	35	85	120	4
	WEX 2030 E		30	25	35	85	120	4
	WEX 2032 E	●	32	32	40	90	130	5
	WEX 2040 E		40	32	30	120	150	6
	WEX 2050 E		50	32	30	120	150	7
	WEX 2063 E		63	32	30	120	150	8

## Body (Long Type "EL")

Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 2014 EL	●	14	16	25	95	120	1
	WEX 2016 EL	●	16	16	25	120	145	2
	WEX 2018 EL		18	16	25	120	145	2
	WEX 2020 EL	●	20	20	40	110	150	2
	WEX 2022 EL		22	20	30	120	150	2
	WEX 2025 EL	●	25	25	50	120	170	2
	WEX 2030 EL		30	25	30	140	170	2
	WEX 2032 EL		32	32	60	120	180	2
	WEX 2040 EL		40	32	30	150	180	2

## Body (Long Type "EL" + Small Shank)

Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 2016 EL15	●	16	15	25	120	145	2
	WEX 2020 EL19	●	20	19	40	110	150	2
	WEX 2025 EL24	●	25	24	50	120	170	2

## Body (Weldon Shank Short Type)

Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 2016 EW	●	16	16	25	75	100	2
	WEX 2020 EW	●	20	20	30	80	110	3

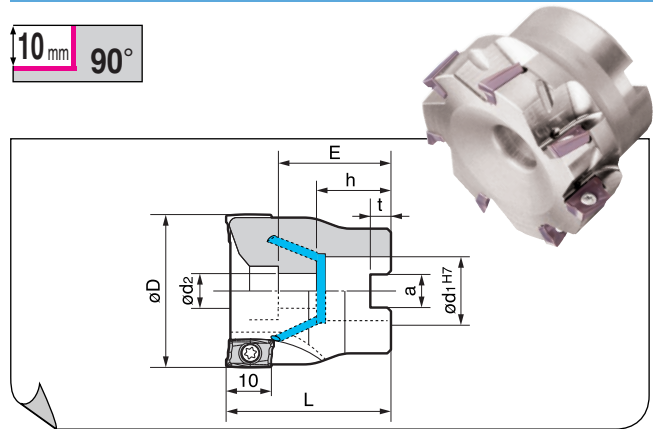
● = Euro stock

## Spare Parts

Screw	Wrench	Applicable endmill
BFTX 0305 IP BFTX 0306 IP	TRDR 08 IP	WEX 2014 ~ WEX 2018 WEX 2020 ~ WEX 2063

Anti-seizure cream SUMI-P included in the package.

# Wavemill Series WEX 2000F Type



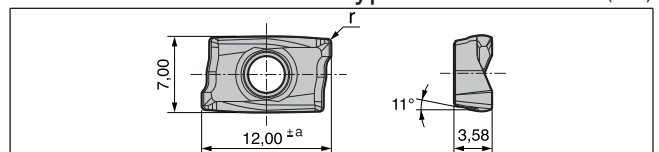
## Body (Shell Type "F")

Cat. No.	Stock	Dimensions(mm)										No. of teeth
		øD	ød <sub>1</sub>	ød <sub>2</sub>	a	t	L	E	h			
WEX 2040 F	●	40	16	9	8,4	5,6	40	28	18	6		
WEX 2050 F	●	50	22	11	10,4	6,3	40	26	20	7		
WEX 2063 F	●	63	22	11	10,4	6,3	40	26	20	8		
WEX 2080 F	●	80	27	13,5	12,4	7,0	50	31	25	10		
WEX 2100 F		100	32	32	14,4	8,5	50	32	26	12		

● = Euro stock

## Inserts for WEX 2000 Type

(mm)



Cat. No.	Coated Carbide					DLC Coated	Un-coated	Dimensions	
	ACP 100	ACP 200	ACP 300	ACK 200	ACK 300	DL 1000	H1	r	a
AXMT 123504 PEER-G	●	●	●	●	●			0,4	0,08
AXMT 123508 PEER-G	●	●	●	●	●			0,8	0,08
AXMT 123512 PEER-G	●	●	●	●	●			1,2	0,08
AXMT 123504 PEER-H	●	●	●	●	●			0,4	0,08
AXMT 123508 PEER-H	●	●	●	●	●			0,8	0,08
AXMT 123512 PEER-H	●	●	●	●	●			1,2	0,08
AXET 123502 PEFR-S						●	●	0,2	0,025
AXET 123504 PEFR-S						●	●	0,4	0,025
AXET 123508 PEFR-S						●	●	0,8	0,025

● = Euro stock

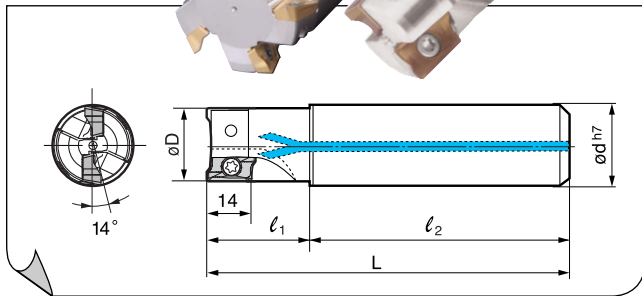
L : Low cutting force, G : General type, H : Strong edge, S : For Aluminum

## Spare Parts

Screw	Wrench	Applicable endmill
BFTX 0306 IP	TRDR 08 IP	WEX 2000 F

# Wavemill Series WEX 3000E/EW Type

14mm 90°



## Body (Short Type "E")

Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 3025 E	●	25	25	35	85	120	2
	WEX 3032 E	●	32	32	40	90	130	3
	WEX 3040 E	●	40	32	50	120	170	4
	WEX 3050 E	●	50	32	50	120	170	5
	WEX 3063 E	●	63	32	50	120	170	6

## Body (Long Type "EL")

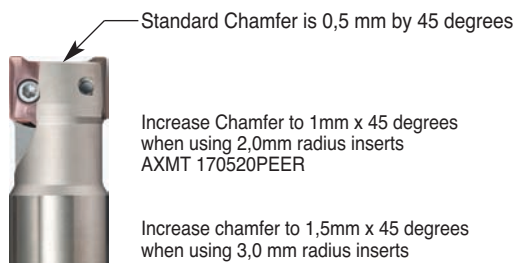
Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 3025 EL	●	25	25	50	120	170	2
	WEX 3030 EL	●	30	25	60	120	180	2
	WEX 3032 EL	●	32	32	60	120	180	2
	WEX 3040 EL	●	40	32	80	140	220	2

## Body (Weldon Shank Short Type)

Shank	Cat. No.	Stock	Dimensions(mm)					No. of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WEX 3025 EW	●	25	25	35	85	120	2
	WEX 3032 EW	●	32	32	40	90	130	3

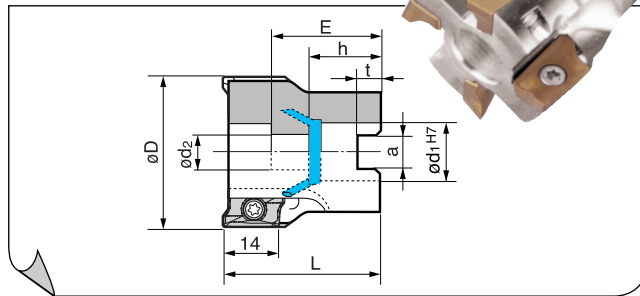
● = Euro stock

**\* ATTENTION:** If nose radius of inserts is 2,0 mm or more please modify cutter body as indicated.



# Wavemill Series WEX 3000F Type

14mm 90°



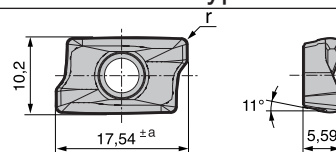
## Body (Shell Type "F")

Cat. No.	Stock	Dimensions(mm)								No. of teeth
		øD	ød <sub>1</sub>	ød <sub>2</sub>	a	t	L	E	h	
WEX 3040 F	●	40	16	9	8,4	5,6	40	28	18	4
WEX 3050 F	●	50	22	11	10,4	6,3	40	26	20	5
WEX 3063 F	●	63	22	11	10,4	6,3	40	26	20	6
WEX 3080 F	●	80	27	13,5	12,4	7,0	50	31	25	7
WEX 3100 F	●	100	32	32	14,4	8,5	50	32	26	8

● = Euro stock

## Inserts for WEX 3000 Type

(mm)



Cat. No.	Coated Carbide					DLC Coated	Un-Coated	Dimensions	
	ACP 100	ACP 200	ACP 300	ACK 200	ACK 300	DL 1000	H1	r	a
AXMT 170508 PEER-L	●	●	●	●	●			0,8	0,08
AXMT 170504 PEER-G	●	●	●	●	●			0,4	0,08
AXMT 170508 PEER-G	●	●	●	●	●			0,8	0,08
AXMT 170512 PEER-G	●	●	●	●	●			1,2	0,08
AXMT 170516 PEER-G*	●	●	●	●	●			1,6	0,08
AXMT 170520 PEER-G*	●	●	●	●	●			2,0	0,08
AXMT 170530 PEER-G	●	●	●	●	●			3,0	0,08
AXMT 170508 PEER-H	●	●	●	●	●			0,8	0,08
AXMT 170512 PEER-H		●	●					1,2	0,08
AXET 170502 PEFR-S						●	●	0,2	0,025
AXET 170504 PEFR-S						●	●	0,4	0,025
AXET 170508 PEFR-S						●	●	0,8	0,025

● = Euro stock

L : Low cutting force, G : General type, H : Strong edge, S : For Aluminum

## Spare Parts

Screw	Wrench	Applicable endmill
BFTX 0407 IP BFTX 0409 IP	TRDR 15 IP	WEX 3025 ~ WEX 3030 WEX 3032 ~ WEX 3063

Anti-seizure cream SUMI-P included in the package.

## Spare Parts

Screw	Wrench	Applicable endmill
BFTX 0409 IP	TRDR 15 IP	WEX3000 F

# "METAL SLASH MILL" MSX Type

Ultra High Feed

Boosts Productivity – Cuts Costs



## ■ Features

The Metal Slash Mill type MSX is a new multi function high shear milling cutter with ultra high feed capability suitable for face milling, slotting, plunging and helical boring. At 50GPa the ultra hard Super ZX coated inserts feature a sharp cutting edge which demonstrates extreme resistance to wear and heat massively boosting productivity and tool life.

The vibration free cutting action ensures accurate sizing, improved surface finish, and protection of the machine tool/workpiece from damage. Inserts are double clamped in wide chip gullets to maximise rigidity and chip evacuation with temperature at the cutting edge being easily controlled via an optional air blast through integral coolant holes. The MSX cutter is readily applied to general purpose machining across the P (steel) M (stainless) and K (cast iron) range of workpiece materials with impressive results.

## ■ Advantages

### Integral Coolant Hole

Otimised chip removal  
– massive chip  
avacuation pockets

### Durable Cutter Body

Special alloyed steel with  
hard surface

### Wide Application Range

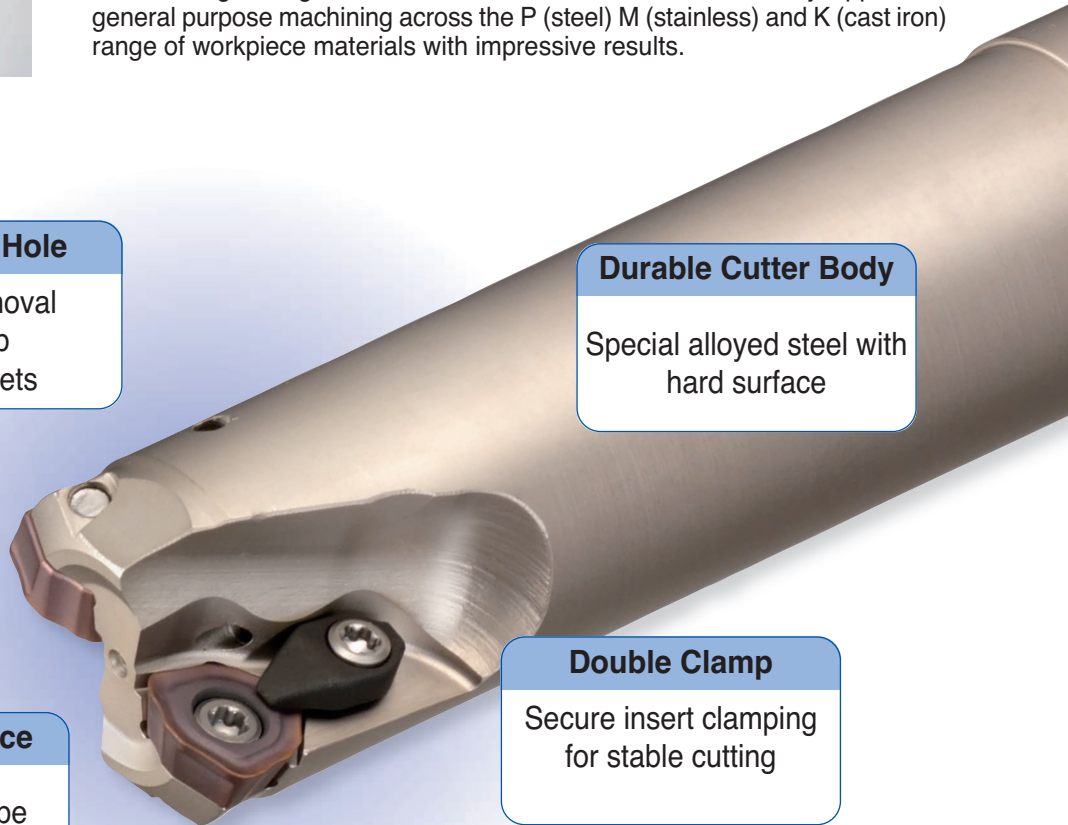
Face milling, slotting,  
helical boring  
and plunging

### Low Cutting Force

Unique insert shape  
reduces cutting force

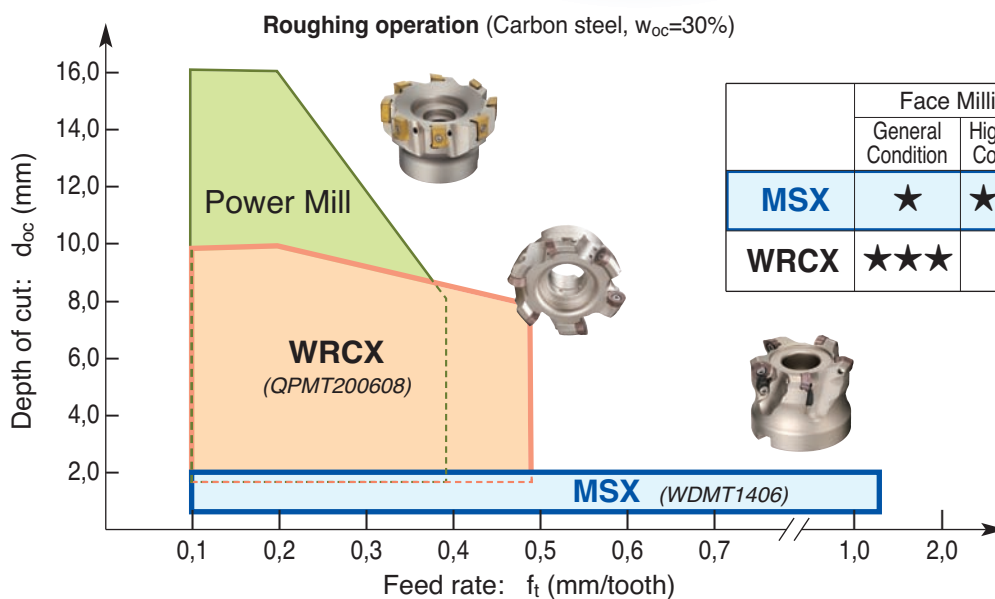
### Double Clamp

Secure insert clamping  
for stable cutting



Indexable  
Endmills

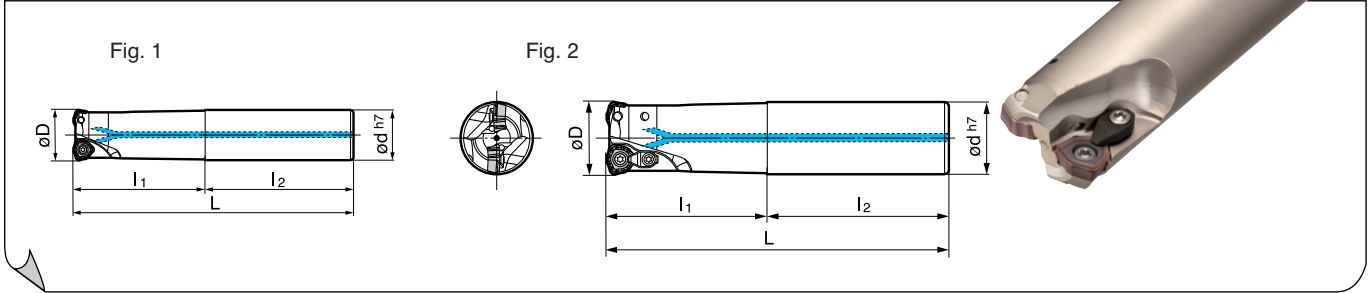
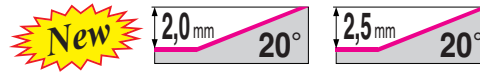
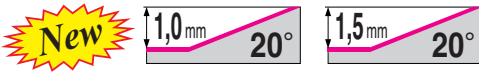
## ■ Application Range





# "METAL SLASH MILL" MSX 06000/08000 ES/EM/EW

# "METAL SLASH MILL" MSX 12000/14000 ES/EM/EW



## Body For insert type : WDMT 0603

Shank	Cat. No.	Stock	Dimensions (mm)					No. of teeth	Fig.
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L		
	MSX 06016 ES	○	16	16	30	80	110	2	1
	MSX 06016 EM	●	16	16	70	80	150	2	1
	MSX 06016 EM15	○	16	15	30	120	150	2	1
	MSX 06017 EM	○	17	16	20	130	150	2	1
	MSX 06018 EM	○	18	16	20	130	150	2	1
	MSX 06020 ES	●	20	20	50	80	130	3	1
	MSX 06020 EM	●	20	20	100	80	180	3	1
	MSX 06020 EM19	○	20	19	50	130	180	3	1
	MSX 06022 EM	○	22	20	30	150	180	3	1
	MSX 06025 ES	●	25	25	60	80	140	3	1
	MSX 06025 EM	●	25	25	120	130	250	3	1
	MSX 06025 EM24	○	25	24	60	190	250	3	1
	MSX 06020 EW	●	20	20	50	80	130	3	1
	MSX 06025 EW	●	25	25	60	80	140	3	1

## Body For insert type : WDMT 0804

Shank	Cat. No.	Stock	Dimensions (mm)					No. of teeth	Fig.
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L		
	MSX 08020 ES	●	20	20	50	80	130	2	1
	MSX 08020 EM	●	20	20	100	80	180	2	1
	MSX 08020 EM19	○	20	19	50	130	180	2	1
	MSX 08022 EM	○	22	20	30	150	180	2	1
	MSX 08025 ES	●	25	25	60	80	140	2	2
	MSX 08025 EM	●	25	25	120	130	250	2	2
	MSX 08025 EM24	○	25	24	60	190	250	2	2
	MSX 08028 EM	○	28	25	40	210	250	2	2
	MSX 08032 ES	○	32	32	70	80	150	3	2
	MSX 08032 EM	○	32	32	120	130	250	3	2
	MSX 08035 EM	○	35	32	50	200	250	3	2
		MSX 08020 EW	●	20	20	50	80	130	2
MSX 08025 EW		●	25	25	60	80	140	2	2
MSX 08032 EW		●	32	32	70	80	150	3	2

ES : Short type with cylindrical shank      ● = Euro stock  
EM : Long type with cylindrical shank      ○ = Stock item in Japan  
EW : Short type with Weldon shank

## Body For insert type : WDMT 1205

Shank	Cat. No.	Stock	Dimensions (mm)					No. of teeth	Fig.
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L		
	MSX12032ES	●	32	32	70	80	150	2	2
	MSX12032EM	●	32	32	120	130	250	2	2
	MSX12035EM	○	35	32	50	200	250	2	2
	MSX12040ES	○	40	32	50	100	150	3	2
	MSX12040EM	○	40	32	50	200	250	3	2
	MSX12050EM	○	50	42	50	200	250	4	2
		MSX12032EW	●	32	32	70	80	150	2

## Body For insert type : WDMT 1406

Shank	Cat. No.	Stock	Dimensions (mm)					No. of teeth	Fig.
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L		
	MSX14040ES	○	40	32	50	100	150	2	2
	MSX14040EM	○	40	32	50	200	250	2	2
	MSX14050ES	○	50	42	50	100	150	3	2
	MSX14050EM	○	50	42	50	200	250	3	2
	MSX14063ES	○	63	42	50	100	150	4	2
	MSX14063EM	○	63	42	50	200	250	4	2

ES : Short type with cylindrical shank      ● = Euro stock  
EM : Long type with cylindrical shank      ○ = Stock item in Japan  
EW : Short type with Weldon shank

## Inserts

Cat. No.	Coated Carbide			Dimensions (mm)			Max. d <sub>oc</sub>
	ACP200	ACP300	ACK300	ød	s	r	
WDMT 0603 ZDTR	●	●	●	6,35	2,0	1,5	1,0
WDMT 0603 ZDTR-H	●	●	●				
WDMT 0804 ZDTR	●	●	●	8,5	4,0	2,0	1,5
WDMT 0804 ZDTR-H	●	●	●				
WDMT 1205 ZDTR	●	●	●	12	5,0	2,0	2,0
WDMT 1205 ZDTR-H	●	●	●				
WDMT 1406 ZDTR	●	●	●	14	6,0	2,0	2,5
WDMT 1406 ZDTR-H	●	●	●				

ZDTR-H : Stronger cutting edge      ● = Euro stock  
○ = Stock item in Japan

## Spare Parts

Insert screw	Wrench	Clamp	C Ring	Cramp screw	Applicable endmill
BFTX 02505 IP	TRDR 08 IP	-	-	-	MSX 06000EO
BFTX 0306 IP	TRDR 08 IP	-	-	-	MSX 08020EO, MSX 08022EO
BFTX 0306 IP	TRDR 08 IP	CCH 3,5	CR 03	BFTX 03510 IP 08	MSX 08025EO, MSX 08028EO, MSX 08032EO, MSX 08035EO, MSX 08000RS
BFTX 0409 IP	TRDR 15 IP	CCH 3,5	CR 03	BFTX 03510 IP 08	MSX 12000EO, MSX 12000RS
BFTX 0511 IP	TRDR 20 IP	CCH 4,5	CR 03	BFTX 03510 IP 08	MSX 14000EO, MSX 14000RS

# "METAL SLASH MILL"

## MSX 08000/12000/14000 RS

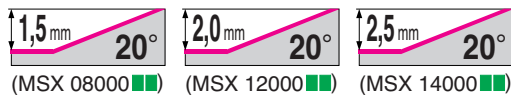


Fig. 1

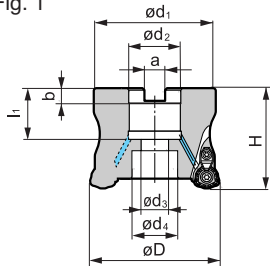
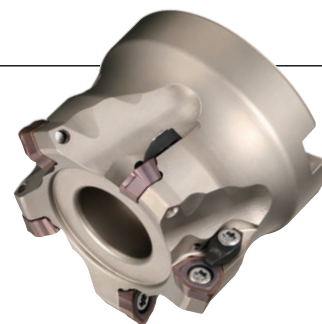
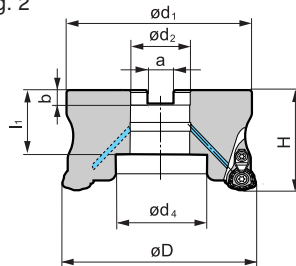


Fig. 2



### Body

Cat. No.	Stock	Dimensions (mm)			Mounting						No. of teeth	Weight (Kg)	Fig.	Applicable Insert
		$\phi D$	$\phi d_1$	H	a	b	$\phi d_2$	$\phi d_3$	$\phi d_4$	$l_1$				
MSX 08040 RS	●	40	37	45	8,4	5,6	16	9	13,5	18	4	0,2	1	WDMT 0804 ZDTR/H
MSX 12050 RS	●	50	47	50	10,4	6,3	22	11	18	20	4	0,3	1	WDMT 1205 ZDTR/H
MSX 12052 RS	●	52	47	50	10,4	6,3	22	11	18	20	4	0,3		
MSX 12063 RS	●	63	60	50	10,4	6,3	22	11	18	20	5	0,4		
MSX 12066 RS	●	66	60	63	12,4	7,0	27	13,5	20	25	5	0,4		
MSX 14050 RS	●	50	47	50	10,4	6,3	22	11	17	20	3	0,3	1	WDMT 1406 ZDTR/H
MSX 14063 RS	●	63	60	50	10,4	6,3	22	11	18	20	4	0,6		
MSX 14066 RS	●	66	60	63	12,4	7,0	27	13,5	20	25	4	0,7		
MSX 14080 RS	●	80	76	63	12,4	7,0	27	13,5	20	25	5	1,2		
MSX 14100 RS	●	100	96	63	14,4	8,5	32	-	44	32	6	1,8	2	

● = Euro stock

### Inserts

Cat. No.	Coated Carbide			Dimensions (mm)			Max. $d_{oc}$
	ACP200	ACP300	ACK300	$\phi d$	s	r	
WDMT 0804 ZDTR	●	●	●	8,5	4,0	2,0	1,5
WDMT 0804 ZDTR-H	●	●	●				
WDMT 1205 ZDTR	●	●	●	12	5,0	2,0	2,0
WDMT 1205 ZDTR-H	●	●	●				
WDMT 1406 ZDTR	●	●	●	14	6,0	2,0	2,5
WDMT 1406 ZDTR-H	●	●	●				

● = Euro stock

○ = Stock item in Japan

ZDTR-H : Stronger cutting edge

Class	Grade	P01	P10 (M10)	P20 (M20)	P30 (M30)	P40 (M40)	Characteristic · Application
P(Steel)	ACP200	<b>ACP200</b>					Super ZX ultra hard coated grade for general steels and die steels
M(Stainless)	ACP300	<b>ACP300</b>					Super ZX ultra hard coated grade for general steels and die steels
K(Cast iron)	ACK300	K01	K10	K20	K30	K40	Super ZX ultra hard coated grade with tough fine grain substrate for cast and ductile irons
		<b>ACK300</b>					

### Spare Parts

Insert screw	Wrench	Clamp	C Ring	Cramp screw	Applicable endmill
BFTX 0306 IP	TRDR 08 IP	CCH 3,5	CR 03	BFTX 03510 IP 08	MSX 08000RS
BFTX 0409 IP	TRDR 15 IP	CCH 3,5	CR 03	BFTX 03510 IP 08	MSX 12000RS
BFTX 0511 IP	TRDR 20 IP	CCH 4,5	CR 03	BFTX 03510 IP 08	MSX 14000RS

# "METAL SLASH MILL" MSX Type

## Recommended Cutting Conditions

Work Material	Coated Carbide Grade	Cutting Speed $v_c$ (m/min)	Insert Cat. No.	Endmill Type ( $\phi D$ )								Shell Type ( $\phi D$ )					
				$\phi 16$		$\phi 20$		$\phi 25$		$\phi 32$		$\phi 40$		$\phi 50\sim 66$		$\phi 80\sim 100$	
				$d_{oc}$ (mm)	Feed rate (mm/tooth)	$d_{oc}$ (mm)	Feed rate (mm/tooth)	$d_{oc}$ (mm)	Feed rate (mm/tooth)	$d_{oc}$ (mm)	Feed rate (mm/tooth)	$d_{oc}$ (mm)	Feed rate (mm/tooth)	$d_{oc}$ (mm)	Feed rate (mm/tooth)	$d_{oc}$ (mm)	Feed rate (mm/tooth)
General Steel (Below HB200)	ACP200	100-150-200	WDMT 0603	0,8	0,8	0,8	0,8	0,8	0,8	-	-	-	-	-	-	-	-
			WDMT 0804	-	-	1,0	1,0	1,0	1,2	1,0	1,2	-	-	-	-	-	-
			WDMT 1205	-	-	-	-	-	-	1,2	1,4	1,2	1,4	1,2	1,4	-	-
			WDMT 1406	-	-	-	-	-	-	-	-	1,5	1,5	1,5	1,5	1,5	1,5
Alloy Steel (Below HRC45)	ACP200	80-130-180	WDMT 0603	0,7	0,8	0,7	0,8	0,7	0,8	-	-	-	-	-	-	-	-
			WDMT 0804	-	-	0,8	1,0	0,8	1,2	0,8	1,2	-	-	-	-	-	-
			WDMT 1205	-	-	-	-	-	-	1,0	1,4	1,0	1,4	1,0	1,4	-	-
			WDMT 1406	-	-	-	-	-	-	-	-	1,3	1,5	1,3	1,5	1,3	1,5
Stainless Steel X5CRNI1810, Others	ACP300	80-120-150	WDMT 0603	0,8	0,7	0,8	0,7	0,8	0,7	-	-	-	-	-	-	-	-
			WDMT 0804	-	-	1,0	0,8	1,0	0,8	1,0	0,8	-	-	-	-	-	-
			WDMT 1205	-	-	-	-	-	-	1,2	1,2	1,2	1,2	1,2	1,2	-	-
			WDMT 1406	-	-	-	-	-	-	-	-	1,5	1,3	1,5	1,3	1,5	1,3
Cast Iron GG, GGG	ACK300	100-150-200	WDMT 0603	0,8	1,0	0,8	1,0	0,8	1,0	-	-	-	-	-	-	-	-
			WDMT 0804	-	-	1,0	1,2	1,0	1,4	1,0	1,4	-	-	-	-	-	-
			WDMT 1205	-	-	-	-	-	-	1,2	1,5	1,2	1,5	1,2	1,5	-	-
			WDMT 1406	-	-	-	-	-	-	-	-	1,5	1,8	1,5	1,8	1,5	1,8
Hardened Steel (Below HRC50)	ACK300	40-80-100	WDMT 0603	0,5	0,5	0,5	0,5	0,5	0,5	-	-	-	-	-	-	-	
			WDMT 0804	-	-	0,5	0,6	0,5	0,8	0,5	0,8	-	-	-	-	-	-
			WDMT 1205	-	-	-	-	-	-	0,6	1,0	0,6	1,0	0,6	1,0	-	-
			WDMT 1406	-	-	-	-	-	-	-	-	1,0	1,2	1,0	1,2	1,0	1,2

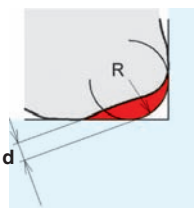
Insert Cat. No.	Max $d_{oc}$	r
WDMT 0603....	1,0	1,5
WDMT 0804....	1,5	2,0
WDMT 1205....	2,0	2,0
WDMT 1406....	2,5	2,0

- The above recommended cutting conditions may require adjustment according to machine rigidity and work rigidity. The above figures are guidelines for use with the BT50 machine tool.
- The above cutting conditions assume a tool overhang length of  $L/D=3$  (i.e. overhang length is 3 times tool diameter) or less. When tool overhang is **more than  $L/D=3$  and less than or equal  $L/D=5$** , settings should be adjusted to approximately **70 to 80%** of those indicated in the above cutting conditions (i.e.  $d_{oc}$  and Feed Rate). When tool overhang is **more than  $L/D=5$  and less than or equal  $L/D=8$** , settings should be adjusted to approximately **50 to 60%** of those indicated in the above cutting conditions (i.e.  $d_{oc}$  and Feed Rate).

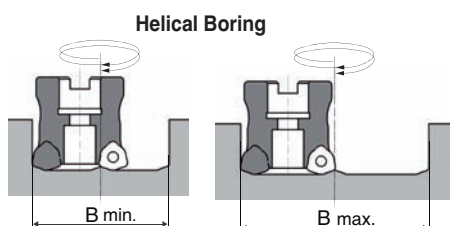
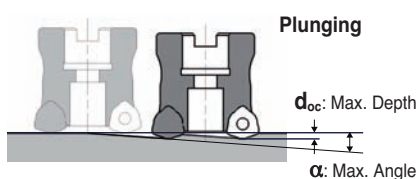
## Information for Programming

For machine programming, please use the theoretical corner radius (R) shown in the list.

Maximum depth (d) between theoretical radius and actual profile will be left on the finished surface, as shown below.

	Body	Insert	Theoretical Radius (R)	Remaining Depth (d)
	MSX 06000	WDMT 0603....	2,0	0,403
	MSX 08000	WDMT 0804....	2,5	0,593
	MSX 12000	WDMT 1205....	3,0	1,030
	MSX 14000	WDMT 1406....	3,5	1,219

## Plunging and Helical Boring



Cutter $\phi$	WDMT0603ZDTR			WDMT0804ZDTR			WDMT1205ZDTR			WDMT1406ZDTR		
	$d_{oc}$ : max 1,0			$d_{oc}$ : max 1,5			$d_{oc}$ : max 2,0			$d_{oc}$ : max 2,5		
	Plunging $\alpha$ max.	Helical boring min. $\phi B$	Helical boring max. $\phi B$	Plunging $\alpha$ max.	Helical boring min. $\phi B$	Helical boring max. $\phi B$	Plunging $\alpha$ max.	Helical boring min. $\phi B$	Helical boring max. $\phi B$	Plunging $\alpha$ max.	Helical boring min. $\phi B$	Helical boring max. $\phi B$
16	6°00'	21	31									
17	5°00'	23	33									
18	4°30'	25	35									
20	3°30'	29	39	7°30'	25	38						
22	3°00'	33	43	5°30'	29	42						
25				4°00'	35	48						
28				3°00'	41	54						
32				2°30'	49	62	6°30'	42	63			
35				2°00'	55	68	5°00'	48	69			
40							4°00'	58	79	6°00'	53	78
50							2°30'	78	99	3°30'	73	98
63										2°00'	99	124
80										1°30'	133	158
100										1°00'	173	198

# Wave Multi-Function Mill WMM Type



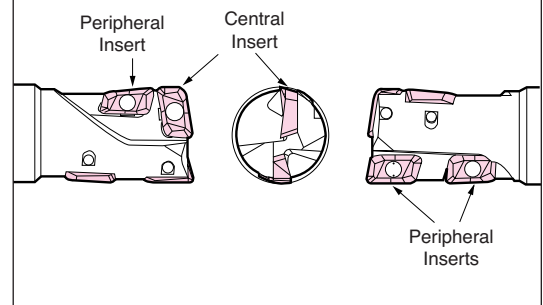
## ■ Features

Utilising some of the design features, which made the Wave-Mill so successful, this multi-functional cutter, which utilizes standard wavy shaped inserts mounted radially and axially, performs a variety of operations. These include slotting, shoulder milling, ramping, pocketing, drilling, helical cutting etc and eliminates the need to stock a variety of application specific tools.

## ■ Advantages

- Multi-functional cutter efficiently performs a number of cutting operations.
- Excellent for ramping, helical cutting, and pocketing.
- Uses standard inserts interchangeable with those used on other Wave-Mill cutters
- Strong high rake inserts gives smooth cutting action.
- Good dimensional stability thanks to long life inserts

## ● Insert orientation of WMM type cutter



## ■ Multi-purpose Applications

● Shoulder cutting	● Slotting	● Taper cutting
DIN X5CrNi810 Cutting of stainless steel tool 	GG25 Deep grooving can be performed easily. Easy chip removal 	C50 Capable of tapered recess cutting of a prepared hole 
Tool dia. : 25mm Insert : APMT103504PDER (Grade : ACZ350) $v_c = 200\text{m/min}$ , $f_t = 0,1\text{mm/tooth}$ Axial $d_{oc}$ : 15mm, Radial $w_{oc}$ : 25mm, Air blow	Tool dia. : 25mm Insert : APMT103504PDER (Grade : ACZ310) $v_c = 180\text{m/min}$ , $f_t = 0,12\text{mm/tooth}$ Axial $d_{oc}$ : 15mm, Radial $w_{oc}$ : 25mm, Air blow	Tool dia. : 25mm Insert : APMT103504PDER (Grade : ACZ310) $v_c = 180\text{m/min}$ , $f_t = 0,12\text{mm/tooth}$ Axial $d_{oc}$ : 15mm, Radial $w_{oc}$ : 25mm, Air blow
● Pocketing	● Drilling	● Helical cutting
C50 Capable of pocketing with continuous lateral feed from initial drilling or taper cutting process 	C50 Capable of easy chip removal and drilling without tool damage 	C50 Capable of large boring in diameter of 1,2-1,8 times the cutter diameter without prepared hole 
Tool dia. : 25mm Insert : APMT103504PDER (Grade : ACZ350) $v_c = 200\text{m/min}$ , $f_t = 0,1\text{mm/tooth}$ Axial $d_{oc}$ : 15mm, Radial $w_{oc}$ : 25mm Air blow	Tool dia. : 25mm Insert : APMT103504PDER (Grade : ACZ350) Bore size : 25mm, Depth : $d=15\text{mm}$ $v_c = 200\text{m/min}$ , $f = 0,1\text{mm/rev}$ Step feed : 0,5mm, Air blow	Tool dia. : 25mm Insert : APMT103504PDER (Grade : ACZ350) Bore size : 40mm, Depth : $d=30\text{mm}$ $v_c = 300\text{m/min}$ , $f = 0,1\text{mm/rev}$ Axial feed : $t=15\text{mm/pitch}$ , Air blow

## ■ Recommended Cutting Conditions for WMM(H) 2000

Material Type of milling $\phi D$ (mm)	Carbon steel (ex. C50)	Stainless steel (ex. 10CrNiS189)	Cast iron (ex. GG20)	Aluminium alloy
20 ~ 26	80-120-160	80-100-120	70-150-180	200-300-500
Shoulder milling	0,05-0,20	0,05-0,15	0,05-0,20	0,1-0,15-0,2
	0,05-0,12	0,05-0,10	0,05-0,12	0,05-0,10
	0,05-0,18	0,05-0,12	0,05-0,18	0,05-0,10
Grade	ACZ330	ACZ350	ACZ310	DL1000 (H1)

[ $v_c = \text{m/min}$ ,  $f_t = \text{mm/tooth}$ ] [min. - optimum - max.]

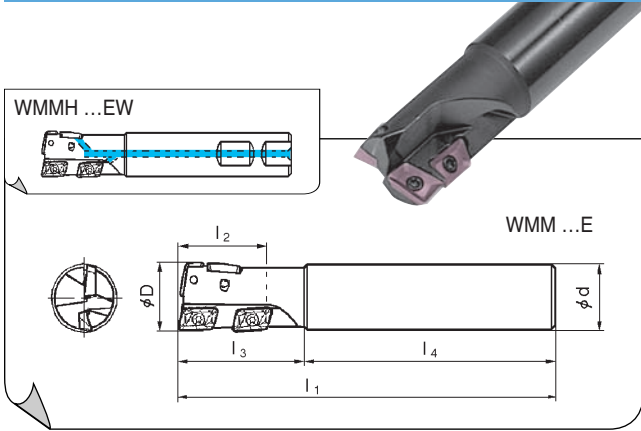
## ■ Recommended Cutting Conditions for WMM(H) 3000

Material Type of milling $\phi D$ (mm)	Carbon steel (ex. C50)	Stainless steel (ex. 10CrNiS189)	Cast iron (ex. GG20)	Aluminium alloy
32 ~ 40	80-120-160	80-100-120	70-150-180	200-300-500
Shoulder milling	0,05-0,25	0,05-0,20	0,05-0,25	0,1-0,15-0,2
	0,05-0,15	0,05-0,12	0,05-0,15	0,05-0,10
	0,05-0,20	0,05-0,18	0,05-0,20	0,05-0,10
Grade	ACZ330	ACZ350	ACZ310	DL1000 (H1)

[ $v_c = \text{m/min}$ ,  $f_t = \text{mm/tooth}$ ] [min. - optimum - max.]

# Wavemill Series

## WMM (H) 2000 <sup>E/EL</sup>/<sub>EW/ELW</sub> Type



### Body

Shank	Cat. No.	Stock	Dimensions(mm)						Total teeth	Effective teeth
			øD	ød	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>1</sub>		
	<b>WMM 2020E</b>	●	20	20	17	35	95	130	3	1
	<b>WMM 2025E</b>	●	25	25	26	40	100	140	4	1

(Long type)

	<b>WMM 2020EL</b>	●	20	20	17	60	125	185	3	1
	<b>WMM 2025EL</b>	●	25	25	26	75	145	220	4	1

(Weldon shank type)

	<b>WMM 2020EW</b>	●	20	20	17	35	95	130	3	1
	<b>WMM 2025EW</b>	●	25	25	26	40	100	140	4	1

(Long type with weldon shank)

	<b>WMM 2020ELW</b>	●	20	20	17	60	125	185	3	1
	<b>WMM 2025ELW</b>	●	25	25	26	75	145	220	4	1

(WMMH Standard type with coolant holes and weldon shank)

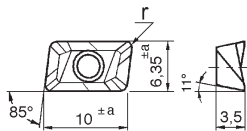
	<b>WMMH 2020EW</b>	●	20	20	17	35	95	130	3	1
	<b>WMMH 2025EW</b>	●	25	25	26	40	100	140	4	1

(WMMH Long type with coolant holes and weldon shank)

	<b>WMMH 2020ELW</b>	●	20	20	17	60	125	185	3	1
	<b>WMMH 2025ELW</b>	●	25	25	26	75	145	220	4	1

### Inserts for WMM 2000 Series

(mm)



Cat. No.	Coated			Diamond coated DL1000	Un-coated H1	Dimensions	
	ACZ310	ACZ330	ACZ350			r	a
<b>APMT 103504 PDER</b>	●	●	●	—	—	0,4	0,08
<b>APMT 103508 PDER</b>	●	●	●	—	—	0,8	0,08
<b>APMT 103512 PDER</b>	○	○	○	—	—	1,2	0,08
<b>APMT 103504 PDER-H</b>	●	●	●	—	—	0,4	0,08
<b>APMT 103508 PDER-H</b>	●	●	○	—	—	0,8	0,08
<b>APMT 103512 PDER-H</b>	○	●	○	—	—	1,2	0,08
<b>APET 103504 PDER-F</b>	●	●	●	—	—	0,4	0,025
<b>APET 103504 PDFR-S</b>	—	—	—	●	●	0,4	0,025

APMT... PDER

APMT... PDER-H

● = Euro stock

○ = Delivery on request



$$\theta_2 < \theta_1$$

$$L_2 > L_1$$

PDER-H : Stronger cutting edge

PDER-F : Ground insert for finishing

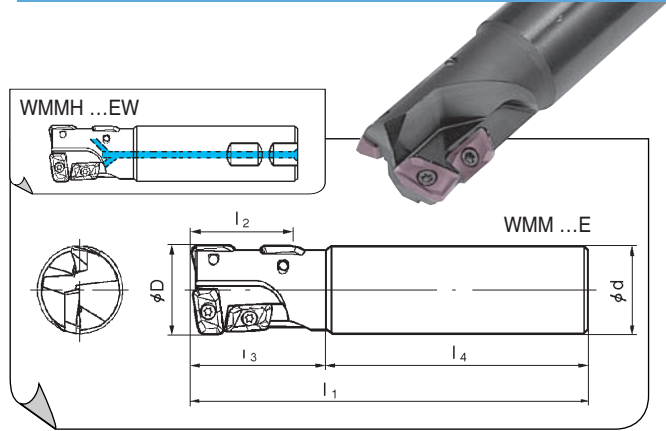
PDFR-S : Round honed sharp cutting edge for aluminium

### Spare Parts

Screw	Wrench
BFTX02506N	TRD08

# Wavemill Series

## WMM (H) 3000 <sup>E/EL</sup>/<sub>EW/ELW</sub> Type



### Body

Shank	Cat. No.	Stock	Dimensions(mm)						Total teeth	Effective teeth
			øD	ød	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>1</sub>		
	<b>WMM 3032E</b>	●	32	32	39	50	100	150	4	1
	<b>WMM 3040E</b>	●	40	32	39	55	105	160	4	1

(Long type)

	<b>WMM 3032EL</b>	●	32	32	39	90	140	230	4	1
	<b>WMM 3040EL</b>	●	40	32	39	55	185	230	4	1

(Weldon shank type)

	<b>WMM 3032EW</b>	●	32	32	39	50	100	150	4	1
	<b>WMM 3040EW</b>	●	40	32	39	55	105	160	4	1

(Long type with weldon shank)

	<b>WMM 3032ELW</b>	●	32	32	39	90	140	230	4	1
	<b>WMM 3040ELW</b>	●	40	32	39	55	185	230	4	1

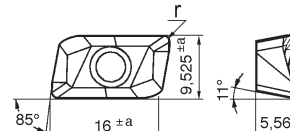
(WMMH Standard type with coolant holes and weldon shank)

	<b>WMMH 3032EW</b>	●	32	32	39	50	100	150	4	1
	<b>WMMH 3040EW</b>	●	40	32	39	55	105	160	4	1

(WMMH Long type with coolant holes and weldon shank)

	<b>WMMH 3032ELW</b>	●	32	32	39	90	140	230	4	1
	<b>WMMH 3040ELW</b>	●	40	32	39	55	185	230	4	1

### Inserts for WMM 3000 Series



Cat. No.	Coated			Diamond coated DL1000	Un-coated H1	Dimensions	
	ACZ310	ACZ330	ACZ350			r	a
<b>APMT 160508 PDER</b>	●	●	●	—	—	0,8	0,08
<b>APMT 160512 PDER</b>	○	○	○	—	—	1,2	0,08
<b>APMT 160516 PDER</b>	○	○	○	—	—	1,6	0,08
<b>APMT 160508 PDER-H</b>	●	●	●	—	—	0,8	0,08
<b>APMT 160512 PDER-H</b>	●	●	●	—	—	1,2	0,08
<b>APMT 160516 PDER-H</b>	○	●	○	—	—	1,6	0,08
<b>APMT 160520 PDER-H</b>	●	●	●	—	—	2,0	0,08
<b>APMT 160530 PDER-H</b>	●	●	●	—	—	3,0	0,08
<b>APMT 160540 PDER-H</b>	●	○	●	—	—	4,0	0,08
<b>APMT 160550 PDER-H</b>	●	○	●	—	—	5,0	0,08
<b>APMT 160560 PDER-H</b>	○	○	●	—	—	6,0	0,08
<b>APET 160508 PDER-F</b>	●	●	●	—	—	0,8	0,025
<b>APET 160504 PDFR-S</b>	—	—	—	●	●	0,4	0,025
<b>APET 160508 PDFR-S</b>	—	—	—	●	●	0,8	0,025

● = Euro stock

○ = Delivery on request

### Spare Parts

Screw	Wrench
BFTX03584	TRD15



● APET---S, uncoated grade "H1" for Aluminium



# Wave Repeater Mill WRM Type



## ■ Features

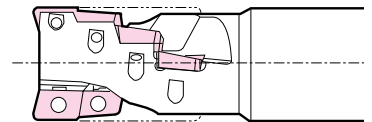
Complementing the already successful WaveMill range of milling cutters the WRM helical cutter is ideal for deep shoulder milling operations where smooth cutting, efficient metal removal, and extended tool life parameters are critical.

Using standard wave shaped inserts radially mounted in a zig zag arrangement to minimize harmonics, this cutter will efficiently remove metal at higher feed rates than conventional cutters thanks to its high shear cutting action.

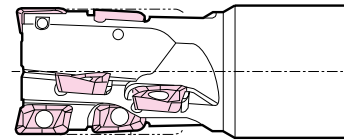
Impressive feed rates substantially reduce cycle times, whilst the long life inserts employed significantly reduce the tool operating costs.

## ■ Advantages

- Ideal for heavy roughing operations thanks to high shear cutting action and ultra hard inserts
- High shear cutting action means heavy roughing operations possible on low power machines
- Multi flute design provides high feed capability with good chip evacuation
- Uses standard WaveMill inserts
- Suitable for most workpiece materials



WRM 20-E type



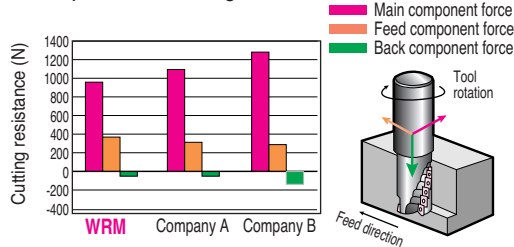
WRM 30-E type

## ■ Product Range

Type	Cutter diameter(mm)	Cutting edge length(mm)	Insert Type	Cutter Body
WRM20R-E	20 ~ 40	26 ~ 53	APMT103500	Shank type
WRM30R-E	40 ~ 50	49 ~ 61	APMT160500	Shank type
WRM30R-F	63 ~ 80	61 ~ 73	APMT160500	Shell type

## ■ Performance and Application Example

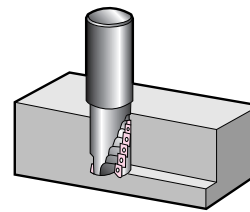
### ● Comparison of cutting resistance



Work material : C50  
Tool : WRM30R4049E-S42  
Insert : APMT160508PDER  
Grade : ACZ350

Cutting conditions  
 $v_c = 100$  m/min  
 $f_t = 0,05$  mm/tooth  
Depth of cut : 30 mm  
Width of cut : 10 mm  
Air Blow

### ● Shoulder cutting



#### <Results>

Superior performance in view of surface roughness & chip removal as compared to competitor's products. Cutting time is also reduced to 1/2 as our cutter cuts with one step with its long flute while competitor's perform 2 steps. ( $v_c=120$ m/min also possible.)

Machine used : MC horizontal type  
Work material : 42CrMo4  
Tool : WRM20R42026E-S20  
Insert : APMT103504PDER  
Grade : ACZ350

Cutting conditions  
 $v_c = 94$  m/min  
 $v_f = 120$  m/min  
 $f_t = 0,08$  mm/tooth  
Depth of cut : 23 mm  
Width of cut : 1,5 mm  
Wet

## ■ Recommended Cutting Conditions for WRM 20-R

Material	$\phi D$ (mm)		Carbon steel	Stainless steel	Cast iron	Aluminium
			(ex. C50)	(ex. 10CrNiS189)	(ex. GG20)	alloy
	20 ~ 25	$v_c$	50-120-180	50-100-160	50-120-180	200-300-500
		$f_t$	0,05-0,15	0,05-0,12	0,05-0,15	0,1-0,15-0,2
	32 ~ 40	$v_c$	50-120-180	50-100-160	50-120-180	200-300-500
		$f_t$	0,05-0,15	0,05-0,12	0,05-0,20	0,1-0,15-0,2
Grade			ACZ330	ACZ350	ACZ310	DL1000 (H1)

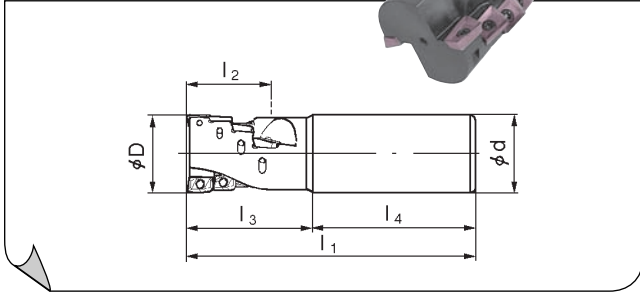
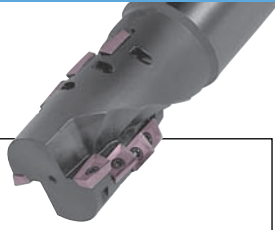
[ $v_c$  =m/min,  $f_t$  =mm/tooth] [min.– optimum – max.]

## ■ Recommended Cutting Conditions for WRM 30-R

Material	$\phi D$ (mm)		Carbon steel	Stainless steel	Cast iron	Aluminium
			(ex. C50)	(ex. 10CrNiS189)	(ex. GG20)	alloy
	40 ~ 80	$v_c$	50-120-180	50-100-160	50-120-180	200-300-500
		$f_t$	0,05-0,22	0,05-0,15	0,05-0,25	0,1-0,15-0,2
Grade			ACZ330	ACZ350	ACZ310	DL1000 (H1)

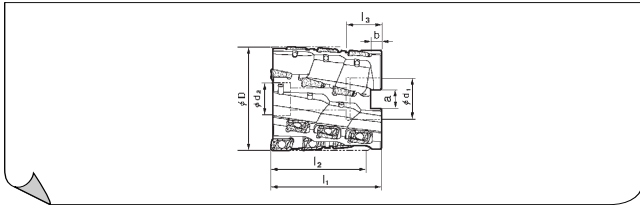
[ $v_c$  =m/min,  $f_t$  =mm/tooth] [min.– optimum – max.]

# Wavemill Series WRM 20 E/F Type



## Body (WRM 20-E shank type)

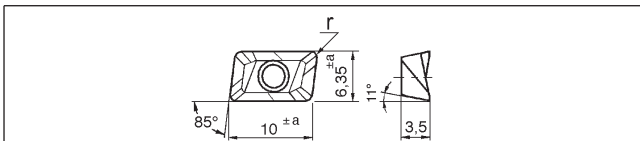
Cat. No.	Stock	Dimensions(mm)						Total teeth	Effective teeth
		$\phi D$	$\phi d$	$l_2$	$l_3$	$l_4$	$l_1$		
WRM 20R 2026E-S20	●	20	20	26	35	85	120	4	1
WRM 20R 2535E-S25	●	25	25	35	45	85	130	8	2
WRM 20R 3244E-S32	●	32	32	44	55	85	140	10	2
WRM 20R 4053E-S40	●	40	40	53	65	85	150	14	2



## Body (WRM 20-F shell type)

Cat. No.	Stock	Dimensions(mm)								Total teeth	Effective teeth
		$\phi D$	$\phi d_1$	$\phi d_2$	a	b	$l_1$	$l_2$	$l_3$		
WRM 20R 4044F-16	○	40	16	14	8.4	5.6	50	44	20	20	2

## Inserts for WRM 20 Series



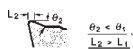
Cat. No.	Coated			Diamond coated DL1000	Un-coated H1	Dimensions	
	ACZ310	ACZ330	ACZ350			r	a
APMT 103504 PDER	●	●	●	-	-	0,4	0,08
APMT 103508 PDER	●	●	●	-	-	0,8	0,08
APMT 103512 PDER	○	○	○	-	-	1,2	0,08
APMT 103504 PDER-H	●	●	●	-	-	0,4	0,08
APMT 103508 PDER-H	●	●	○	-	-	0,8	0,08
APMT 103512 PDER-H	○	●	○	-	-	1,2	0,08
APET 103504 PDER-F	●	●	●	-	-	0,4	0,025
APET 103504 PDFR-S	-	-	-	●	●	0,4	0,025

APMT... PDER

APMT... PDER-H

● = Euro stock

○ = Delivery on request



PDER-H : Stronger cutting edge  
 PDER-F : Ground insert for finishing  
 PDFR-S : Round honed sharp cutting edge for aluminium

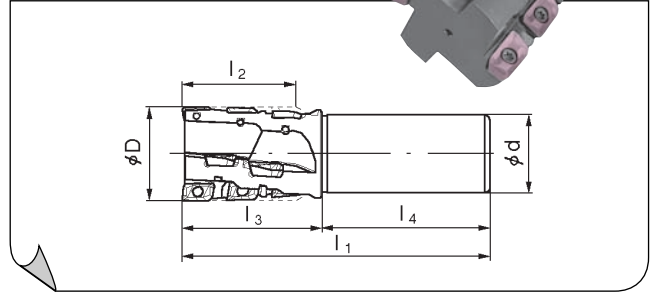
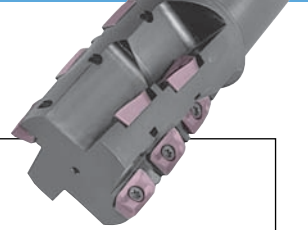
## Spare Parts

Screw	Wrench
BFTX02506N	TRD08



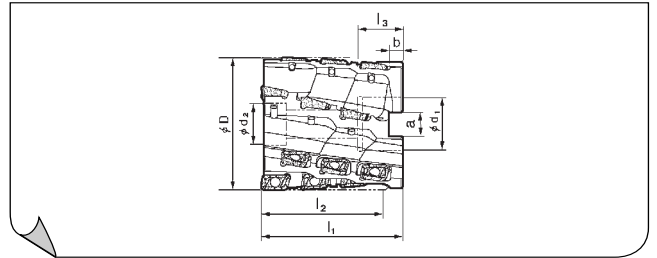
● APET... S, uncoated grade "H1" for Aluminium

# Wavemill Series WRM 30 E/F Type



## Body (WRM 30-E shank type)

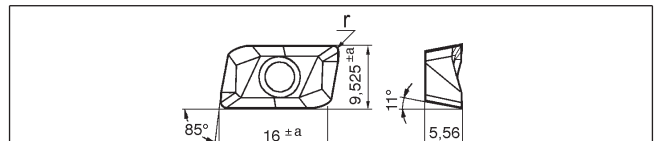
Cat. No.	Stock	Dimensions(mm)						Total teeth	Effective teeth
		$\phi D$	$\phi d$	$l_2$	$l_3$	$l_4$	$l_1$		
WRM 30R 4049E-S40	●	40	40	49	65	85	150	8	2
WRM 30R 5061E-S40	●	50	40	61	75	90	165	10	2



## Body (WRM 30-F shell type)

Cat. No.	Stock	Dimensions(mm)								Total teeth	Effective teeth
		$\phi D$	$\phi d_1$	$\phi d_2$	a	b	$l_1$	$l_2$	$l_3$		
WRM 30R 5049F-22	○	50	22	18	10,4	7	59	49	20	8	2
WRM 30R 6361F-27	●	63	27	20	12,4	7	70	61	23	10	2
WRM 30R 8073F-32	●	80	32	25	14,4	8	85	73	27	18	3

## Inserts for WRM 30 Series



Cat. No.	Coated			Diamond coated DL1000	Un-coated H1	Dimensions	
	ACZ310	ACZ330	ACZ350			r	a
APMT 160508 PDER	●	●	●	-	-	0,8	0,08
APMT 160512 PDER	○	○	○	-	-	1,2	0,08
APMT 160516 PDER	○	○	○	-	-	1,6	0,08
APMT 160508 PDER-H	●	●	●	-	-	0,8	0,08
APMT 160512 PDER-H	●	●	●	-	-	1,2	0,08
APMT 160516 PDER-H	○	●	●	-	-	1,6	0,08
APMT 160520 PDER-H	●	●	●	-	-	2,0	0,08
APMT 160530 PDER-H	●	●	●	-	-	3,0	0,08
APMT 160540 PDER-H	●	○	●	-	-	4,0	0,08
APMT 160550 PDER-H	●	○	●	-	-	5,0	0,08
APMT 160560 PDER-H	○	○	●	-	-	6,0	0,08
APET 160508 PDER-F	●	●	●	-	-	0,8	0,025
APET 160504 PDFR-S	-	-	-	●	●	0,4	0,025
APET 160508 PDFR-S	-	-	-	●	●	0,8	0,025

● = Euro stock

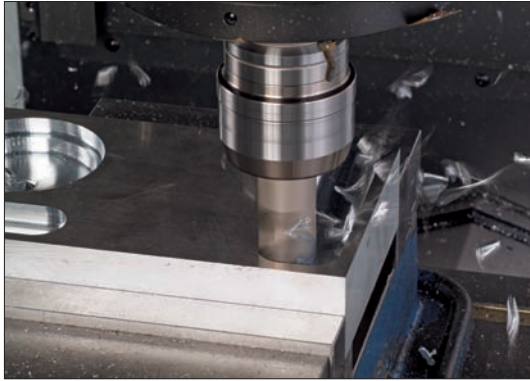
○ = Delivery on request

## Spare Parts

Screw	Wrench	Applicable endmill
BFTX03584 BFTX03588	TRD15	$\phi D = 40$ (mm) $\phi D = 50-80$ (mm)

# Wavemill Series WAX Type

For the Smooth and Reliable Cutting Action for Aluminium

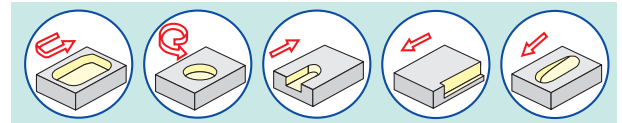


## Overview

Based on our proven Wavemill design this new range of WAX cutters is capable of rough and finishing Aluminium Alloys and other Non Ferrous Metals. It is ideal for high productivity Aluminium machining to exacting tolerances in the Aircraft, Electronics, and Automotive industries. The award winning Auroracoat DLC (diamond like carbon) inserts resist chip adhesion and substantially increase both tool life and productivity when dry machining Aluminium helping customers boost compliance with ISO14001 accreditation standards

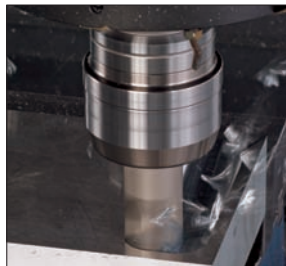
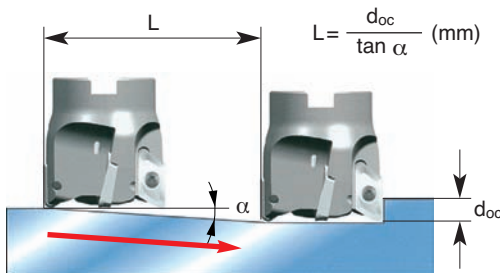
## Advantages

- High Productivity
- Dry machining capability with MQL system
- DLC (diamond like carbon) inserts
- True 90 degree shoulder milling
- Chip adhesion resistance
- Wide range of nose radius



## Ramping (Slant Milling)

Maximum ramping angle ( $\alpha_{max. max.}$ ) depends on cutter diameter.  
Minimum milling length ( $L_{min}$ ) is the ramping distance required to reach the maximum cutting depth ( $d_{oc max}$ ) at the maximum ramping angle of that cutter.  
Minimum milling length ( $L$ ) for any depth can be calculated by the equation below:



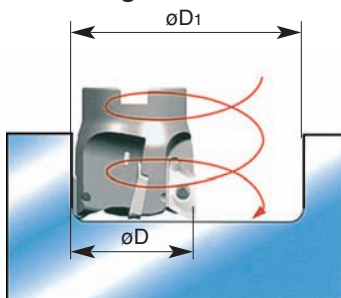
## WAX3000 E/EL Type

Cutter diameter $\phi D$	Ramping angle $\alpha_{max.}$	Depth-of cut $d_{oc max.}$	Milling Distance L min.
20	8°	10	72
25	17°	10	33
32	12°	10	47
40	9°	10	64

## WAX3000 RS Type

Cutter diameter $\phi D$	Ramping angle $\alpha_{max.}$	Depth-of cut $d_{oc max.}$	Milling Distance L min.
50	7°	10	82
60	5°	10	115
80	3°	10	191
100	3°	10	191
125	2°	10	287

## Helical Milling



## Helical Milling Diameter

Cutter diameter $\phi D$	Milling diameter $\phi D_1$	
	Min.	Max.
20	22	33
25	29	43
32	43	57
40	59	73
50	79	93
63	105	119
80	139	153
100	179	193
125	229	243

## Maximum Allowable Spindle Speed

Cutter diameter $\phi D$	Spindle revolution n ( $min^{-1}$ )	Cutting speed $v_c$ (m/min)
20	14.000	880
25	29.000	2.200
32	25.000	2.500
40	23.000	2.900
50	20.000	3.100
63	18.000	3.500
80	16.000	4.000
100	14.000	4.400
125	13.000	5.100

## Recommended Cutting Conditions

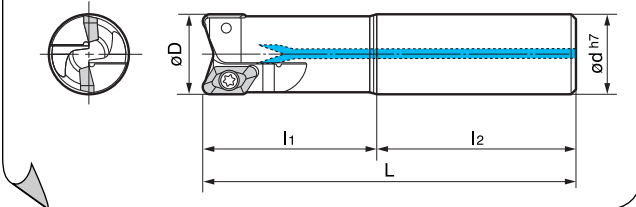
Work material	Aluminum alloy
Cutting speed	600 ~ 1.200 m/min
Feed rate	0,05 ~ 0,25 mm/tooth

# Wavemill Series WAX 3000E/EL Type

16-18 mm 90°

(Endmill)

Short Type "E"  
Long Type "EL"



■ Body (For inserts with nose radius 3,2 mm and less)

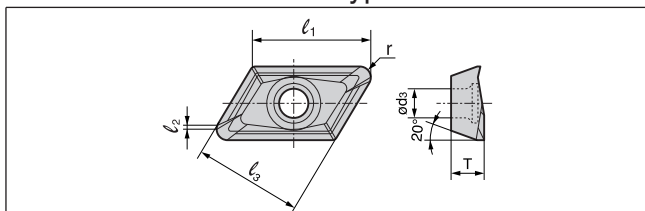
Shank	Cat. No.	Stock	Dimensions(mm)					No.of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WAX 3020 E -3.2	●	20	20	60	70	130	1
	WAX 3025 E -3.2	●	25	25	60	80	140	2
	WAX 3025 EL-3.2	●	25	25	60	140	200	2
	WAX 3032 E -3.2	●	32	32	70	80	150	2
	WAX 3032 EL-3.2	●	32	32	70	150	220	2
	WAX 3040 E -3.2	●	40	32	70	90	160	3
	WAX 3040 EL-3.2	●	40	32	70	150	220	3

■ Body (For inserts with nose radius 4,0 mm and more)

Shank	Cat. No.	Stock	Dimensions (mm)					No.of teeth
			øD	ød	l <sub>1</sub>	l <sub>2</sub>	L	
	WAX 3020 E -4.0	●	20	20	60	70	130	1
	WAX 3025 E -4.0	●	25	25	60	80	140	2
	WAX 3025 EL-4.0	●	25	25	60	140	200	2
	WAX 3032 E -4.0	●	32	32	70	80	150	2
	WAX 3032 EL-4.0	●	32	32	70	150	220	2
	WAX 3040 E -4.0	●	40	32	70	90	160	3
	WAX 3040 EL-4.0	●	40	32	70	150	220	3

● = Euro stock

■ Inserts for WAX 3000 Type



Cat. No.	DLC Coated	Carbide	Dimensions (mm)					
			DL 1000	H1	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	r
AECT 160404 PEFRA	●	●	18	1,4	16,4	0,4	5	4,4
AECT 160408 PEFRA	●	●	18	1,0	16,4	0,8	5	4,4
AECT 160412 PEFRA	●	●	18	0,6	16,4	1,2	5	4,4
AECT 160416 PEFRA	●	●	17,5	0,5	16,4	1,6	5	4,4
AECT 160420 PEFRA	●	●	17,5	0,5	16,4	2,0	5	4,4
AECT 160430 PEFRA	●	●	17	0,7	16,4	3,0	5	4,4
AECT 160432 PEFRA	●	●	17	0,5	16,4	3,2	5	4,4
AECT 160440 PEFRA	●	●	16,5	0,5	16,4	4,0	5	4,4
AECT 160450 PEFRA	●	●	16	0,4	16,4	5,0	5	4,4

● = Euro stock

■ Spare Parts

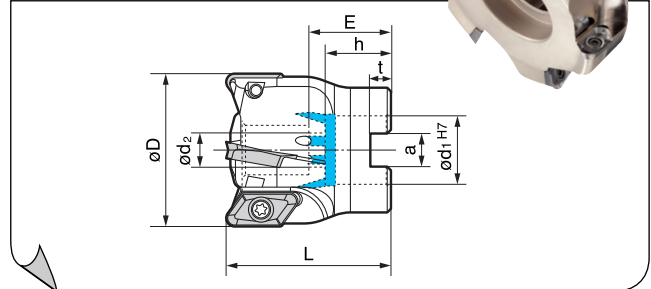
Screw	Wrench	Applicable endmill
BFTX 0408	TRD 15	WAX 3000

\*Required torque: 3,5 Nm

# Wavemill Series WAX 3000RS Type

16-18 mm 90°

(Shellmill)



■ Body (For inserts with nose radius 3,2 mm and less)

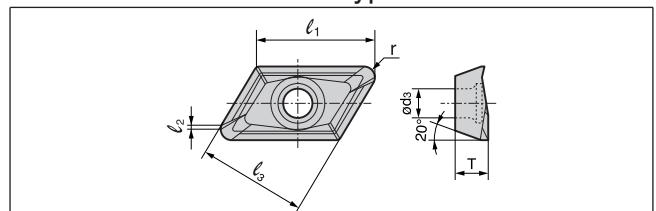
Cat. No.	Stock	Dimensions(mm)								No.of teeth
		øD	ød <sub>1</sub>	ød <sub>2</sub>	L	a	t	h	E	
WAX 3050 RS-3.2	●	50	22	11	50	10,4	6,3	21	26	4
WAX 3063 RS-3.2	●	63	22	11	50	10,4	6,3	21	26	5
WAX 3080 RS-3.2	●	80	27	13,5	50	12,4	7	23	30	5
WAX 3100 RS-3.2	●	100	32	18	63	14,4	8	26	32	6
WAX 3125 RS-3.2	●	125	40	22	63	16,4	9	29	35	7

■ Body (For inserts with nose radius 4,0 mm and more)

Cat. No.	Stock	Dimensions (mm)								No.of teeth
		øD	ød <sub>1</sub>	ød <sub>2</sub>	L	a	t	h	E	
WAX 3050 RS-4.0	●	50	22	11	50	10,4	6,3	21	26	4
WAX 3063 RS-4.0	●	63	22	11	50	10,4	6,3	21	26	5
WAX 3080 RS-4.0	●	80	27	13,5	50	12,4	7	23	30	5
WAX 3100 RS-4.0	●	100	32	18	63	14,4	8	26	32	6
WAX 3125 RS-4.0	●	125	40	22	63	16,4	9	29	35	7

● = Euro stock

■ Inserts for WAX 3000 Type



Cat. No.	DLC Coated	Carbide	Dimensions (mm)					
			DL 1000	H1	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	r
AECT 160404 PEFRA	●	●	18	1,4	16,4	0,4	5	4,4
AECT 160408 PEFRA	●	●	18	1,0	16,4	0,8	5	4,4
AECT 160412 PEFRA	●	●	18	0,6	16,4	1,2	5	4,4
AECT 160416 PEFRA	●	●	17,5	0,5	16,4	1,6	5	4,4
AECT 160420 PEFRA	●	●	17,5	0,5	16,4	2,0	5	4,4
AECT 160430 PEFRA	●	●	17	0,7	16,4	3,0	5	4,4
AECT 160432 PEFRA	●	●	17	0,5	16,4	3,2	5	4,4
AECT 160440 PEFRA	●	●	16,5	0,5	16,4	4,0	5	4,4
AECT 160450 PEFRA	●	●	16	0,4	16,4	5,0	5	4,4

● = Euro stock

■ Spare Parts

Screw	Wrench	Applicable endmill
BFTX 0408	TRD 15	WAX 3000

\*Required torque: 3,5 Nm



# Wave Ball Mill™ for Roughing WBMR Type

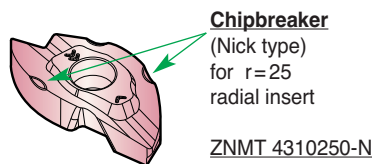


## ■ Features

Particularly suitable for die mold machining the WBMR replaceable insert ball nose endmill efficiently roughs complex profiles.

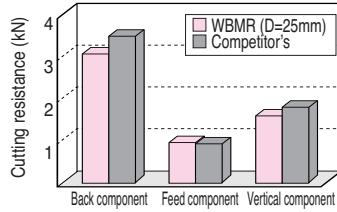
Its high feed rate capability is a direct result of a sharp cutting edge which is maintained during the cutting cycle by the special cemented carbide substrate working in parallel with the ultra hard ZX coating.

- ## ■ Advantages
- Wave shaped cutting edge
  - Economical M class insert
  - Precise clamping
  - High feed rate capability



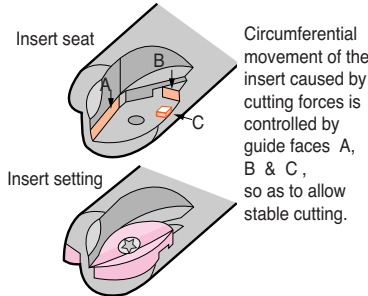
## ■ Performance

### ● Cutting resistance

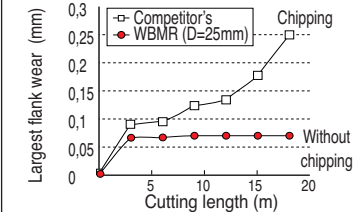


Cutting conditions (Shoulder milling, downcut)  
 $v_c=200\text{m/min}$ ,  $f_t=0.15\text{mm/tooth}$   
 Axial  $d_{oc}$ : 5mm, Radial  $w_{oc}$ : 5mm  
 Work material: C50

### ● Anti-rotational mechanism



### ● Insert life

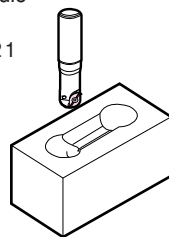


Cutting conditions (Shoulder milling, downcut)  
 $v_c=100\text{m/min}$ ,  $f_t=0.15\text{mm/tooth}$   
 Axial  $d_{oc}$ : 5mm, Radial  $w_{oc}$ : 5mm  
 Work material: X 40 CrMoV 5-1 (HRC45)

## ■ Application Example

### ● Cold molding die

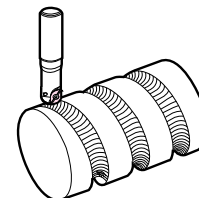
Work material :  
X 155 CrMo 12 1



<Results>  
Flank wear after continuous cutting for seven hours was less than other manufacturer's product. Stable cutting was observed.

WBMR 2200S ( $\phi 20\text{mm}$ )  
 Insert grade : ACZ350  
 Cutting conditions :  
 $n = 2200\text{ rpm}$ ,  $v_f = 500\text{ mm/min}$   
 Depth of cut : 0.3-2 mm  
 Non-water soluble cutting oil

### ● Injection molded part (Cr-Mo steel + Stellite-overlay)



<Results>  
Wave ball ( $\phi 30\text{mm}$ ) could cut without chattering while other manufacturer's products could not cut at all due to chattering.

WBMR 2300M ( $\phi 30\text{mm}$ )  
 Insert grade : ACZ350  
 Cutting conditions :  
 $n = 500\text{ rpm}$ ,  $v_f = 35\text{ mm/min}$   
 Depth of cut : 5 mm  
 Dry cut

## ■ Recommended cutting conditions (2 teeth)

Condition	Material	Carbon steel	Alloy steel	Stainless, Die steel etc.	Cast iron
		(Below HRC25)	(Below HRC45)		
(A)	$v_c$	200-250-300	100-150-200	50-80-100	100-120-150
	$f_t$	0,1-0,2-0,3	0,1-0,2-0,3	0,1-0,15-0,2	0,2-0,3-0,4

[ $v_c = \text{m/min}$ ,  $f_t = \text{mm/tooth}$ ] [min. - optimum - max.]

## ■ Recommended cutting conditions (4 teeth)

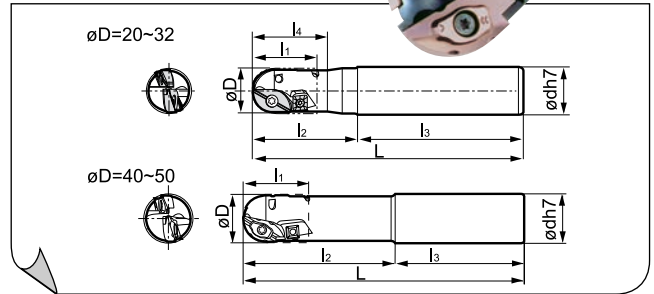
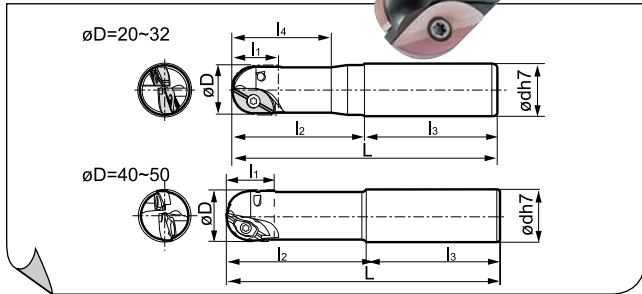
Condition	Material	Carbon steel	Alloy steel	Stainless, Die steel etc.	Cast iron
		(Below HRC25)	(Below HRC45)		
(A)	$v_c$	200-250-300	100-150-200	50-80-100	100-120-150
	$f_t$	0,1-0,2-0,3	0,1-0,2-0,3	0,1-0,15-0,2	0,2-0,3-0,4
(B)	$v_c$	160-200-240	80-120-160	40-60-80	80-100-120
	$f_t$	0,1-0,2-0,3	0,1-0,2-0,3	0,1-0,15-0,2	0,2-0,3-0,4

[ $v_c = \text{m/min}$ ,  $f_t = \text{mm/tooth}$ ] [min. - optimum - max.]



# Wave Ball Mill™ for Roughing WBMR 2000 Type

# Wave Ball Mill™ for Roughing WBMR 2000L Type



## Body ( Short and middle length type, 2 teeth)

Cat. No.	Stock	Dimensions(mm)						
		øD	ød	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	L
WBMR 2200S	●	20	25	20	60	80	40	140
WBMR 2200M	●				60	140		
WBMR 2200MW	●				60	140		
WBMR 2250S	●	25	32	23	70	80	50	150
WBMR 2250M	●				73	147		
WBMR 2250MW	●				73	147		
WBMR 2320S	●	32	32	31	80	80	60	160
WBMR 2320M	●				85	155		
WBMR 2320MW	●				85	155		
WBMR 2400S	○	40	42	35	100	100	-	200
WBMR 2400M	○				180	100		
WBMR 2500S	○				100	100		
WBMR 2500M	○	50	42	47	100	100	-	200
WBMR 2500M	○				180	100		

- S: Short type with cylindrical shank
- M: Middle length type with cylindrical shank
- MW: Middle length type with Weldon shank

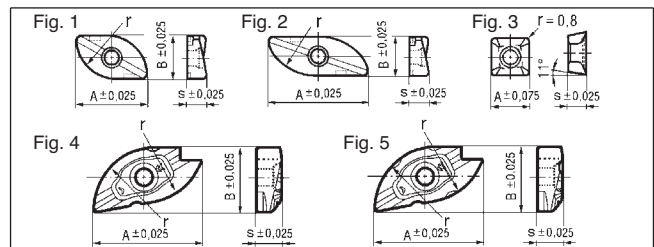
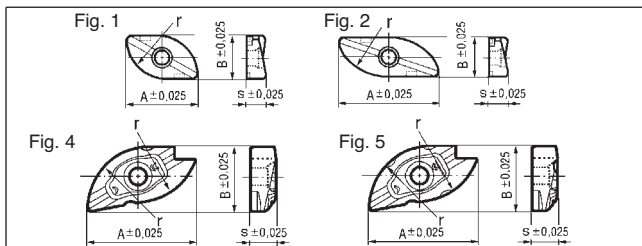
## Body ( Extra long type, 4 teeth)

Cat. No.	Stock	Dimensions(mm)						
		øD	ød	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	L
WBMR 2200LL	●	20	25	30	80	170	40	250
WBMR 2200LLW	●							
WBMR 2250LL	●	25	32	38	100	200	50	300
WBMR 2250LLW	●							
WBMR 2320LL	●	32	32	44	120	230	60	350
WBMR 2320LLW	●							
WBMR 2400LL	○	40	42	50	250	100	-	350
WBMR 2400LLW	○							
WBMR 2500LL	○	50	42	69	250	100	-	350
WBMR 2500LLW	○							

- LL: Extra long type with cylindrical shank
- LLW: Extra long type with Weldon shank

## Inserts

## Inserts



Cat. No.	Coated			Dimensions (mm)				Fig.	No. of teeth	Applicable endmill
	ACP 200	ACP 300	ACK 300	A	B	s	r			
ZNMT 1804100-C	●	●	●	18,00	9,76	4,76	10	1	1	WBMR2200
ZNMT 2004100-S	●	●	●	20,00	7,50	4,37	10	2		
ZNMT 2205125-C	●	●	●	22,50	12,20	5,70	12,5	1	1	WBMR2250
ZNMT 2305125-S	●	●	●	23,00	9,38	5,56	12,5	2		
ZNMT 2907160-C	●	●	●	29,00	15,62	7,15	16	1	1	WBMR2320
ZNMT 3006160-S	●	●	●	30,00	12,00	6,70	16	2		
ZNMT 3608200	○	○	○	36,00	19,50	6,70	20	4	2	WBMR2400
ZNMT 4310250	○	○	○	43,00	25,70	10,15	25	4		
ZNMT 4310250-N	○	○	○	43,00	25,70	10,15	25	5	2	WBMR2500
ZNMT 4310250-N	○	○	○	43,00	25,70	10,15	25	5		

- = Euro stock
- = Delivery on request

Cat. No.	Coated			Dimensions (mm)				Fig.	No. of teeth	Applicable endmill
	ACP 200	ACP 300	ACK 300	A	B	s	r			
ZNMT 1804100-C	●	●	●	18,00	9,76	4,76	10	1	1	WBMR2200
ZNMT 2004100-S	●	●	●	20,00	7,50	4,37	10	2		
SPMT 070308	●	●	●	7,94	-	3,18	-	3	2	WBMR2250
ZNMT 2205125-C	●	●	●	22,50	12,20	5,70	12,5	1		
ZNMT 2305125-S	●	●	●	23,00	9,38	5,56	12,5	2	1	WBMR2320
SPMT 09T308	●	●	●	9,53	-	3,97	-	3		
ZNMT 2907160-C	●	●	●	29,00	15,62	7,15	16	1	1	WBMR2400
ZNMT 3006160-S	●	●	●	30,00	12,00	6,70	16	2		
SPMT 09T308	●	●	●	9,53	-	3,97	-	3	2	WBMR2500
ZNMT 3608200	○	○	○	36,00	19,50	6,70	20	4		
SPMT 09T308	○	○	○	9,53	-	3,97	-	3	2	WBMR2500
ZNMT 4310250	○	○	○	43,00	25,70	10,15	25	4		
ZNMT 4310250-N	○	○	○	43,00	25,70	10,15	25	5	2	WBMR2500
SPMT 120408	○	○	○	12,7	-	4,76	-	3		

- = Euro stock
- = Delivery on request

## Spare Parts

Screw	Wrench	Wrench	Applicable endmill
BFTX0307N	TRX10	-	WBMR 2200
BFTX0409N	-	TRD15	WBMR 2250
BFTX0511N	-	TRD20	WBMR 2320
BFTX0619N	-	TRD25	WBMR 2400 WBMR 2500

## Spare Parts

Screw	Wrench	Wrench	Applicable endmill
BFTX0307N	TRX10	-	WBMR 2200 LL
BFTX0409N	-	TRD15	WBMR 2250 LL
BFTX0511N	-	TRD20	WBMR 2320 LL
BFTX0407N	-	TRD15	WBMR 2400 LL
BFTX0619N	-	TRD25	WBMR 2400 LL WBMR 2500 LL
BFTX0409N	-	TRD15	WBMR 2500 LL

# Wave Ball Mill for Finishing WBMF Type

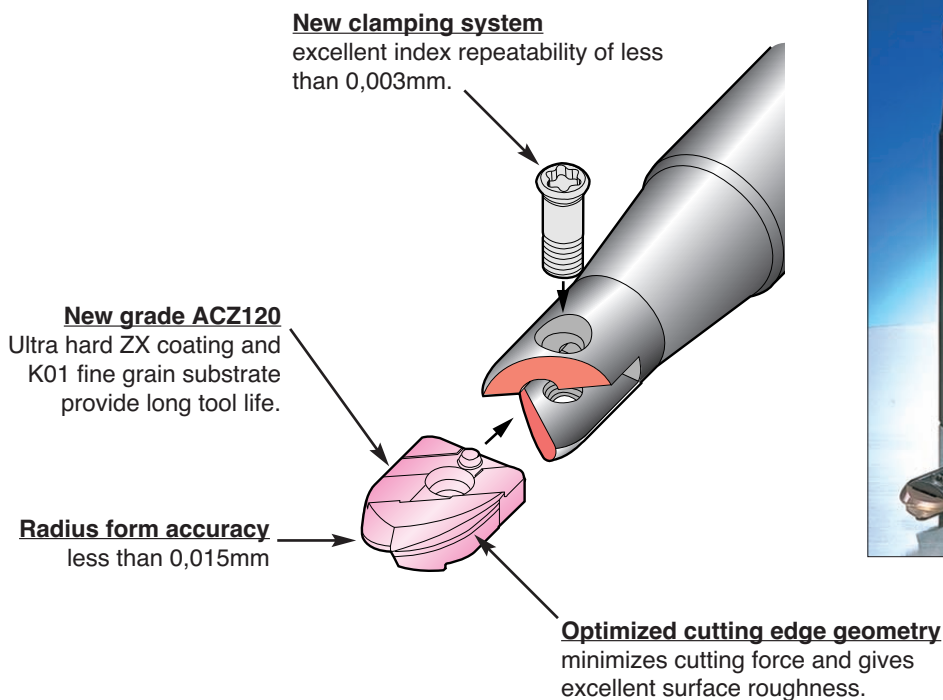


## ■ Features

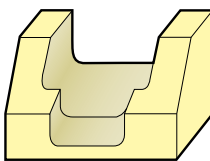
The outstanding results obtained from this finishing cutter are due to the combination of its large sigmoid blade and precise clamping system making it extremely rigid !

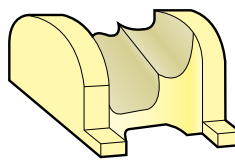
The WBMF achieves an excellent machined finish greatly reducing hand finishing and polishing operations.

- Advantages
- Unique rigid clamping system
  - Large sigmoid blade
  - Smooth cutting action
  - High quality machined surface
  - Ultra hard ZX coated cutting edge

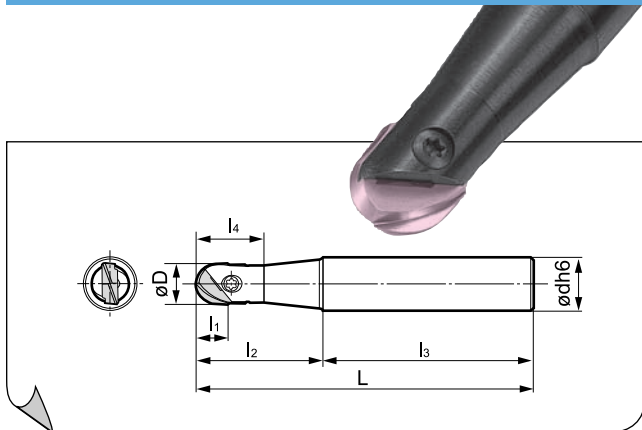


## ■ Application Example

<p>● Bumper moulding die</p> <p>Work material : C55</p> 	<p>&lt;Results&gt; Surface roughness after continuous cutting for twelve hours was better than other manufacturer's product. Less width of flank wear was observed.</p>
<p>WBMF1200M (ø20mm) Insert : ZPGU2471100 Grade : ACZ120</p>	<p>Cutting conditions v<sub>c</sub> = 88 m/min v<sub>f</sub> = 700 mm/min ( f<sub>t</sub> = 0,25 mm/tooth) Width of cut : 0,5 mm Depth of cut : 0,5 mm Dry</p>

<p>● Bumper moulding die</p> <p>Work material : C50</p> 	<p>&lt;Results&gt; Smooth cutting and good surface finish after continuous cutting for eight hours</p>
<p>WBMF1200M (ø20mm) Insert : ZPGU2471100 Grade : ACZ120</p>	<p>Cutting conditions v<sub>c</sub> = 190 m/min v<sub>f</sub> = 1200 mm/min ( f<sub>t</sub> = 0,21 mm/tooth) Width of cut : 0,2 mm Depth of cut : 0,2 mm Dry</p>

# Wave Ball Mill for Finishing WBMF 1000 Type

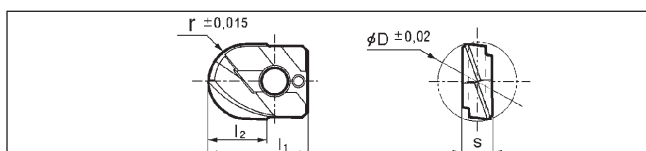


## ■ Body

Cat. No.	Stock	Dimensions(mm)						
		$\phi D$	$\phi d$	$l_1$	$l_2$	$l_3$	$l_4$	L
WBMF 1100S	○				30	70		100
WBMF 1100M	●	10	16	9	35	95	17	130
WBMF 1100L	○				50	130		180
WBMF 1120S	○				40	70		110
WBMF 1120M	●	12	16	10,5	40	110	19,5	150
WBMF 1120L	○				60	140		200
WBMF 1160S	○				50	80		130
WBMF 1160M	●	16	20	12	50	130	25,5	180
WBMF 1160L	○				70	150		220
WBMF 1200S	○				60	80		140
WBMF 1200M	●	20	25	15	60	140	32	200
WBMF 1200L	○				80	170		250
WBMF 1250S	○				70	80		150
WBMF 1250M	●	25	32	18,5	73	147	36	220
WBMF 1250L	○				100	200		300
WBMF 1300S	○				80	80		160
WBMF 1300M	●	30	32	22,5	85	155	43	240
WBMF 1300L	○				120	230		350

S : Short type  
M : Middle length type  
L : Long type

## ■ Inserts



Cat. No.	Coated	Dimensions(mm)					Applicable endmill	
		ACZ120	$\phi D$	$l_1$	$l_2$	s		r
ZPGU 1551050	●		10	15,6	9	5,1	5,0	WBMF1100
ZPGU 1856060	●		12	18	10,5	5,6	6,0	WBMF1120
ZPGU 2061080	●		16	20,5	12	6,1	8,0	WBMF1160
ZPGU 2471100	●		20	24,5	15	7,1	10,0	WBMF1200
ZPGU 2876125	●		25	28,5	18,5	7,6	12,5	WBMF1250
ZPGU 3486150	●		30	34,4	22,5	8,6	15,0	WBMF1300

● = Euro stock  
○ = Delivery on request

## ■ Spare Parts

Screw	Wrench	Applicable endmill
BFTG0408F	TRD15	WBMF1100
BFTG0409F	TRD15	WBMF1120
BFTG0513F	TRD20	WBMF1160
BFTG0617F	TRD25	WBMF1200
BFTG0621F	TRD25	WBMF1250
BFTG0825F	TRD25	WBMF1300

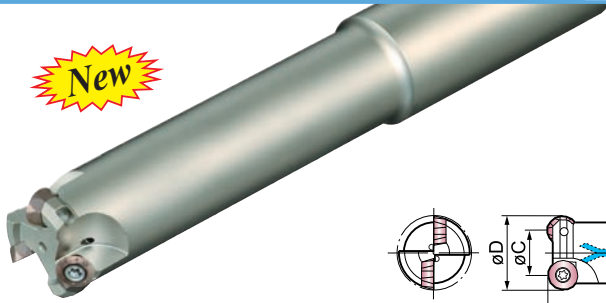
## ■ Recommended cutting conditions

Condition	Material	Carbon steel	Alloy steel	Stainless,	Cast iron	
		(Below HRC25)	(Below HRC45)	Die steel etc.		
$\phi D$		200-250-300	100-150-200	50-80-100	100-120-150	
$v_c$		0,1-0,2-0,3	0,1-0,2-0,3	0,1-0,15-0,2	0,2-0,3-0,4	
$f_t$						

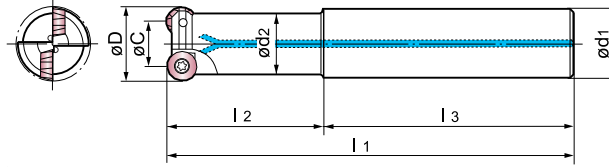
# Wave Radius Mill WRCX 0800/1000 E

Multi Purpose Endmills with Polygon Inserts

Shank Type with Small Diameter Inserts



E\_ : Cylindrical straight shank type



Axial rake angle:  $-3^\circ$   
Radial rake angle:  $0 \sim -35^\circ$

ES : Short type with straight shank  
EM : Middle length type with straight shank  
EL : Long type with straight shank

## ■ BODY

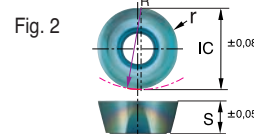
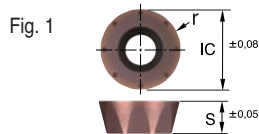
Insert IC (mm)	Cat. No.	Stock	Dimensions (mm)							No. of teeth	Axial rake	Radial rake	Helical boring øB Standard	Plunging $\alpha$ max.		
			øD	øC	ød1	ød2	l1	l2	l3							
8	WRCX 08012 ES	●	12	-	12	9,4	110	40	70	1	$-3^\circ$	$-35^\circ$	-	$0^\circ 30'$	BFTX 02505 IP	TRDR 08 IP
	WRCX 08012 EM	●	12	-	12	9,4	150	70	80	1	$-3^\circ$	$-10^\circ$	$24^{+7}_{-4}$	$5^\circ 30'$	BFTX 02506 IP	TRDR 08 IP
	WRCX 08016 ES	●	16	-	16	14	120	50	70	1	$-3^\circ$	$-10^\circ$	$24^{+7}_{-4}$	$5^\circ 30'$		
	WRCX 08016 EM	●	16	-	16	14	150	70	80	1	$-3^\circ$	$-10^\circ$	$24^{+7}_{-4}$	$5^\circ 30'$		
	WRCX 08020 ES	●	20	12	20	18	130	50	80	2	$-3^\circ$	$-3^\circ$	$32 \pm 7$	$13^\circ$		
	WRCX 08020 EM	●	20	12	20	18	180	100	80	2	$-3^\circ$	$-3^\circ$	$32 \pm 7$	$13^\circ$		
	WRCX 08020 EL	●	20	12	20	18	250	130	120	2	$-3^\circ$	$-3^\circ$	$32 \pm 7$	$13^\circ$		
	WRCX 08025 ES	●	25	17	25	21	130	50	80	3	$-3^\circ$	$0^\circ$	$42 \pm 7$	$8^\circ 20'$		
WRCX 08025 EM	●	25	17	25	21	180	100	80	3	$-3^\circ$	$0^\circ$	$42 \pm 7$	$8^\circ 20'$			
WRCX 08025 EL	●	25	17	25	21	250	130	120	3	$-3^\circ$	$0^\circ$	$42 \pm 7$	$8^\circ 20'$			
10	WRCX 10025 ES	●	25	15	25	21	130	50	80	2	$-3^\circ$	$0^\circ$	$40 \pm 8$	$13^\circ 10'$	BFTX 03584 IP	TRDR 15 IP
	WRCX 10025 EM	●	25	15	25	21	180	100	80	2	$-3^\circ$	$0^\circ$	$40 \pm 8$	$13^\circ 10'$		
	WRCX 10025 EL	●	25	15	25	21	250	130	120	2	$-3^\circ$	$0^\circ$	$40 \pm 8$	$13^\circ 10'$		
	WRCX 10032 ES	●	32	22	32	28	130	50	80	3	$-3^\circ$	$0^\circ$	$54 \pm 8$	$8^\circ$		
	WRCX 10032 EM	●	32	22	32	28	200	120	80	3	$-3^\circ$	$0^\circ$	$54 \pm 8$	$8^\circ$		
	WRCX 10032 EL	●	32	22	32	28	300	180	120	3	$-3^\circ$	$0^\circ$	$54 \pm 8$	$8^\circ$		

## ■ Spare Parts

## ■ Insert

● QPMT... : Standard 16 cornered polygon type  
QPMT...-H : Stronger cutting edge type

**New** ● QPET...-S : Polished round insert for non-ferrous material



Rake angle:  $25^\circ$   
4 corners use  
R : wiper radius

Cat. No.	Coated carbide					Diamond coated DL1000	Uncoated carbide H1	IC (mm)	r (mm)	s (mm)	Max. d <sub>oc</sub>		Fig.
	ACP100	ACP200	ACP300	ACK200	ACK300						4 corners application	8 corners application	
QPMT 080330 PPEN	●	●	●	●	●			8	3,0	3,18	3,8	1,0	①
QPMT 080330 PPEN-H	●	●	●	●	●			8	3,0	3,18	3,8	1,0	①
QPMT 10T335 PPEN	●	●	●	●	●			10	3,5	3,97	4,7	1,2	①
QPMT 10T335 PPEN-H	●	●	●	●	●			10	3,5	3,97	4,7	1,2	①
QPET 10T350 PPRF-S						●	●	5,0					②

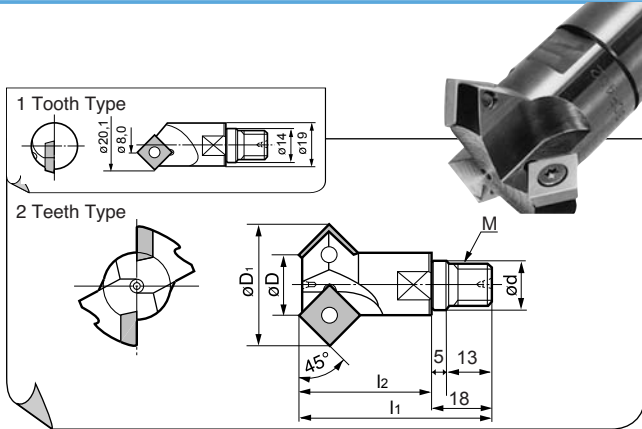
● = Euro stock

## ■ Recommended cutting conditions

[ $v_c = m/min$ ,  $f_t = mm/tooth$ ] [min. – optimum – max.]

Material	Grade	Carbon steel (ex. C40 ~ C50)	Alloy steel (Below HRC40)	Stainless steel (ex. X10CrNiS18-9)	Cast iron (ex. GG20)	Non-ferrous material
		ACP100, ACP200	ACP100, ACP200	ACP200, ACP300	ACK200, ACK300	DL1000, H1
12 ~ 32	$v_c$	80-120-160	60-100-140	60-100-120	60-80-120	200-500-1000
	$f_t$	0,1-0,3-0,4	0,1-0,2-0,3	0,1-0,15-0,2	0,1-0,2-0,3	0,1-0,2-0,3

# Chamfering Endmills SCP Type



## Body

Cat. No.	Stock	Dimensions (mm)						No. of teeth
		$\phi D$	$\phi D_1$	$\phi d$	$l_1$	$l_2$	M	
SCP 308	●	8	20,1	14	50	32	M12	1
SCP 419	●	19	35,6	14	56	38	M12	2
SCP 432	●	32	48,6	20	60	42	M16	3

## Inserts

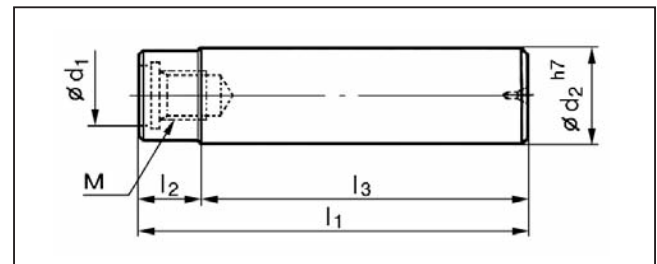
Fig. 1

Fig. 2

Cat. No.	Carbide			Fig.	Applicable endmill
	A30N	G10E			
SDMA 090308		●		1.	SCP 308
SDMA 090308 T	●				
SPMA 120408		●		2.	SCP 419 SCP 432
SPMA 120408 T	●				

● = Euro stock

## Holder for SCP



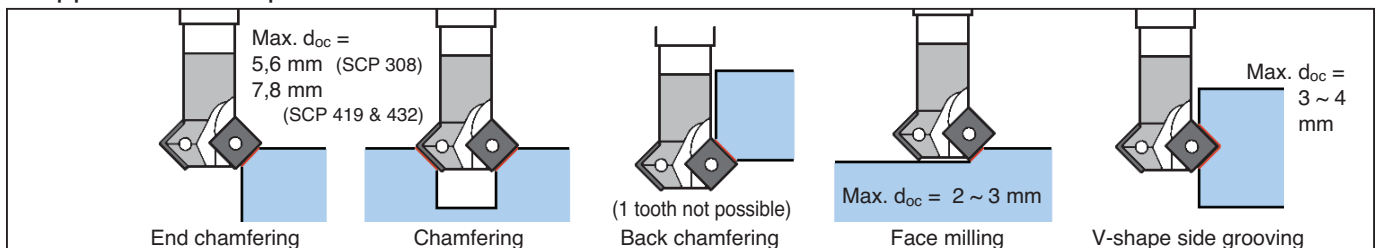
Cat. No.	Stock	Dimensions (mm)						Applicable endmill
		$\phi d_1$	$\phi d_2$	M	$l_1$	$l_2$	$l_3$	
SCA 20	●	14	20	M12	105	20	85	SCP 308 SCP 419
SCA 32	●	20	32	M16	130	20	110	SCP 432

● = Euro stock

## Spare Parts

SCP	Screw	Wrench
308	BFTX 0407 N	TRX 10
419, 432	BFTX 0511 N	TRX 20

## Application examples



## Recommended cutting conditions for SCP

( min. - optimal - max. )

Multi-Mills	$\phi D$ (mm)	Tooling	Cutting conditions	General steel			Cast iron
				Less than HRC25	HRC25 ~ 35	HRC35 ~ 45	(GG20)
SCP 308	8,5 ~ 19,5	Chamfering	$v_c$ (m/min)	80 - 100 - 140	50 - 60 - 80	20 - 40 - 60	90 - 110 - 130
SCP 419	19,5 ~ 35,1		$f_t$ (mm/tooth)	0,15 - 0,4	0,1 - 0,25	0,05 - 0,15	0,2 - 0,5
SCP 432	32,5 ~ 48,1	Face milling	$v_c$ (m/min)	80 - 100 - 140	50 - 60 - 80	20 - 40 - 60	90 - 110 - 130
			$f_t$ (mm/tooth)	0,1 - 0,2	0,05 - 0,1	0,04 - 0,08	0,1 - 0,3



