MillLine

PROFILEMILL SERIES

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Tungaloy Report No. 528-G

Robust indexable profile mills with new ball end mills for rough profiling

Member IMC Group Tungaloy

INDUSTRY 4.0

FEED the SPEED!


ACCELERATED MACHINING

MillLine

PROFILEMILL SERIES

TUNGALOY

TUNG FORCE MILL

ACCELERATED MACHINING

Excellent surface finish and stable machining due to secure clamping and minimum run-out

PROFILEMILL SERIES
TUNGALOY

Indexable endmill series for die & mold and aerospace industries

Lineups and Application Ranges

- All inserts are precision ground, making them suitable for various applications ranging from roughing to finishing
- Increased reliability thanks to the innovative insert clamping design

Finishing

Semi-Finishing

Roughing

Ball type

BALL FINISH NOSE
Tool diameter ø8 - 32
(R4 – R16)

New
BALL ROUGH NOSE
Tool diameter ø16 - 25
(R8 - R12.5)

Radius type

BALL FINISH NOSE
Tool diameter ø12 - 20
(R0.5 – R1.5)

DO MINI MILL
Tool diameter ø16-25
(R0.5, R1.0)

BALLFINISH NOSE

(See page 6)

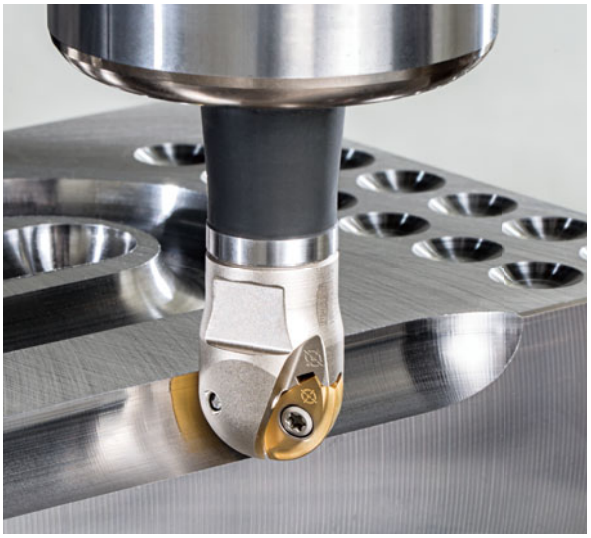
- Indexable end mill series with accurate insert repeatability thanks to its unique asymmetric V profile
- 2 insert profiles available: ball nose and square with radii
- Tool holders are available in monoblock shank and modular style

New

BALLROUGH NOSE

(See page 12)

- Secure clamping to prevent insert movement during roughing and semi-finishing.
- Double-sided insert design allows the same insert to be used for both center and peripheral cutting.
- Tool holders available in monoblock shank and modular style



DOMINI MILL

(See page 16)

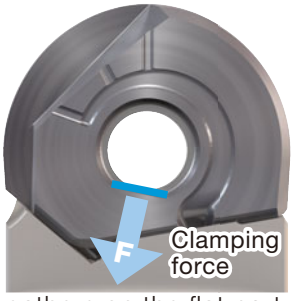
- End mill with dovetail clamping system for high productive semi-finishing operations
- Highly economical insert with 6 cutting edges
- Modular style toolholders available

PROFILEMILL SERIES

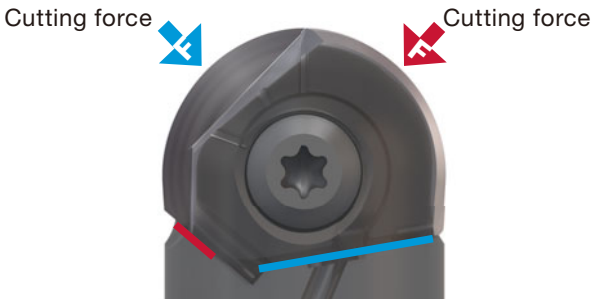
TUNGALOY

FINISH BALL NOSE

Secure clamping mechanism

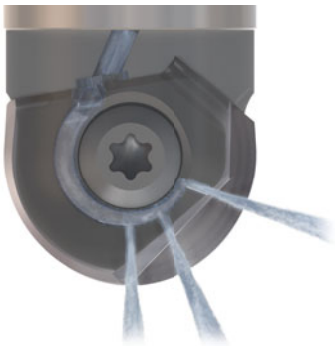


Clamping force gathers on the flat part of the insert hole as the screw is tightened. The force pushes the insert towards the cutter body, providing high repeatability and rigidity as well as minimum run-out.



Asymmetric shape of the insert and directed clamping force maintains centrality of the insert under 3 dimensional cutting force.

Unique coolant supply system

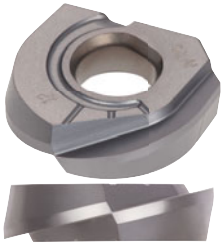


- The coolant channel on insert surface, supplies coolant to the cutting edge from three directions.
- Excellent chip evacuation and cooling effect provides good surface finish and long tool life in machining of hardened steel.

Two insert varieties

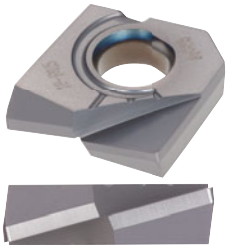
MJ chipbreaker

Ball nose type: ZFBM



- Suitable for finishing and three-dimensional milling of die & mold
- Applicable for a wide range of operations

Radius type: ZFRM



- Suitable for finishing of die & mold
- Designed for milling with high productivity

Versatile grade

AH710 — P Steel, K Cast iron, H Hard Materials

For pre-hardened steel, tool steel, and hardened steel

AH725 — P Steel, M Stainless, K Cast iron

For steel, stainless steel, and cast iron

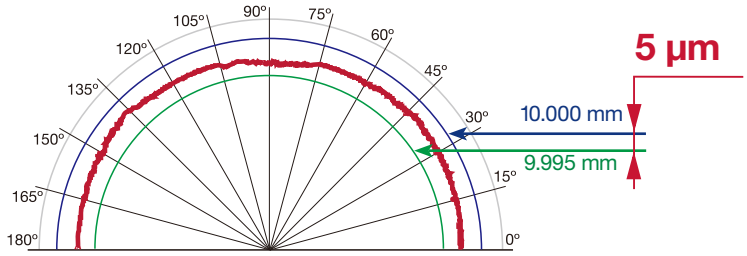
Application	Grade: Application code	Substrate: Relative density	Substrate: Hardness HRA	Substrate: T. R. S. (GPa)	Coating layer: Main Composition	Coating layer: Thickness (μm)	Features
P K H	AH710 P05 - P15	15.0	93.0	2.9	(Ti, Al)N	3	**For hardened steel** High wear resistance due to hard substrate and coating
P M K	AH725 P20 - P30	14.4	91.5	3.0	(Ti, Al)N	2	**For general purpose** Good balance between wear and fracture resistances

First choice

Workpiece material	P Carbon steel, Alloy steel	M Stainless steel	P Prehardend steel, Die & mold tool steel	H High hardened steel	K Cast iron
Hardness	85 - 280 HB	135 - 200 HB	HRC 40 - 48	HRC 48 - 65	150 - 240 HB
AH710			←	→	→
AH725	←	→			

Excellent machining accuracy

High radius accuracy

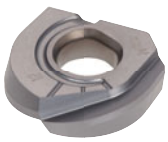


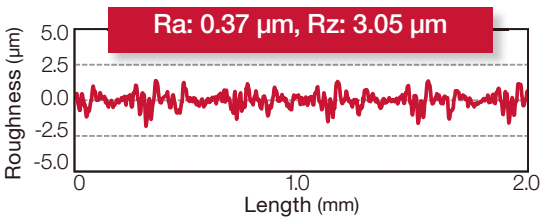
Ball nose insert has high radius accuracy within 5 μm and precisely meets dimensional requirements.

Shank: EBFM20T25S180
Insert: ZFBM200R00-MJ
Tool diameter: ø*D*c = ø20 mm (r_ε = 10 mm)

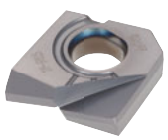
Good surface finish

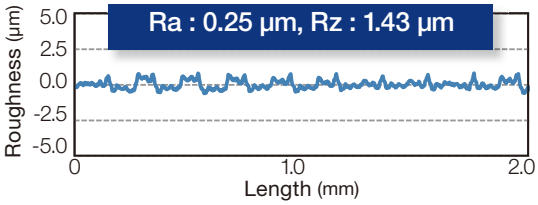
Ball nose type
ZFBM200R00-MJ





Radius type
ZFRM200R10-MJ





P Steel

Shank : EBFM20T25S180
Workpiece material: S55C / C55
Cutting speed: *Vc* = 200 m/min
Feed per tooth: *fz* = 0.15 mm/t
Depth of cut: *ap* =0.5 mm
Coolant: Wet

BALL FINISH NOSE

EBFM

Indexable endmills for high precision finish

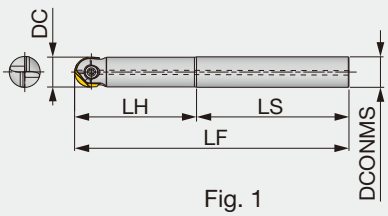


Fig. 1

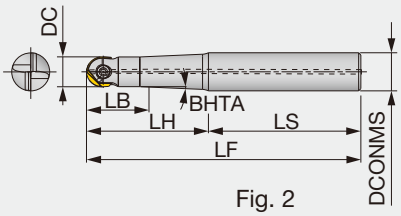


Fig. 2

Designation	material	DC	DCONMS	LS	LH	LF	LB	BHTA	Air hole	Fig	Insert
EBFM08T12S100	Steel	8	12	80	20	100	10	9.5	with	2	ZF*M080...
EBFM08S08C100	Carbide	8	8	70	30	100	-	-	without	1	ZF*M080...
EBFM08S08C140	Carbide	8	8	75	65	140	-	-	without	1	ZF*M080...
EBFM10T12S100	Steel	10	12	75	25	100	15	5	with	2	ZF*M100...
EBFM10S10C140	Carbide	10	10	65	75	140	-	-	without	1	ZF*M100...
EBFM10S10C220	Carbide	10	10	80	140	220	-	-	without	1	ZF*M100...
EBFM12S12S110	Steel	12	12	80	30	110	-	-	with	1	ZF*M120...
EBFM12S12C160	Carbide	12	12	70	90	160	-	-	without	1	ZF*M120...
EBFM12S12C220	Carbide	12	12	70	150	220	-	-	without	1	ZF*M120...
EBFM16T20S130	Steel	16	20	80	50	130	15.5	1.5	with	2	ZF*M160...
EBFM16S16C160	Carbide	16	16	80	80	160	-	-	without	1	ZF*M160...
EBFM16S16C220	Carbide	16	16	70	150	220	-	-	without	1	ZF*M160...
EBFM20T25S180	Steel	20	25	100	80	180	24	2.5	with	2	ZF*M200...
EBFM20S20C220	Carbide	20	20	100	120	220	-	-	without	1	ZF*M200...
EBFM20S20C300	Carbide	20	20	80	220	300	-	-	without	1	ZF*M200...
EBFM25T32S200	Steel	25	32	100	100	200	32	1.5	with	2	ZF*M250...
EBFM25S25C220	Carbide	25	25	100	120	220	-	-	without	1	ZF*M250...
EBFM25S25C300	Carbide	25	25	80	220	300	-	-	without	1	ZF*M250...
EBFM30T32S220	Steel	30	32	120	100	220	35	0.5	with	2	ZF*M300...
EBFM30S32C250	Carbide	30	32	100	150	250	-	-	without	1	ZF*M300...
EBFM30S32C350	Carbide	30	32	100	250	350	-	-	without	1	ZF*M300...
EBFM32S32S250	Steel	32	32	150	100	250	-	-	with	1	ZF*M320...
EBFM32S32C300	Carbide	32	32	80	220	300	-	-	without	1	ZF*M320...

SPARE PARTS



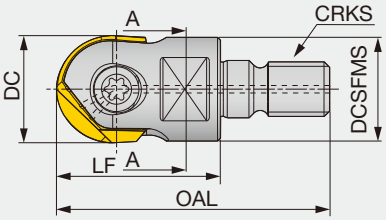

Designation	Clamping screw	Torx bit	Grip	Wrench
EBFM08...	TS 25F080A	-	-	T-8D
EBFM10...	TS 30F100A	-	-	T-10D
EBFM12...	TS 40F120A	-	-	T-15D
EBFM16...	TS 50F160A	BT20S	H-TB2W	-
EBFM20...	TS 60F200A	BLDT25/M7	H-TB2W	-
EBFM25...	TS 70F250A	BLDT25/M7	H-TB2W	-
EBFM30...	TS 80F300A	-	-	T-T30
EBFM32...	TS 80F300A	-	-	T-T30

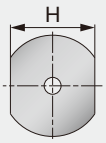
*Torque: Recommended torque (N·m) for clamping：TS25F080A=1.3, TS30F100A=2.5, TS40F120A=3.5, TS50F160A=5, TS60F200A=7, TS70F250A=7, TS80F300A=10

BALL FINISH NOSE

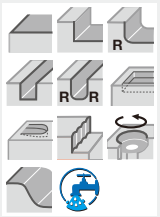
HBFM

Indexable endmills with TungFlex threaded adaptation for high precision finish





A-A cross section



Designation	DC	OAL	LF	H	DCSFMS	CRKS	Air hole	Insert
HBFM10M06	10	34.5	20	7	9.7	M6	with	ZF*M100...
HBFM12M06	12	37.5	23	7	11.5	M6	with	ZF*M120...
HBFM12M08	12	40	23	10	13	M8	with	ZF*M120...
HBFM16M08	16	47	30	10	13	M8	with	ZF*M160...
HBFM20M10	20	49	30	15	19	M10	with	ZF*M200...
HBFM25M12	25	57	35	17	24	M12	with	ZF*M250...
HBFM30M16	30	66	43	22	29	M16	with	ZF*M300...
HBFM32M16	32	66	43	22	29.5	M16	with	ZF*M320...

SPARE PARTS

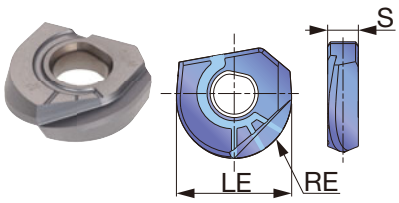



Designation	Clamping screw	Torx bit	Grip	Wrench
HBFM10...	TS 30F100A	-	-	T-10D
HBFM12...	TS 40F120A	-	-	T-15D
HBFM16...	TS 50F160A	BT20S	H-TB2W	-
HBFM20...	TS 60F200A	BLDT25/M7	H-TB2W	-
HBFM25...	TS 70F250A	BLDT25/M7	H-TB2W	-
HBFM30...	TS 80F300A	-	-	T-T30
HBFM32...	TS 80F300A	-	-	T-T30

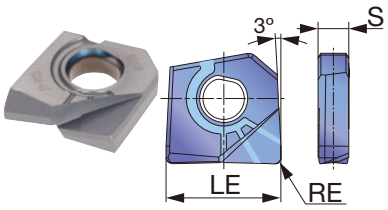
*Torque: Recommended torque (N·m) for clamping：TS25F080A=1.3, TS30F100A=2.5, TS40F120A=3.5, TS50F160A=5, TS60F200A=7, TS70F250A=7, TS80F300A=10

INSERT

ZFBM-MJ



ZFRM-MJ



P	Steel	☆	★
M	Stainless		☆
K	Cast iron	★	☆
N	Non-ferrous		☆
S	Superalloys		★
H	Hard materials	★	☆

★ : First choice
☆ : Second choice

Designation	RE	Coating		LE	S
		AH710	AH725		
ZFBM080R00-MJ	4	●	●	8	2.4
ZFBM100R00-MJ	5	●	●	10	2.9
ZFBM120R00-MJ	6	●	●	12	3.4
ZFBM160R00-MJ	8	●	●	16	4.4
ZFBM200R00-MJ	10	●	●	20	5.4
ZFBM250R00-MJ	12.5	●	●	25	6.4
ZFBM300R00-MJ	15	●	●	30	7.4
ZFBM320R00-MJ	16	●	●	32	7.4
ZFRM120R05-MJ	0.5	●	●	12	3.4
ZFRM120R10-MJ	1	●	●	12	3.4
ZFRM160R05-MJ	0.5	●	●	16	4.4
ZFRM160R10-MJ	1	●	●	16	4.4
ZFRM160R15-MJ	1.5	●	●	16	4.4
ZFRM200R10-MJ	1	●	●	20	5.4
ZFRM200R15-MJ	1.5	●	●	20	5.4

●: Line up
ZFBM080/100/120/160... : 5 pcs.
ZFBM200/250/300/320... : 1 pcs.
ZFRM120/160... : 5 pcs.
ZFRM200... : 1 pcs.

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Max. depth of cut (mm)	Cutting speed *Vc* (m/min)	Feed per tooth: *fz* (mm/t)							
							D8	D10	D12	D16	D20	D25	D30	D32
P	Low carbon steel, alloy steel	85 - 180 HB	First choice	AH725	≤ 0.04D	180 - 260	0.15	0.2	0.2	0.25	0.25	0.3	0.35	0.35
		85 - 180 HB	For wear resistance	AH710	≤ 0.04D	180 - 260	0.15	0.2	0.2	0.25	0.25	0.3	0.35	0.35
	High carbon steel, alloy steel	180 - 280 HB	First choice	AH725	≤ 0.03D	150 - 230	0.15	0.2	0.2	0.25	0.25	0.3	0.35	0.35
		180 - 280 HB	For wear resistance	AH710	≤ 0.03D	180 - 230	0.15	0.2	0.2	0.25	0.25	0.3	0.35	0.35
	Prehardened steel Die & mold tool steel	40 - 48 HRC	First choice	AH710	≤ 0.03D	180 - 300	0.15	0.15	0.2	0.2	0.25	0.25	0.3	0.3
		40 - 48 HRC	For fracture resistance	AH725	≤ 0.03D	180 - 300	0.15	0.15	0.2	0.2	0.25	0.25	0.3	0.3
M	Stainless steel	135 - 200 HB	First choice	AH725	≤ 0.03D	100 - 250	0.1	0.15	0.2	0.2	0.25	0.25	0.3	0.3
K	Cast iron	150 - 240 HB	First choice	AH710	≤ 0.04D	90 - 350	0.2	0.2	0.25	0.3	0.3	0.35	0.4	0.4
		150 - 240 HB	For fracture resistance	AH725	≤ 0.04D	90 - 350	0.2	0.2	0.25	0.3	0.3	0.35	0.4	0.4
N	Aluminium	-	First choice	AH725	≤ 0.03D	200 - 400	0.25	0.25	0.35	0.35	0.35	0.4	0.4	0.45
H	High hardened steel	48 - 65 HRC	First choice	AH710	≤ 0.02D	50 - 180	0.08	0.08	0.1	0.13	0.15	0.2	0.2	0.25

· Remove excessive chip accumulation with an air blast.
· For the operation with depth of cut which varies (ex.casting skin) and machining of workpiece materials with interrupted surface, the feed per tooth (*fz*) should be set to the lower recommended value shown in the above table.
· Cutting conditions maybe limited depending on machine power, workpiece rigidity, and spindle output. When the cutting width, depth, or overhang length is large, set *Vc* and *fz* to the lower recommended values and check the machine power and vibration.

How to clamp the insert

1. Clear chips and dust from the pocket.
2. Place the insert in the pocket. The insert can be placed only in one direction.
3. Tighten the screw while pressing the insert into the pocket.

How to check the run-out

1. Clamp the insert on the shank.
2. Clamp the shank on a high-precision arbor.
3. Measure the run-out on tool presetter or by dial gauge.

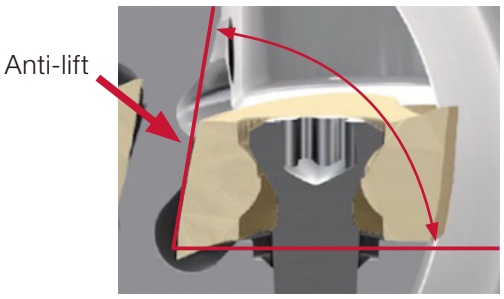
Notes:
1. Due to the helical cutting edge, it is important that the run-out is inspected with the insert clamped on the shank.
2. Do not use micrometer or caliper to inspect the insert diameter as inaccurate dimensions may be provided.

BALLROUGH NOSE

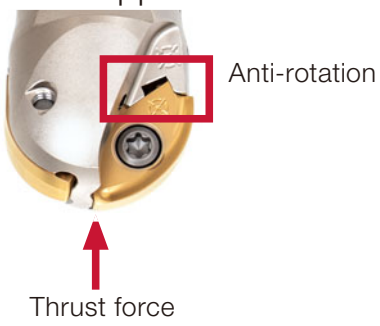
Profiling Reliability

Dovetail clamping design and axial support prevents insert movement for reliability

Dovetail-clamping system

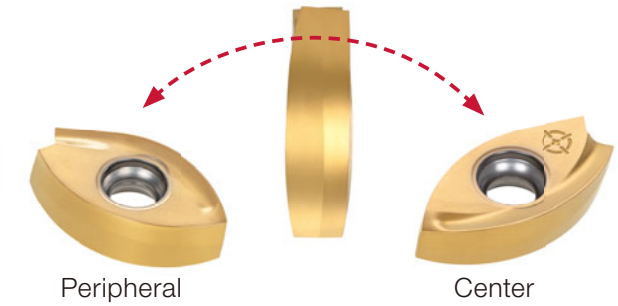


Axial stopper



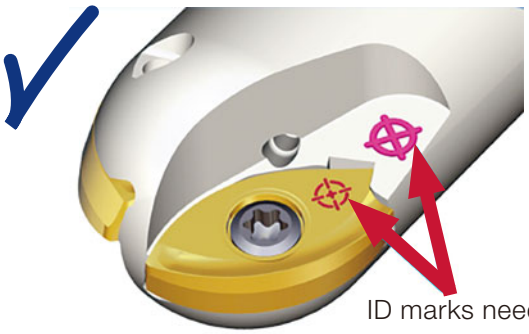
Unique 2-in-1 insert design

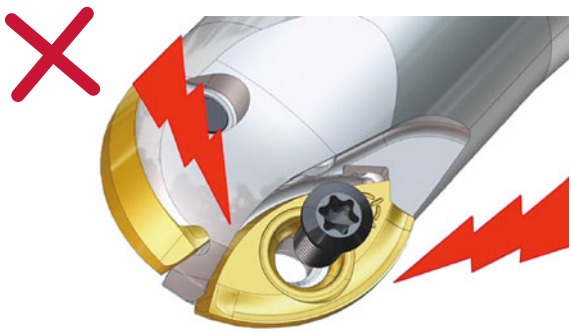
The BallRoughNose insert is double-sided. The same insert can be used for center cutting as well as peripheral, thus streamlining tool inventory with reduced tool costs.



Helical cutting edge for smoother entry into the material

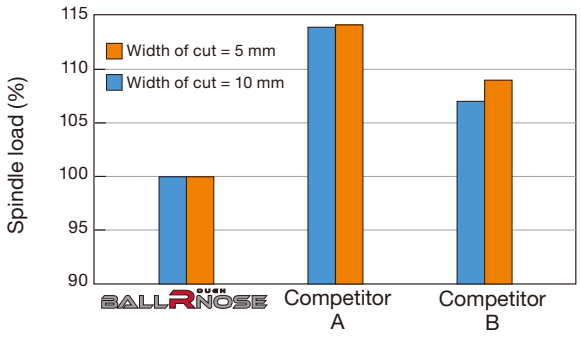
Insert will not fit the pocket when ID marks do not match





CUTTING PERFORMANCE

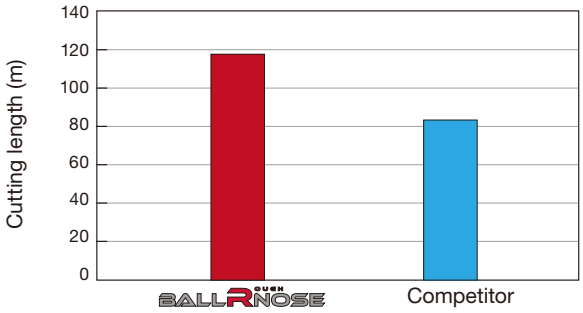
Cutting force



Steel

Cutter	: EBRM20T25S160 (D20, Z = 2)
Insert	: ZRBM200-MM APH730
Application	: Shouldering
Cutting speed	: *Vc* = 150 m/min
Feed per tooth	: *fz* = 0.15 mm/t
Depth of cut	: *ap* = 10mm
Machine	: Vertical M/C (BT50, 30kW)
Workpiece material	: S55C/C55 (200HB)

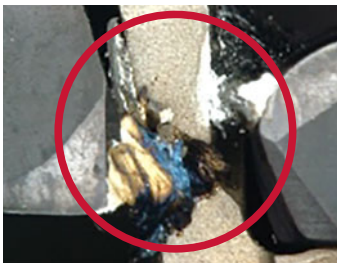
Tool life



Steel

Cutter	: EBRM20T25S160 (D20, Z = 2)
Insert	: ZRBM200-MM APH730
Application	: Shouldering
Cutting speed	: *Vc* = 200 m/min
Feed per tooth	: *fz* = 0.15 mm/t
Depth of cut	: *ap* = 5mm
Width of cut	: *ae* = 8 mm
Machine	: Vertical M/C (BT50, 30kW)
Workpiece material	: S55C/C55 (200HB)

Plunging performance



Steel

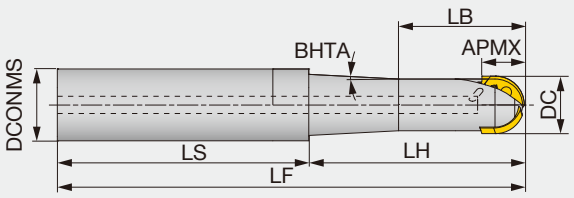
Cutter	: EBRM20T25S160 (D20, Z = 2)
Insert	: ZRBM200-MM APH730
Application	: Plunging
Cutting speed	: *Vc* = 150 m/min
Feed per tooth	: *fz* = 0.4 mm/t
Max.drilling depth	: 3 mm
Machine	: Vertical M/C (BT50, 30kW)
Workpiece material	: S55C/C55 (200HB)

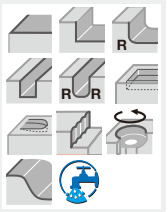
No chip build on the cutting edge of BallRough-Nose inserts.

ROUGH BALL NOSE

EBRM...

Indexable ball nose endmill for semi-roughing, shank type





Designation	APMX	DC	CICT	DCONMS	LS	LF	LH	LB	BHTA	WT(kg)	Air hole	Insert
EBRM16T20S130	11.8	16	2	20	70	130	60	35	3	0.235	with	ZRBM160...
EBRM16T20S200	11.8	16	2	20	140	200	60	35	3.46	0.395	with	ZRBM160...
EBRM20T25S160	13.6	20	2	25	85	160	75	45	3	0.455	with	ZRBM200...
EBRM20T25S220	13.6	20	2	25	135	220	85	60	5	0.655	with	ZRBM200...
EBRM25T32S200	17.7	25	2	32	115	200	85	55	6	0.965	with	ZRBM250...
EBRM25T32S300	17.7	25	2	32	180	300	120	70	4	1.505	with	ZRBM250...

SPARE PARTS

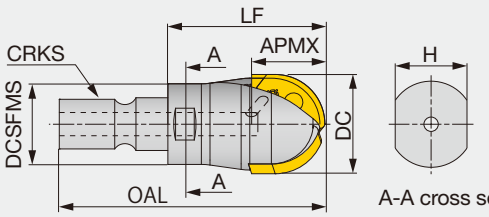
Designation	Clamping screw	Wrench
EBRM16...	TS25064I	T-8D
EBRM20...	TS30085I/HG	T-9D
EBRM25...	TS35085I/HG	T-15D

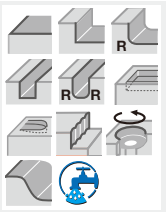
*Torque: Recommended torque (N·m) for clamping : TS25064I=1.3, TS30085I/HG=2.3, TS35085I/HG=3.5

ROUGH BALL NOSE

HBRM...

Indexable ball nose endmill for semi-roughing, modular type (TungFlex)





Designation	APMX	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Air hole	Insert
HBRM16M08	11.8	16	2	42.8	25.3	10	13	M8	0.025	with	ZRBM160...
HBRM20M10	13.6	20	2	50	30	15	18	M10	0.05	with	ZRBM200...
HBRM25M12	17.7	25	2	57	35	17	21	M12	0.08	with	ZRBM250...

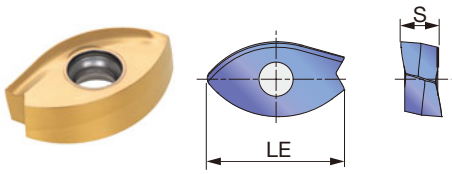
SPARE PARTS

Designation	Clamping screw	Wrench
HBRM16...	TS25064I	T-8D
HBRM20...	TS30085I/HG	T-9D
HBRM25...	TS35085I/HG	T-15D

*Torque: Recommended torque (N·m) for clamping : TS25064I=1.3, TS30085I/HG=2.3, TS35085I/HG=3.5

INSERT

ZRBM...



P	Steel	★
M	Stainless	☆
K	Cast iron	☆
N	Non-ferrous	
S	Superalloys	☆
H	Hard materials	☆

★ : First choice
☆ : Second choice

Designation	RE	Coated APH730	LE	S
ZRBM160-MM	8	●	12.4	3.7
ZRBM200-MM	10	●	14.9	4.8
ZRBM250-MM	12.5	●	18.9	5.9

●: Line up
Pack quantity = 5 pcs.

Standard cutting conditions

ISO	Workpiece materials	Hardness	Selection criteria	Recommended grade	Chip-breaker	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	Low carbon steel (C15 etc.)	- 200HB	First choice	APH730	MM	150 - 350	0.08 - 0.6
	High carbon and alloy steel (C55, 42CrMo4, etc.)	- 300HB	First choice	APH730	MM	120 - 320	0.05 - 0.5
	Prehardened steels (NAK80, PX5 etc.)	30 - 40HRC	First choice	APH730	MM	100 - 200	0.05 - 0.5
M	Austenitic stainless steel (X5CrNi18-9, X5CrNiMo17-12-3, etc.)	- 200HB	First choice	APH730	MM	100 - 280	0.05 - 0.6
	Martensitic stainless steel (X20Cr13 etc.)	- 200HB	First choice	APH730	MM	100 - 300	0.05 - 0.6
K	Gray cast irons (GG25, 250, etc.)	150 - 250HB	First choice	APH730	MM	120 - 380	0.08 - 0.6
	Ductile cast iron (GGG60 / 600-3, etc.)	150 - 250HB	First choice	APH730	MM	100 - 280	0.08 - 0.5
S	Titanium alloy (Ti-6Al-4V, etc.)	-	First choice	APH730	MM	20 - 80	0.05 - 0.6
	Heat-resistance alloys (Inconel718, etc.)	-	First choice	APH730	MM	20 - 60	0.05 - 0.4
H	Hardened steel (SKD61 / X40CrMoV51)	40- 50HB	First choice	APH730	MM	40 - 80	0.05 - 0.2
	Hardened steel (SKD11 / X153CrMoV12, etc.)	50 - 60HB	First choice	APH730	MM	30 - 60	0.04 - 0.14

The above cutting parameters are for reference. Adjustments may be required depending on applications, machine powers and rigidity, and/or workpiece fixture/clamping methods.

PROFILEMILL SERIES

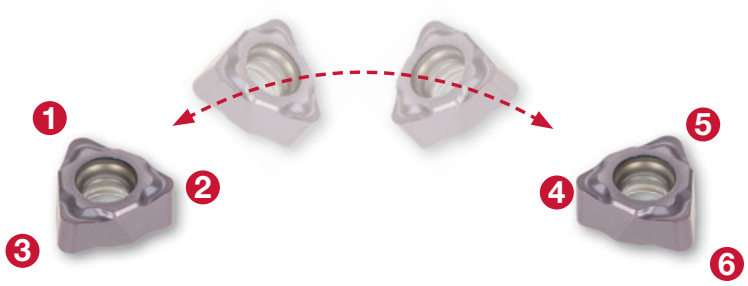
TUNGALOY

DOMINIMILL

Double sided with positive edge - innovative geometry

- The unique twisted peripheral shape provides positive flank clearance for double sided insert.
- Positive insert positioning and sharper cutting edge improves cutting action and surface finish.

- Highly economical insert with 6 cutting edges.



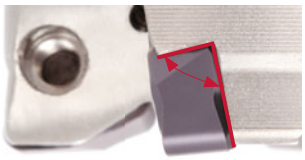
Positive flank clearance

High stability

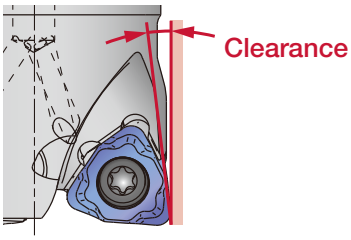
- Dovetail clamping system maintains the rigidity for accurate 3 dimensional machining.
- Improves reliability in plunging operations.

- Back clearance angle with wall surface avoids chip packing allowing smooth cutting even in machining of square wall.

- Optimized geometry of cutting edge offers resistance to chipping in machining of steel and hardened material.



Dovetail clamping system

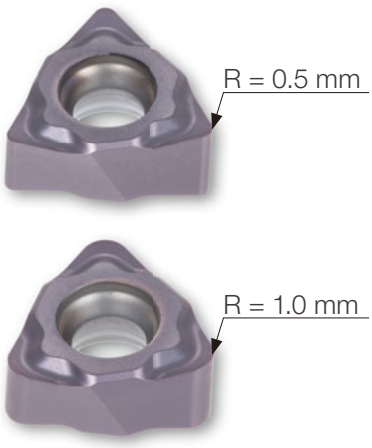


Inserts

- H-class insert with high accuracy provides minimized runout.

- 2 sizes of corner radii available for various type of machining.
  R = 0.5 mm: Suitable for general purpose with low depth and width of cut
  R = 1.0 mm: Ideal for hardened steel machining due to improved corner strength

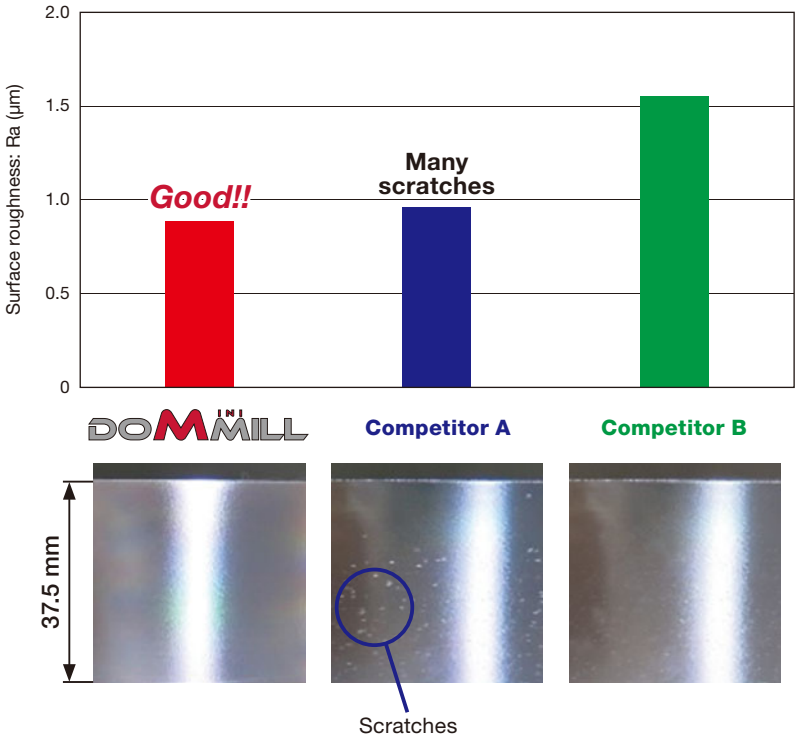
- AH110 grade with PremimumGTec and high wear resistance is ideal for hardened material machining.



WXHU04-MJ

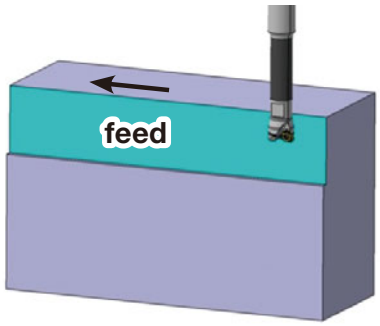
CUTTING PERFORMANCE

Surface finish

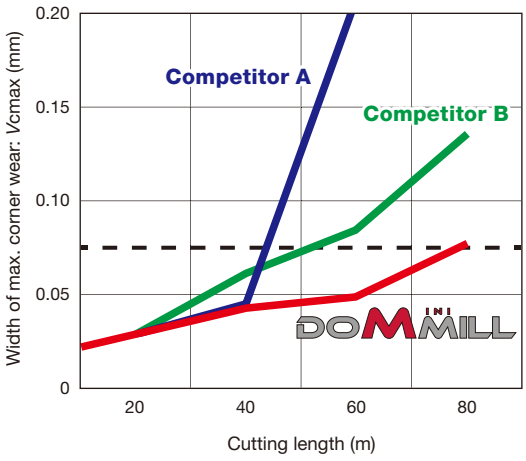


P
Steel

Cutter	: HFWX04M016M08R02 (ø*D*c = 16 mm, z = 2)
Insert	: WXHU040310R-MJ
Workpiece material	: SCM440 / 42CrMo4 (302HB)
Cutting speed	: *V*c = 300 m/min
Feed per tooth	: *f*z = 0.15 mm/t
Depth of cut	: *a*p = 0.15 mm
Width of cut	: *a*e = 0.5 mm

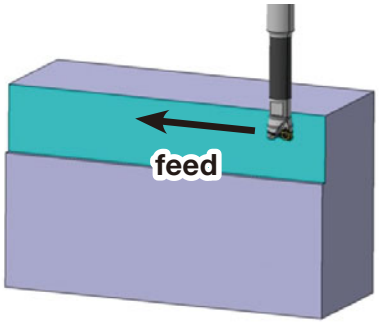


Tool life



H
Hard Materials

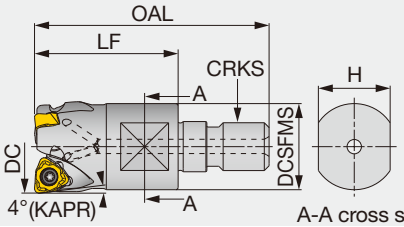
Cutter	: HFWX04M016M08R02 (ø*D*c = 16 mm, z = 2)
Insert	: WXHU040310R-MJ
Workpiece material	: SKD11 / X153CrMoV12 (58.5HRC)
Cutting speed	: *V*c = 100 m/min
Feed per tooth	: *f*z = 0.15 mm/t
Depth of cut	: *a*p = 0.15 mm
Width of cut	: *a*e = 0.2 mm



DOMINI MILL

HFWX04-M

Small-radius cutter for finishing operation; Modular head with TungFlex thread connection



Designation	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Air hole	Insert
HFWX04M016M08R02	16.00	2	42.0	25.0	10.0	13	M8	0.03	with	WXHU04**
HFWX04M020M10R03	20.00	3	49.0	30.0	15.0	18	M10	0.05	with	WXHU04**
HFWX04M025M12R04	25.00	4	52.0	30.0	17.0	21	M12	0.09	with	WXHU04**

SPARE PARTS

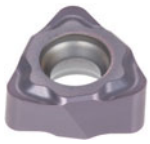
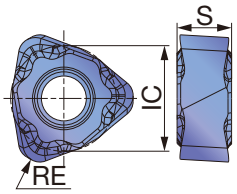


Designation	Clamping screw	Lubricant	Wrench
HFWX04M...	SR34-514	M-1000	T-7F

*Torque: Recommended torque (N·m) for clamping : SR34-514=0.9

INSERT

WXHU-MJ

		Coated
P	Steel	★
M	Stainless	
K	Cast iron	
N	Non-ferrous	
S	Superalloys	
H	Hard materials	★

★ : First choice
☆ : Second choice

Designation	RE	APMX	AH110	IC	S
WXHU040305R-MJ	0.5	0.5	●	6.35	3.18
WXHU040310R-MJ	1	1	●	6.35	3.18

* For plunging, width up to 2 mm is possible.

●: Line up

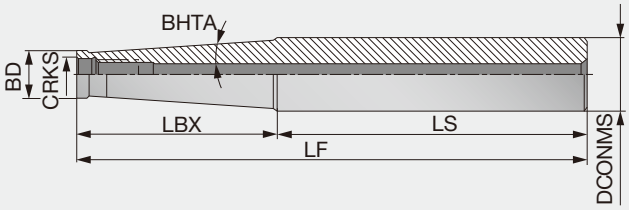
STANDARD CUTTING CONDITIONS

ISO	Workpiece material		Hardness	Grade	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	High carbon steel C45, C55, etc.		200 - 300 HB	AH110	100 - 300	0.1 - 0.3
P	Alloy steel 42CrMo4, SCr145, etc.		150 - 300 HB	AH110	100 - 300	0.1 - 0.3
P	Prehardened steel NAK80, PX5, etc.		30 - 40 HRC	AH110	100 - 300	0.05 - 0.3
H	Hardened steel	X40CrMoV5-1, etc.	40 - 50 HRC	AH110	80 - 130	0.1 - 0.3
H		X153CrMoV12, etc.	50 - 60 HRC	AH110	50 - 100	0.05 - 0.15

TUNGFLEX

SM

Endmills - modular shank

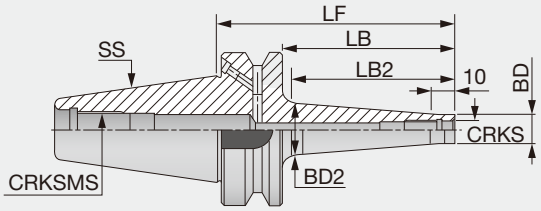


Designation	DCONMS	LF	LS	LBX	BD	CRKS	BHTA	Shank type
SM06-L60C10	10	60	40	20	9.7	M6	0°	Cylindrical
SM06-L125-C12	12	105	45	60	9.7	M6	1.2°	Cylindrical
SM06-L125-C16	16	125	65	60	9.7	M6	3.3°	Cylindrical
SM08-L73C16	16	73	48	25	13	M8	0°	Cylindrical
SM08-L128-C16	16	128	48	80	13	M8	0.9°	Cylindrical
SM08-L170-C20	20	170	103.2	66.8	13	M8	3.3°	Cylindrical
SM10-L80-C20	20	80	50	30	18	M10	0°	Cylindrical
SM10-L130-C20	20	130	50	80	18	M10	0.6°	Cylindrical
SM10-L200-C25	25	200	142.8	57.2	19	M10	3.3°	Cylindrical
SM12-L86-C25	25	86	56	30	21	M12	5.1°	Cylindrical
SM12-L200-C32	32	200	122	78	21	M12	4.4°	Cylindrical
SM16-L95-C32	32	95	60	35	29	M16	1.7°	Cylindrical
SM16-L230-C32	32	230	180	50	29	M16	1.8°	Cylindrical

TUNGFLEX

BT-ODP (Screw clamping head holder)

TungFlex modular tooling system with BT shank



Designation	SS	CRKS	BD	BD2	LF	LB	LB2	CRKSMS
BT40ODP6X66	40	M6	9.8	13	66	39	30	M16
BT40ODP6X106	40	M6	9.8	23	106	79	70	M16
BT40ODP8X66	40	M8	13	15	66	39	30	M16
BT40ODP8X106	40	M8	13	23	106	79	70	M16
BT40ODP10X66	40	M10	18	20	66	39	30	M16
BT40ODP10X106	40	M10	18	28	106	79	70	M16
BT40ODP12X66	40	M12	21	24	66	39	30	M16
BT40ODP12X106	40	M12	21	31	106	79	70	M16
BT40ODP16X66	40	M16	29	28.6	66	39	-	M16
BT40ODP16X106	40	M16	29	34	106	79	70	M16
BT50ODP12X94	50	M12	23	30	94	56	50	M24
BT50ODP12X144 (1)	50	M12	23	40	144	106	100	M24
BT50ODP12X194 (1)	50	M12	23	40	194	156	150	M24
BT50ODP12X244 (1)	50	M12	23	46	244	206	200	M24
BT50ODP16X94 (1)	50	M16	29	34	94	56	50	M24
BT50ODP16X144 (1)	50	M16	29	40	144	106	100	M24
BT50ODP16X194 (1)	50	M16	29	55	194	156	150	M24
BT50ODP16X244 (1)	50	M16	29	60	244	206	200	M24

• Applicable for 10 MPa pressure coolant (1) Balanced to G6.3 at 12,000 min-1

RED screw arbor

(Manufactured by MST Corporation)

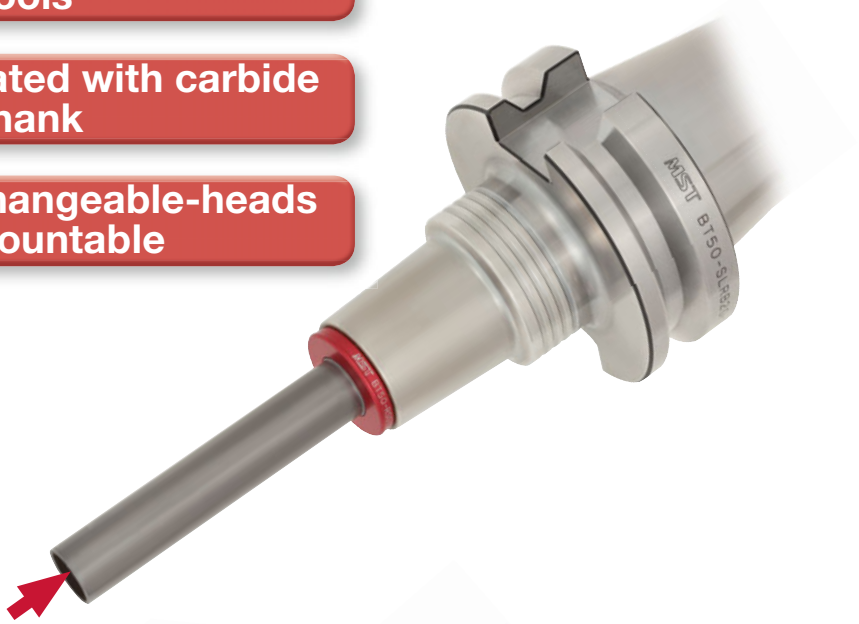
- Arbor integrated with carbide shank
- Carbide shank provides high rigidity
- Eliminates shank slip-off when rotated at high torque thanks to integrated shank-arbor design
- Chatter-free machining is possible even with long overhang

Ensures the highest performance with changeable-head tools

Optimized for changeable-head tools

Arbors integrated with carbide shank

All types of changeable-heads are mountable



BALL ROUGH NOSE
HBRM...

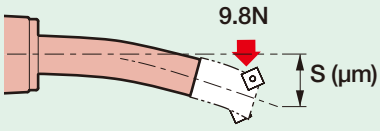
BALL FINISH NOSE
HBFM...

DO MINI MILL
HFWX...

DO FEED
HXN...

Tool rigidity index

Values in "S" colmun in the table on page 19 indicates the amount of deflection at the tool tip when working load of 9.8N is applied. The smaller the value is, the more rigid the tool is.

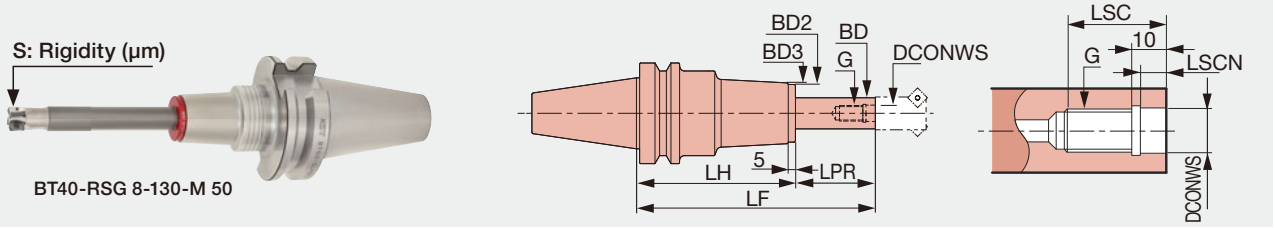


Manufactured by: MST corporation

TUNGFLEX

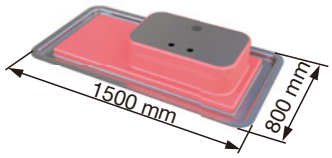
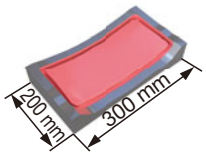
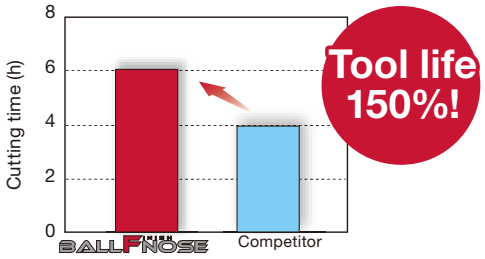
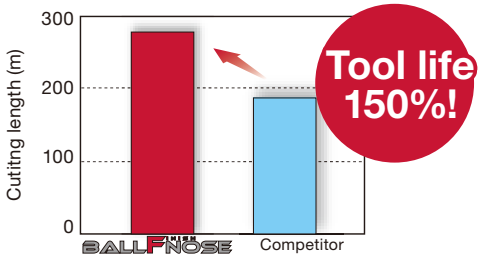
BT-RSG (Screw clamping head holder)

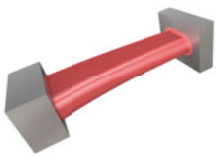
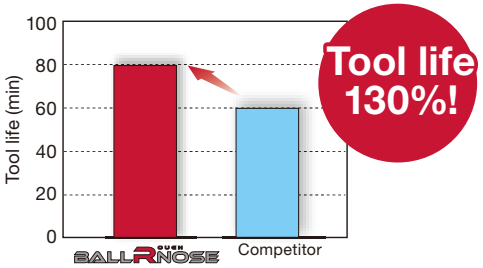
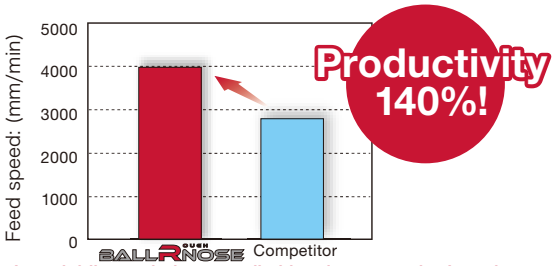
TungFlex modular tooling system with BT shank



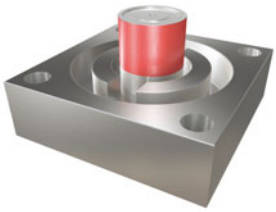
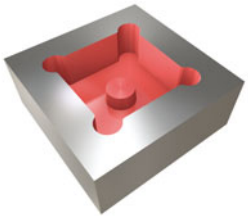
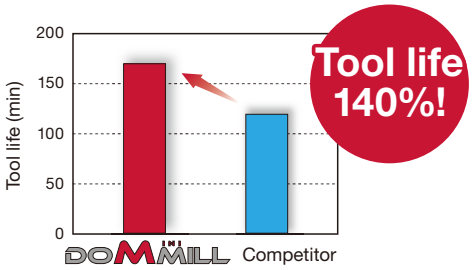
Designation	DCONWS	LSC	LSCN	BD	LF	LPR	LH	BD2	BD3	S	WT (kg)	G
BT40-RSG 8-105-M 25	8.5	18	6.5	15	105	25	80	30	32	0.6	1.4	M8
BT40-RSG 8-135-M 25	8.5	18	6.5	15	135	25	110	30	32	0.7	1.8	M8
BT40-RSG 8-130-M 50	8.5	18	6.5	15	130	50	80	30	32	1.5	1.4	M8
BT40-RSG 8-160-M 50	8.5	18	6.5	15	160	50	110	30	32	1.7	1.8	M8
BT40-RSG 8-155-M 75	8.5	18	6.5	15	155	75	80	30	32	3.1	1.5	M8
BT40-RSG 8-185-M 75	8.5	18	6.5	15	185	75	110	30	32	3.4	1.9	M8
BT40-RSG 8-165-M 85	8.5	18	6.5	15	165	85	80	30	32	4	1.5	M8
BT40-RSG 10-125-M 25	10.5	22	6.5	19	125	25	100	36	38	0.4	1.8	M10
BT40-RSG 10-155-M 25	10.5	22	6.5	19	155	25	130	36	38	0.5	2.2	M10
BT40-RSG 10-150-M 50	10.5	22	6.5	19	150	50	100	36	38	0.9	1.9	M10
BT40-RSG 10-180-M 50	10.5	22	6.5	19	180	50	130	36	38	1	2.3	M10
BT40-RSG 10-175-M 75	10.5	22	6.5	19	175	75	100	36	38	1.6	2	M10
BT40-RSG 10-205-M 75	10.5	22	6.5	19	205	75	130	36	38	1.8	2.4	M10
BT40-RSG 10-200-M100	10.5	22	6.5	19	200	100	100	36	38	2.8	2	M10
BT40-RSG 10-230-M100	10.5	22	6.5	19	230	100	130	36	38	3	2.4	M10
BT40-RSG 12-125-M 25	12.5	22	6	24	125	25	100	43	45	0.3	2	M12
BT40-RSG 12-155-M 25	12.5	22	6	24	155	25	130	43	45	0.4	2.4	M12
BT40-RSG 12-150-M 50	12.5	22	6	24	150	50	100	43	45	0.5	2.1	M12
BT40-RSG 12-180-M 50	12.5	22	6	24	180	50	130	43	45	0.7	2.5	M12
BT40-RSG 12-175-M 75	12.5	22	6	24	175	75	100	43	45	0.9	2.3	M12
BT40-RSG 12-205-M 75	12.5	22	6	24	205	75	130	43	45	1.1	2.7	M12
BT40-RSG 12-200-M100	12.5	22	6	24	200	100	100	43	45	1.4	2.4	M12
BT40-RSG 12-230-M100	12.5	22	6	24	230	100	130	43	45	1.6	2.8	M12
BT50-RSG 8-120-M 25	8.5	18	6.5	15	120	25	95	30	32	0.6	4	M8
BT50-RSG 8-150-M 25	8.5	18	6.5	15	150	25	125	30	32	0.7	4.3	M8
BT50-RSG 8-145-M 50	8.5	18	6.5	15	145	50	95	30	32	1.5	4	M8
BT50-RSG 8-175-M 50	8.5	18	6.5	15	175	50	125	30	32	1.7	4.3	M8
BT50-RSG 8-170-M 75	8.5	18	6.5	15	170	75	95	30	32	3	4.1	M8
BT50-RSG 8-200-M 75	8.5	18	6.5	15	200	75	125	30	32	3.3	4.4	M8
BT50-RSG 8-180-M 85	8.5	18	6.5	15	180	85	95	30	32	3.9	4.1	M8
BT50-RSG 10-140-M 25	10.5	22	6.5	19	140	25	115	36	38	0.4	4.3	M10
BT50-RSG 10-170-M 25	10.5	22	6.5	19	170	25	145	36	38	0.5	4.6	M10
BT50-RSG 10-165-M 50	10.5	22	6.5	19	165	50	115	36	38	0.8	4.4	M10
BT50-RSG 10-195-M 50	10.5	22	6.5	19	195	50	145	36	38	0.9	4.7	M10
BT50-RSG 10-190-M 75	10.5	22	6.5	19	190	75	115	36	38	1.6	4.5	M10
BT50-RSG 10-220-M 75	10.5	22	6.5	19	220	75	145	36	38	1.7	4.8	M10
BT50-RSG 10-215-M100	10.5	22	6.5	19	215	100	115	36	38	2.7	4.5	M10
BT50-RSG 10-245-M100	10.5	22	6.5	19	245	100	145	36	38	2.9	4.8	M10
BT50-RSG 12-140-M 25	12.5	22	6	24	140	25	115	43	45	0.2	4.6	M12
BT50-RSG 12-170-M 25	12.5	22	6	24	170	25	145	43	45	0.3	5	M12
BT50-RSG 12-165-M 50	12.5	22	6	24	165	50	115	43	45	0.5	4.7	M12
BT50-RSG 12-195-M 50	12.5	22	6	24	195	50	145	43	45	0.6	5.1	M12
BT50-RSG 12-190-M 75	12.5	22	6	24	190	75	115	43	45	0.8	4.9	M12
BT50-RSG 12-220-M 75	12.5	22	6	24	220	75	145	43	45	1	5.3	M12
BT50-RSG 12-215-M100	12.5	22	6	24	215	100	115	43	45	1.3	5	M12
BT50-RSG 12-245-M100	12.5	22	6	24	245	100	145	43	45	1.5	5.4	M12
BT50-RSG 12-240-M125	12.5	22	6	24	240	125	115	43	45	2	5.2	M12
BT50-RSG 16-140-M 25	17	25	6	29	140	25	115	52	54	0.2	5.4	M16
BT50-RSG 16-165-M 50	17	25	6	29	165	50	115	52	54	0.3	5.6	M16
BT50-RSG 16-190-M 75	17	25	6	29	190	75	115	52	54	0.5	5.8	M16
BT50-RSG 16-215-M100	17	25	6	29	215	100	115	52	54	0.7	6	M16
BT50-RSG 16-240-M125	17	25	6	29	240	125	115	52	54	1.1	6.2	M16

PRACTICAL EXAMPLES

	Workpiece type	Mold part	Mold part
	Cutter	EBFM20S20C220	EBFM12S12S110
	Insert	ZFBM200R00-MJ	ZFBM120R00-MJ
	Grade	AH725	AH725
	Workpiece material	SKD11 / X153CrMoV12	STAVAX
		 H	 H
Cutting conditions	Cutting speed: ***Vc*** **(m/min)**	350	360
	Feed per tooth: ***fz*** **(mm/t)**	0.15	0.09
	Depth of cut: ***ap*** **(mm)**	0.2	0.5
	Pick feed: **pf (mm)**	0.3	1.0
	Method of machining	Profiling	Profiling
	Coolant	Dry	Internal supply, water-soluble coolant
	Machine	M/C, BT50	M/C, BT40
	Results	 BallFinishNose's tool life was 50% longer than the competitor's due to high wear resistance.	 BallFinishNose's cutting length was 50% longer than the competitor's due to excellent chip evacuation.

	Workpiece type	New Mold part	New Turbine blade
	Cutter	EBRM25T32S200	EBRM20T25S160
	Insert	ZRBM250-MM	ZRBM200-MM
	Grade	APH730	APH730
	Workpiece material	SCM440 / 42CrMo4	10705BU
		 P	 M
Cutting conditions	Cutting speed: ***Vc*** **(m/min)**	250	175
	Feed per tooth: ***fz*** **(mm/t)**	0.25	0.72
	Feed speed: ***Vf*** **(mm/min)**	1592	4011
	Depth of cut: ***ap*** **(mm)**	8	0.1 - 0.6
	Width of cut: ***ae*** **(mm)**	4	-
	Method of machining	Profiling	Profiling
	Coolant	Air	Air blow
	Machine	Vertical M/C	Specialized machine
	Results	 Thanks to its tough cutting edge and APH730 grade, BallRoughNose achieved 30% longer tool life compared to the competitor.	 Low rigidity workpiece was limiting the competitor's tool from increasing the feed rate. Thanks to its free cutting geometry, BallRoughNose has increased the feed rate by 40% over that of the competitor's.

PRACTICAL EXAMPLES

Workpiece type		Mold	Mold
Cutter		HFWX04M020M10R03 (ø20 mm, z = 3)	HFWX04M025M12R04 (ø25 mm, z = 4)
Insert		WXHU040310R-MJ	WXHU040310R-MJ
Grade		AH110	AH110
Workpiece material		2738 (28 – 32 HRC)	DIN 1.2344 (50 – 52HRC)
		 P	 H
Cutting conditions	Cutting speed : *Vc* (m/min)	195	274
	Feed per tooth: *fz* (mm/t)	0.16	0.14
	Feed speed : *Vf* (mm/min)	1500	2000
	Depth of cut : *ap* (mm)	0.25	0.11
	Width of cut : *ae* (mm)	0.35	-
	Machining	Profiling	Profiling
	Coolant	Wet (internal, 40bar)	Dry
	Machine	Vertical M/C	Vertical M/C
Results		 DoMini-Mill increased tool life by 40% because of lower cutting force compared to competitor's tool and AH110 grade with high wear resistance.	**5 hours machining!** New PremiumGTec grade with improved wear resistance achieved long tool life.

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