

# PROFILEMILL SERIES

[www.tungaloy.com](http://www.tungaloy.com)

Tungaloy Report No. 528-G

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



**INDUSTRY 4.0**  
*FEED the SPEED!*



ACCELERATED MACHINING



MillLine

# PROFILEMILL SERIES

TUNGALOY



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

[www.tungaloy.com](http://www.tungaloy.com)

## 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

Ball type



**BALL<sup>FINISH</sup>NOSE**

Tool diameter  $\varnothing 8 - 32$   
(R4 - R16)

Radius type



**BALL<sup>FINISH</sup>NOSE**

Tool diameter  $\varnothing 12 - 20$   
(R0.5 - R1.5)

Semi-Finishing



**BALL<sup>ROUGH</sup>NOSE**

Tool diameter  $\varnothing 16 - 25$   
(R8 - R12.5)



**DOM<sup>INI</sup>MILL**

Tool diameter  $\varnothing 16-25$   
(R0.5, R1.0)

Roughing

## 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

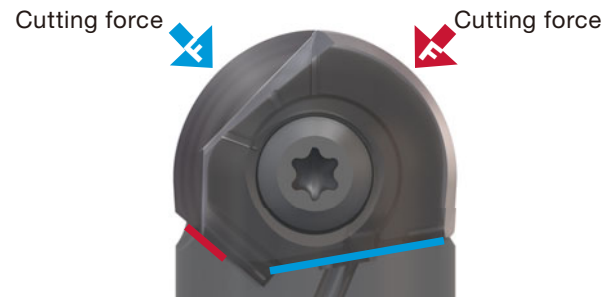
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## BALLFINISH NOSE

### Secure clamping mechanism

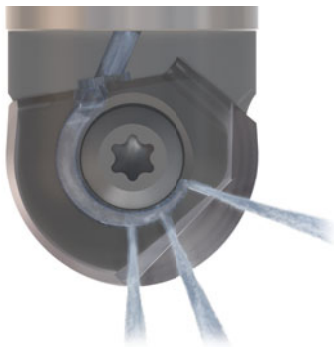


Clamping force gathers on the flat part of the insert hole as the screw is tightened. The force pushes the insert towards the cutter body, providing high repeatability and rigidity as well as minimum run-out.



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

### Unique coolant supply system

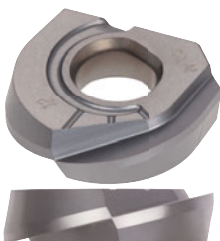


- The coolant channel on insert surface, supplies coolant to the cutting edge from three directions.
- Excellent chip evacuation and cooling effect provides good surface finish and long tool life in machining of hardened steel.

### Two insert varieties

#### MJ chipbreaker

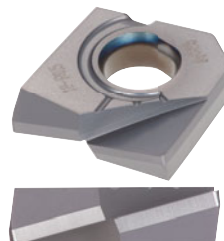
##### Ball nose type: ZFBM



- 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



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



For steel, stainless steel, and cast iron

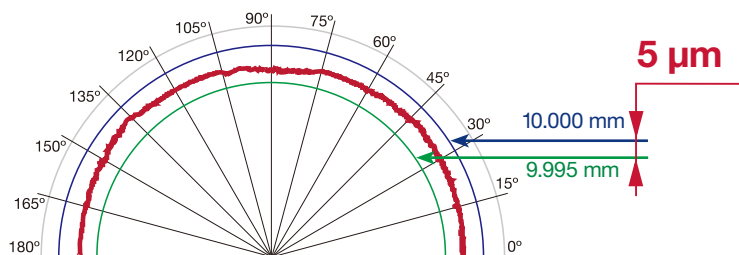
| Application  | Grade            | Substrate        |              |                | Coating layer    |                | Features                                                                            |
|--------------|------------------|------------------|--------------|----------------|------------------|----------------|---------------------------------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

## First choice

| Workpiece material | <b>P</b> Carbon steel,<br>Alloy steel | <b>M</b> Stainless steel | <b>P</b> Prehardend steel,<br>Die & mold tool steel | <b>H</b> High hardened<br>steel | <b>K</b> 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



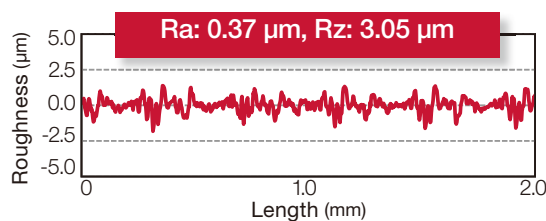
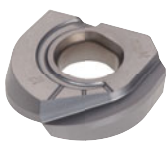
Ball nose insert has high radius accuracy within 5 μm and precisely meets dimensional requirements.

Shank: EBFM20T25S180

Insert: ZFBM200R00-MJ

Tool diameter:  $\phi D_c = \phi 20$  mm ( $r_E = 10$  mm)

## Good surface finish

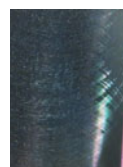
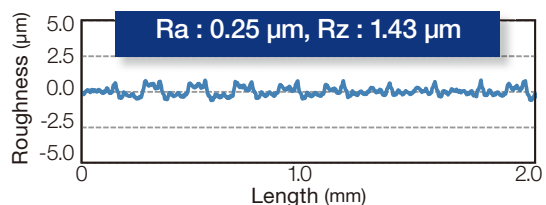
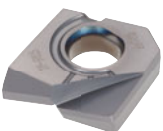
Ball nose type  
ZFBM200R00-MJ

Shank : EBFM20T25S180

Workpiece material: S55C / C55

Cutting speed:  $V_c = 200$  m/minFeed per tooth:  $f_z = 0.15$  mm/tDepth of cut:  $a_p = 0.5$  mm

Coolant: Wet

Radius type  
ZFRM200R10-MJ



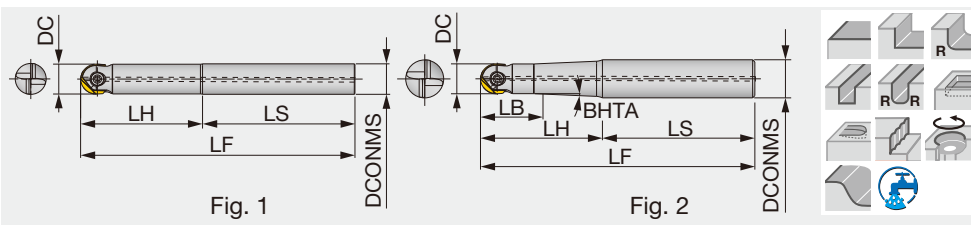
# PROFILEMILL SERIES

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## BALL FINISH

### EBFM

Indexable endmills for high precision finish



| 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



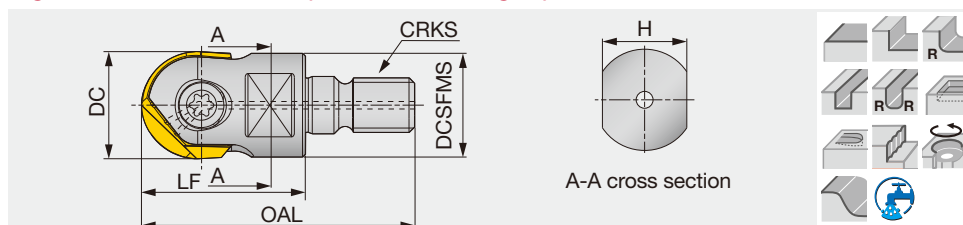
| Designation | Clamping screw | Torx bit  | Grip   | Wrench |
|-------------|----------------|-----------|--------|--------|
| EBFM08...   | TS 25F080A     | -         | -      | T-8D   |
| EBFM10...   | TS 30F100A     | -         | -      | T-10D  |
| EBFM12...   | TS 40F120A     | -         | -      | 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



**BALLFINISH****HBFM**

Indexable endmills with TungFlex threaded adaptation for high precision finish



| 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... |

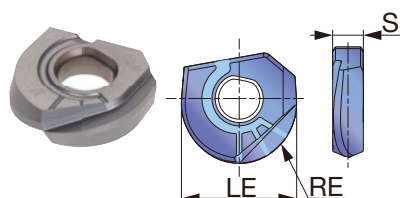
**SPARE PARTS**

| 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  |

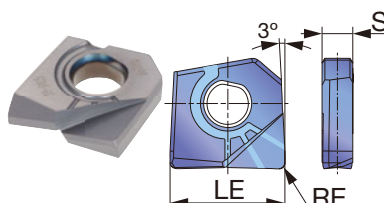
\*Torque: Recommended torque (N-m) for clamping : TS25F080A=1.3, TS30F100A=2.5, TS40F120A=3.5, TS50F160A=5, TS60F200A=7, TS70F250A=7, TS80F300A=10

## INSERT

### ZFBM-MJ



### ZFRM-MJ



|                         |   |   |
|-------------------------|---|---|
| <b>P</b> Steel          | ☆ | ★ |
| <b>M</b> Stainless      |   | ☆ |
| <b>K</b> Cast iron      | ★ | ☆ |
| <b>N</b> Non-ferrous    |   | ☆ |
| <b>S</b> Superalloys    |   | ★ |
| <b>H</b> 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  |
| <b>P</b> | 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<br>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  |
| <b>M</b> | 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  |
| <b>K</b> | 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  |
| <b>N</b> | Aluminium                                  | -            | First choice            | AH725  | ≤ 0.03D                | 200 - 400                | 0.25                      | 0.25 | 0.35 | 0.35 | 0.35 | 0.4  | 0.4  | 0.45 |
| <b>H</b> | 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.

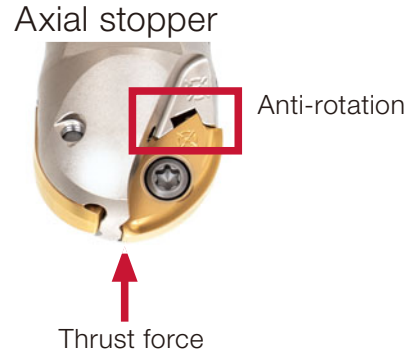
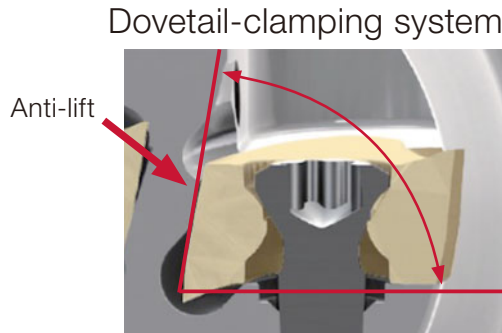
## Notes:

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.

## BALL<sup>ROUGH</sup>NOSE

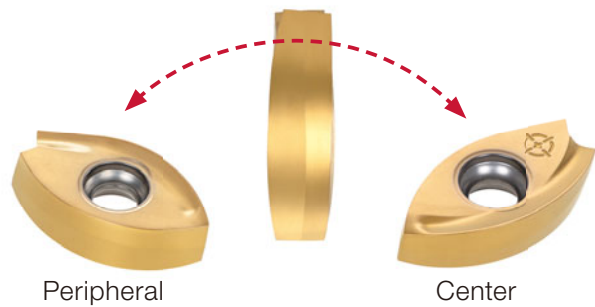
### Profiling Reliability

Dovetail clamping design and axial support prevents insert movement for reliability



### Unique 2-in-1 insert design

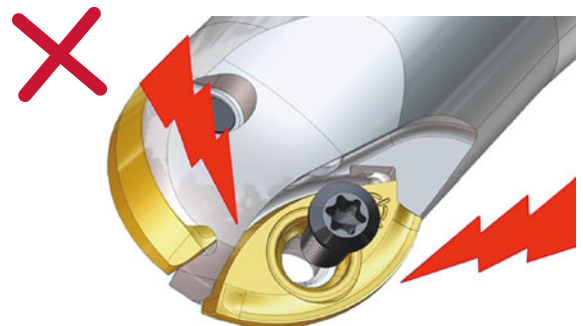
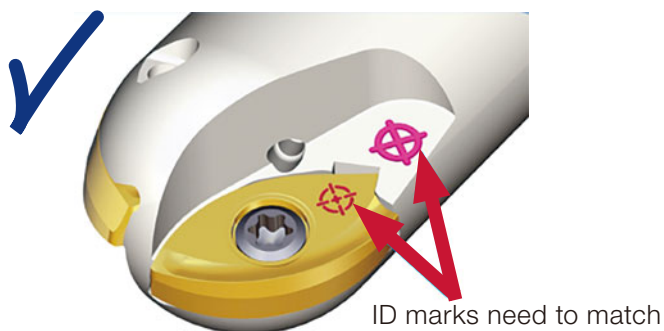
The BallRoughNose insert is double-sided. The same insert can be used for center cutting as well as peripheral, thus streamlining tool inventory with reduced tool costs.



Helical cutting edge for smoother entry into the material



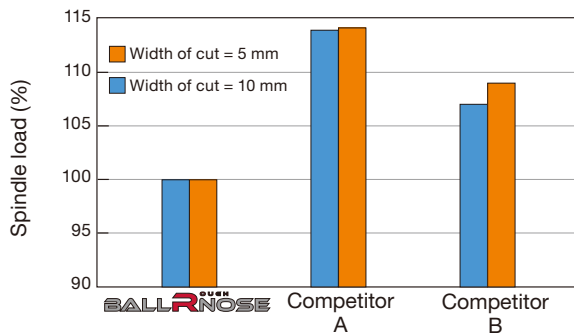
Insert will not fit the pocket when ID marks do not match





## CUTTING PERFORMANCE

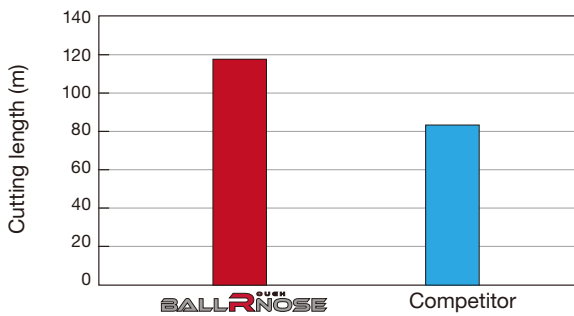
## Cutting force



Steel

Cutter : EBRM20T25S160 (D20, Z = 2)  
 Insert : ZRBM200-MM APH730  
 Application : Shouldering  
 Cutting speed :  $V_c = 150$  m/min  
 Feed per tooth :  $f_z = 0.15$  mm/t  
 Depth of cut :  $a_p = 10$  mm  
 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 :  $V_c = 200$  m/min  
 Feed per tooth :  $f_z = 0.15$  mm/t  
 Depth of cut :  $a_p = 5$  mm  
 Width of cut :  $a_e = 8$  mm  
 Machine : Vertical M/C (BT50, 30kW)  
 Workpiece material : S55C/C55 (200HB)

## Plunging performance



BALLRNOSE



Competitor



Steel

Cutter : EBRM20T25S160 (D20, Z = 2)  
 Insert : ZRBM200-MM APH730  
 Application : Plunging  
 Cutting speed :  $V_c = 150$  m/min  
 Feed per tooth :  $f_z = 0.4$  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.

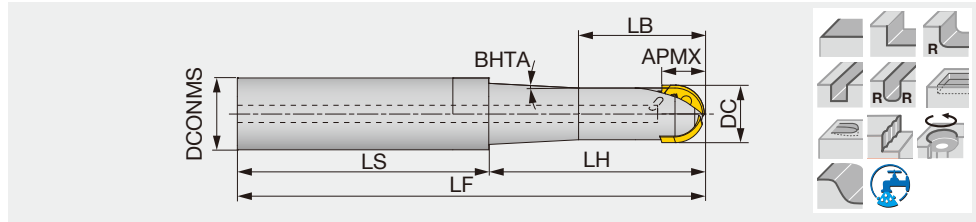
# PROFILEMILL SERIES

TUNGALOY

## BALL<sup>ROUGH</sup>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



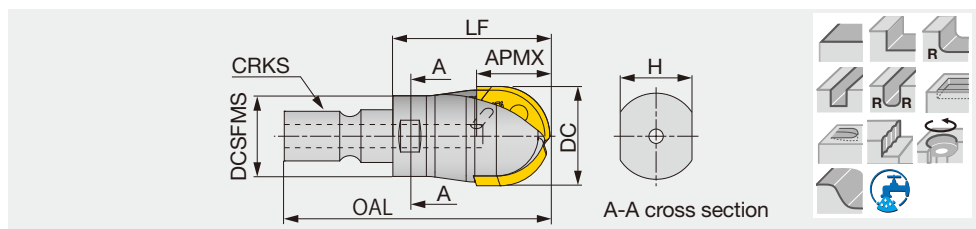
| Designation | Clamping screw | Wrench |
|-------------|----------------|--------|
| EBRM16...   | TS25064I       | T-8D   |
| EBRM20...   | TS30085I/HG    | T-9D   |
| EBRM25...   | TS35085I/HG    | T-15D  |

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

## BALL<sup>ROUGH</sup>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  |

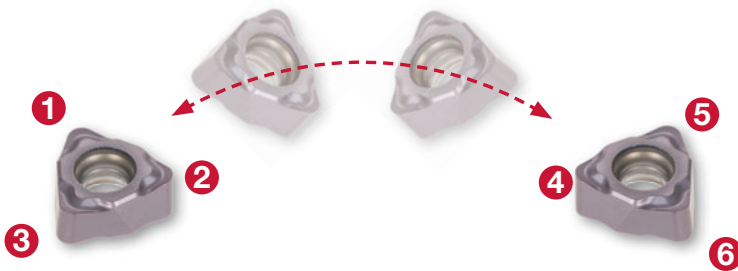
\*Torque: Recommended torque (N-m) for clamping : TS25064I=1.3, TS30085I/HG=2.3, TS35085I/HG=3.5



## DOM<sup>INI</sup>MILL

### 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.

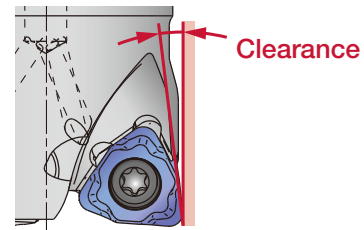


### High stability

- 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.

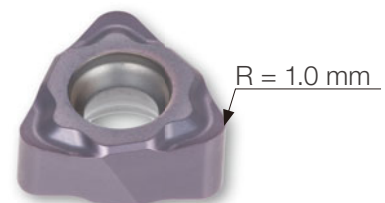
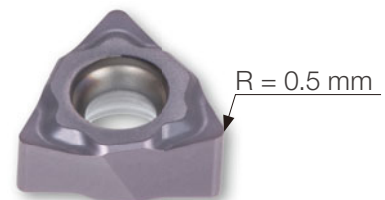


Dovetail clamping system



### Inserts

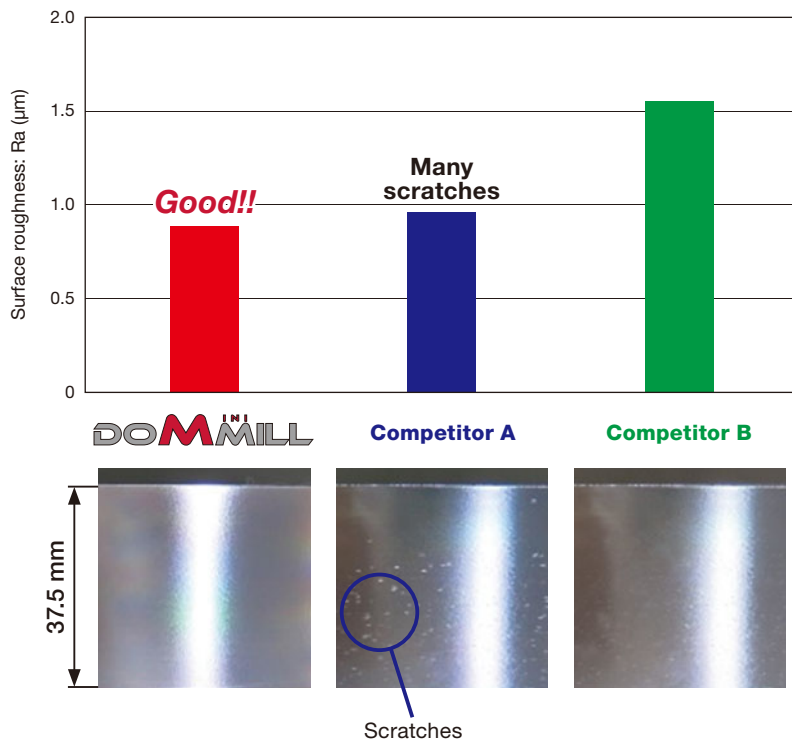
- H-class insert with high accuracy provides minimized runout.
- 2 sizes of corner radii available for various type of machining.  
 $R = 0.5 \text{ mm}$ : Suitable for general purpose with low depth and width of cut  
 $R = 1.0 \text{ mm}$ : Ideal for hardened steel machining due to improved corner strength
- AH110 grade with PremiumGTec and high wear resistance is ideal for hardened material machining.



WXHU04-MJ

## CUTTING PERFORMANCE

## Surface finish

**P**

Steel

Cutter : HFWX04M016M08R02  
( $\phi D_c = 16$  mm,  $z = 2$ )

Insert : WXHU040310R-MJ

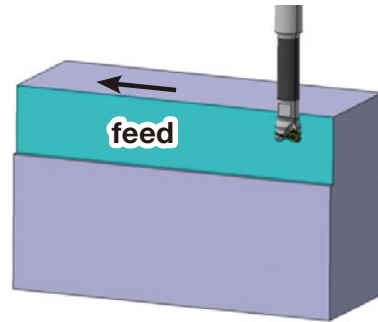
Workpiece material : SCM440 / 42CrMo4 (302HB)

Cutting speed :  $V_c = 300$  m/min

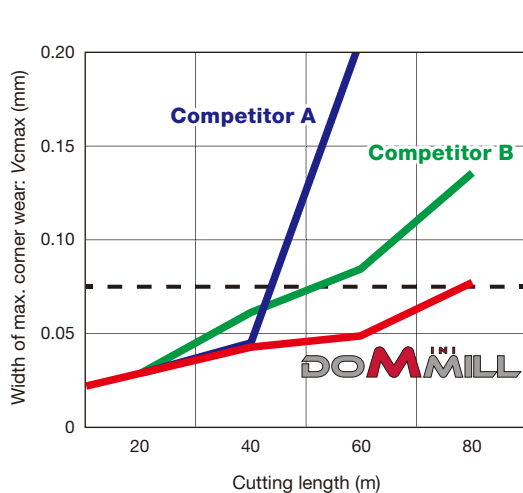
Feed per tooth :  $f_z = 0.15$  mm/t

Depth of cut :  $a_p = 0.15$  mm

Width of cut :  $a_e = 0.5$  mm



## Tool life

**H**

Hard Materials

Cutter : HFWX04M016M08R02 ( $\phi D_c = 16$  mm,  $z = 2$ )

Insert : WXHU040310R-MJ

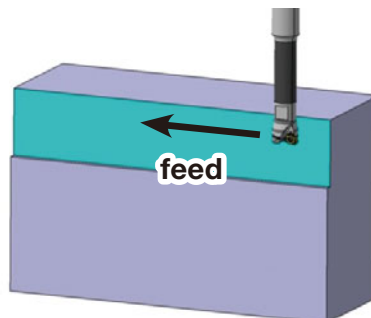
Workpiece material : SKD11 / X153CrMoV12 (58.5HRC)

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





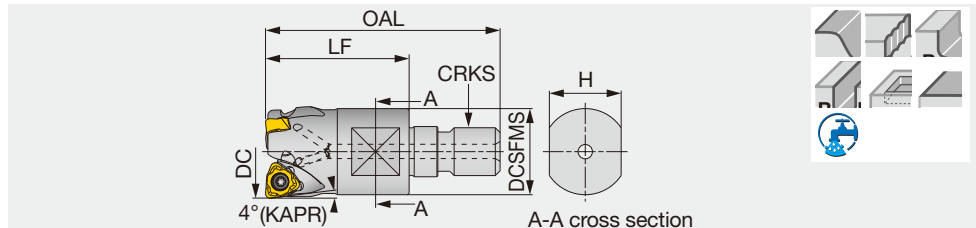
# PROFILEMILL SERIES

TUNGALOY

**DOM<sup>INI</sup>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

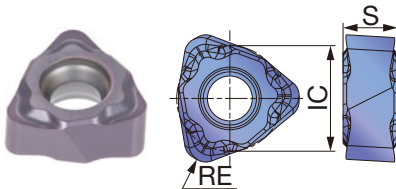


| Designation | Clamping screw | Lubricant | Wrench |
|-------------|----------------|-----------|--------|
| HFWX04M...  | SR34-514       | M-1000    | T-7F   |

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

## INSERT

WXHU-MJ



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

★ : First choice  
☆ : Second choice

| Designation    | RE  | APMX | Coated | 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.

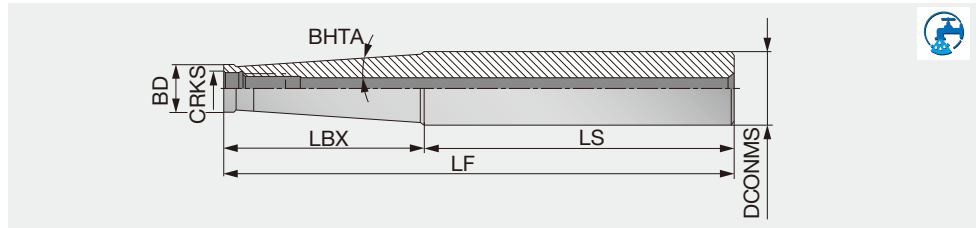
●: Line up

## STANDARD CUTTING CONDITIONS

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

**TUNGFLEX****SM**

## Endmills - modular shank

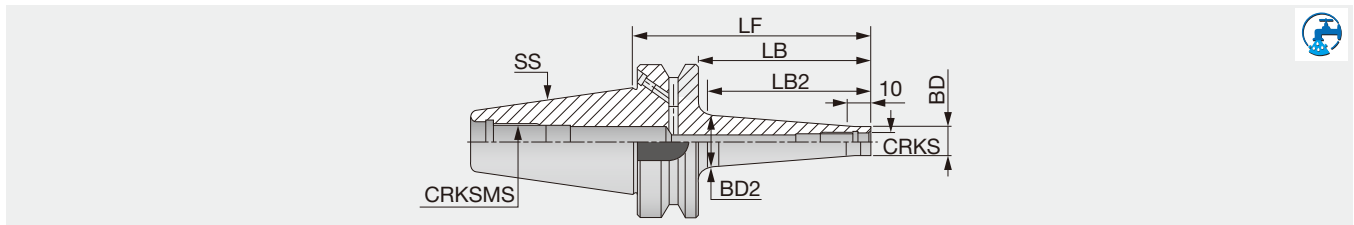


| Designation   | DCONMS | LF  | LS    | LBX  | BD  | CRKS | BHTA | Shank type  |
|---------------|--------|-----|-------|------|-----|------|------|-------------|
| SM06-L60C10   | 10     | 60  | 40    | 20   | 9.7 | M6   | 0°   | Cylindrical |
| SM06-L125-C12 | 12     | 105 | 45    | 60   | 9.7 | M6   | 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



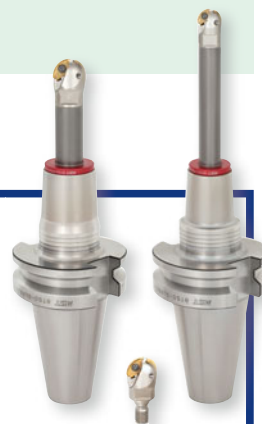
| Designation       | SS | CRKS | BD  | BD2  | LF  | LB  | LB2 | CRKSMS |
|-------------------|----|------|-----|------|-----|-----|-----|--------|
| BT40ODP6X66       | 40 | M6   | 9.8 | 13   | 66  | 39  | 30  | M16    |
| BT40ODP6X106      | 40 | M6   | 9.8 | 23   | 106 | 79  | 70  | M16    |
| BT40ODP8X66       | 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<sup>-1</sup>

# 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

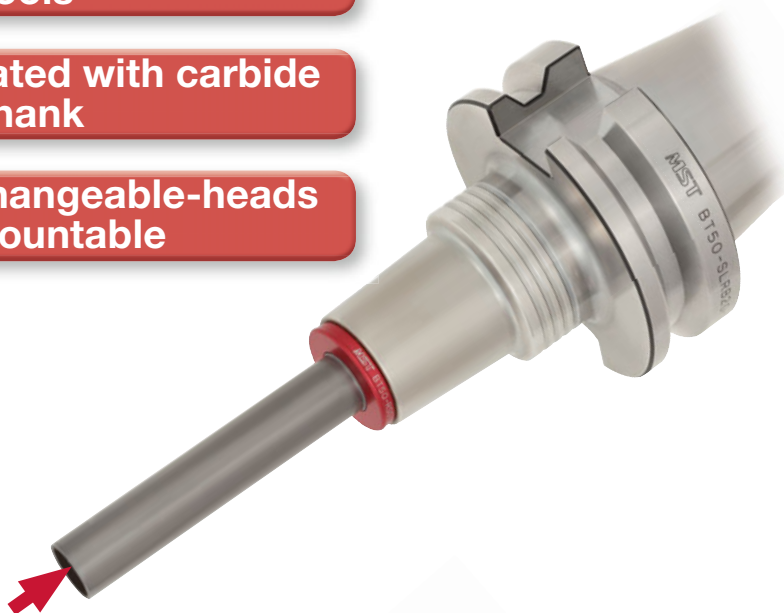


## Ensures the highest performance with changeable-head tools

Optimized for changeable-head tools

Arbors integrated with carbide shank

All types of changeable-heads are mountable



BALL <sup>ROUSE</sup> NOSE  
HBRM...



BALL <sup>FINISH</sup> NOSE  
HBFM...



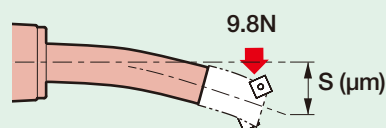
DO <sup>MILL</sup> M  
HFWX...



DO <sup>FEED</sup> FEED  
HXN...

### Tool rigidity index

Values in "S" column 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.

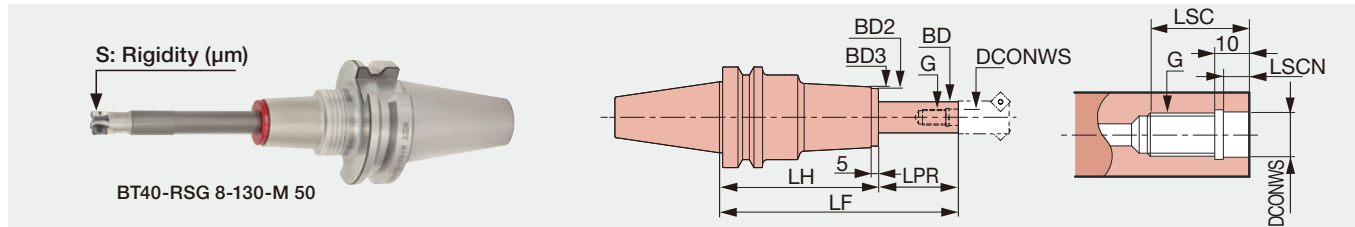


Manufactured by: **MST** corporation

# TUNGFLEX

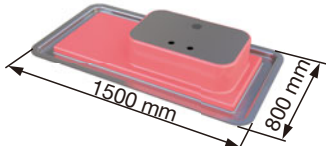
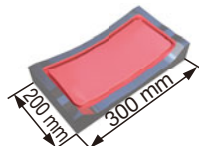
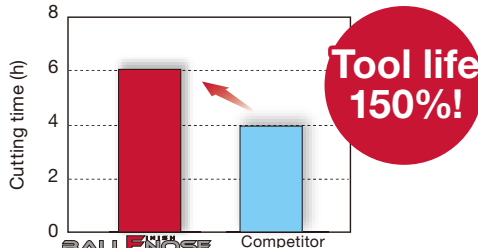
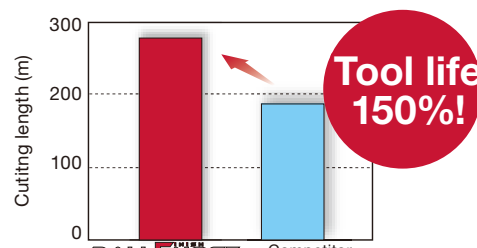
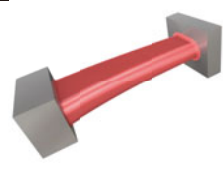
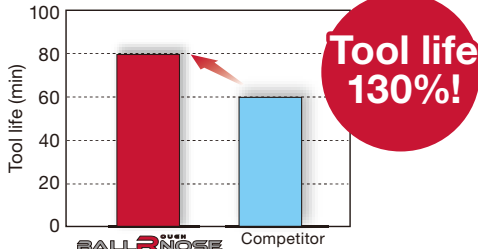
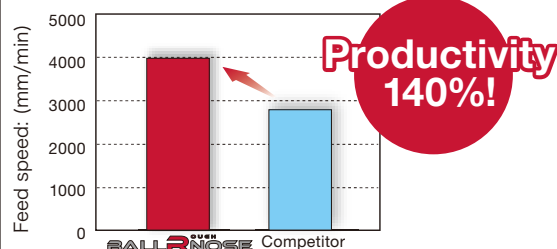
## BT-RSG (Screw clamping head holder)

TungFlex modular tooling system with BT shank



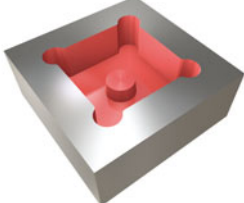
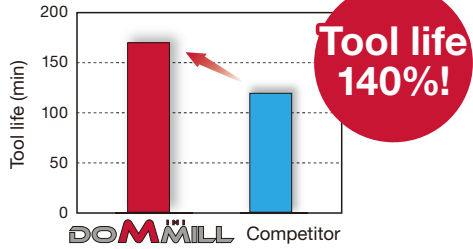
| Designation          | DCONWS | LSC | LSCN | BD | LF  | LPR | LH  | BD2 | BD3 | S   | WT (kg) | G   |
|----------------------|--------|-----|------|----|-----|-----|-----|-----|-----|-----|---------|-----|
| BT40-RSG 8-105-M 25  | 8.5    | 18  | 6.5  | 15 | 105 | 25  | 80  | 30  | 32  | 0.6 | 1.4     | 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                                                                                                                                                                                                                                                                                                    |
|                    |                              |  <b>H</b>                                                                                                                            |  <b>H</b>                                                                                                                                                                                                              |
| Cutting conditions | Cutting speed: $V_c$ (m/min) | 350                                                                                                                                                                                                                   | 360                                                                                                                                                                                                                                                                                                       |
|                    | Feed per tooth: $f_z$ (mm/t) | 0.15                                                                                                                                                                                                                  | 0.09                                                                                                                                                                                                                                                                                                      |
|                    | Depth of cut: $a_p$ (mm)     | 0.2                                                                                                                                                                                                                   | 0.5                                                                                                                                                                                                                                                                                                       |
|                    | Pick feed: $p_f$ (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            |                              |  <p>BallFinishNose's tool life was 50% longer than the competitor's due to high wear resistance.</p>                                |  <p>BallFinishNose's cutting length was 50% longer than the competitor's due to excellent chip evacuation.</p>                                                                                                         |
| Workpiece type     |                              | <b>New</b> Mold part                                                                                                                                                                                                  | <b>New</b> Turbine blade                                                                                                                                                                                                                                                                                  |
| Cutter             |                              | EBRM25T32S200                                                                                                                                                                                                         | EBRM20T25S160                                                                                                                                                                                                                                                                                             |
| Insert             |                              | ZRBM250-MM                                                                                                                                                                                                            | ZRBM200-MM                                                                                                                                                                                                                                                                                                |
| Grade              |                              | APH730                                                                                                                                                                                                                | APH730                                                                                                                                                                                                                                                                                                    |
| Workpiece material |                              | SCM440 / 42CrMo4                                                                                                                                                                                                      | 10705BU                                                                                                                                                                                                                                                                                                   |
|                    |                              |  <b>P</b>                                                                                                                          |  <b>M</b>                                                                                                                                                                                                            |
| Cutting conditions | Cutting speed: $V_c$ (m/min) | 250                                                                                                                                                                                                                   | 175                                                                                                                                                                                                                                                                                                       |
|                    | Feed per tooth: $f_z$ (mm/t) | 0.25                                                                                                                                                                                                                  | 0.72                                                                                                                                                                                                                                                                                                      |
|                    | Feed speed: $V_f$ (mm/min)   | 1592                                                                                                                                                                                                                  | 4011                                                                                                                                                                                                                                                                                                      |
|                    | Depth of cut: $a_p$ (mm)     | 8                                                                                                                                                                                                                     | 0.1 - 0.6                                                                                                                                                                                                                                                                                                 |
|                    | Width of cut: $a_e$ (mm)     | 4                                                                                                                                                                                                                     | -                                                                                                                                                                                                                                                                                                         |
|                    | Method of machining          | Profiling                                                                                                                                                                                                             | Profiling                                                                                                                                                                                                                                                                                                 |
|                    | Coolant                      | Air                                                                                                                                                                                                                   | Air blow                                                                                                                                                                                                                                                                                                  |
| Machine            |                              | Vertical M/C                                                                                                                                                                                                          | Specialized machine                                                                                                                                                                                                                                                                                       |
| Results            |                              |  <p>Thanks to its tough cutting edge and APH730 grade, BallRoughNose achieved 30% longer tool life compared to the competitor.</p> |  <p>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.</p> |



## 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)                                                             |
|                    |                               |                                  |  |
| Cutting conditions | Cutting speed : $V_c$ (m/min) | 195                                                                                                               | 274                                                                                 |
|                    | Feed per tooth: $f_z$ (mm/t)  | 0.16                                                                                                              | 0.14                                                                                |
|                    | Feed speed : $V_f$ (mm/min)   | 1500                                                                                                              | 2000                                                                                |
|                    | Depth of cut : $a_p$ (mm)     | 0.25                                                                                                              | 0.11                                                                                |
|                    | Width of cut : $a_e$ (mm)     | 0.35                                                                                                              | -                                                                                   |
|                    | Machining                     | Profiling                                                                                                         | Profiling                                                                           |
|                    | Coolant                       | Wet (internal, 40bar)                                                                                             | Dry                                                                                 |
|                    | Machine                       | Vertical M/C                                                                                                      | Vertical M/C                                                                        |
| Results            |                               |                                |                                                                                     |
|                    |                               | <p><b>5 hours machining!</b><br/>New PremiumGTec grade with improved wear resistance achieved long tool life.</p> |                                                                                     |

### **Tungaloy Corporation (Head office)**

11-1 Yoshima-Kogyodanchi  
Iwaki-city, Fukushima, 970-1144 Japan  
Phone: +81-246-36-8501  
Fax: +81-246-36-8542  
www.tungaloy.co.jp

### **Tungaloy America, Inc.**

3726 N Ventura Drive  
Arlington Heights, IL 60004, U.S.A.  
Phone: +1-888-554-8394  
Fax: +1-888-554-8392  
www.tungaloy.com/us

### **Tungaloy Canada**

432 Elgin St. Unit 3  
Brantford, Ontario N3S 7P7, Canada  
Phone: +1-519-758-5779  
Fax: +1-519-758-5791  
www.tungaloy.com/ca

### **Tungaloy de Mexico S.A.**

C Los Arellano 113,  
Parque Industrial Siglo XXI  
Aguascalientes, AGS, Mexico 20290  
Phone: +52-449-929-5410  
Fax: +52-449-929-5411  
www.tungaloy.com/mx

### **Tungaloy do Brasil Ltda.**

Avd. Independencia N4158 Residencial Flora  
13280-000 Vinhedo, São Paulo, Brasil  
Phone: +55-19-38262757  
Fax: +55-19-38262757  
www.tungaloy.com/br

### **Tungaloy Germany GmbH**

An der Alten Ziegelei 1  
D-40789 Monheim, Germany  
Phone: +49-2173-90420-0  
Fax: +49-2173-90420-19  
www.tungaloy.de

### **Tungaloy France S.A.S.**

ZA Courtaboeuf - Le Rio  
1 rue de la Terre de feu  
F-91952 Courtaboeuf Cedex, France  
Phone: +33-1-6486-4300  
Fax: +33-1-6907-7817  
www.tungaloy.fr

### **Tungaloy Italia S.r.l.**

Via E. Andolfato 10  
I-20126 Milano, Italy  
Phone: +39-02-252012-1  
Fax: +39-02-252012-65  
www.tungaloy.it

### **Tungaloy Czech s.r.o.**

Turanka 115  
CZ-627 00 Brno, Czech Republic  
Phone: +420-532 123 391  
Fax: +420-532 123 392  
www.tungaloy.cz

### **Tungaloy Ibérica S.L.**

C/Miquel Servet, 43B, Nau 7  
Pol. Ind. Bufalvent  
ES-08243 Manresa (BCN), Spain  
Phone: +34 93 113 1360  
Fax: +34 93 876 2798  
www.tungaloy.es

### **Tungaloy Scandinavia AB**

Bultgatan 38  
442 40 Kungälv, Sweden  
Phone: +46-462119200  
www.tungaloy.se

### **Tungaloy Rus, LLC**

115432, Moscow, Andropov Avenue, 18,  
building 7, 11th floor (office 3). Metro station  
"Technopark". Business center «I-Land».  
Phone: +7-499-683-01-80/81  
www.tungaloy.com/ru

### **Tungaloy Polska Sp. z o.o.**

ul. Genewska 24  
03-963 Warszawa, Poland  
Phone: +48-22-617-0890  
Fax: +48-22-617-0890  
www.tungaloy.com/pl

### **Tungaloy U.K. Ltd**

The Technology Centre,  
Wolverhampton Science Park  
Glaisher Drive, Wolverhampton  
West Midlands WV10 9RU, UK  
Phone: +44 121 4000 231  
Fax: +44 121 270 9694  
www.tungaloy.com/uk  
salesinfo@tungaloyuk.co.uk

### **Tungaloy Hungary Kft**

Erzsébet királyné útja 125  
H-1142 Budapest, Hungary  
Phone: +36 1 781-6846  
Fax: +36 1 781-6866  
www.tungaloy.com/hu  
info@tungaloytools.hu

### **Tungaloy Turkey**

Dudullu OSB 4. Cad No:4  
34776 Umraniye Istanbul, TURKEY  
Phone: +90 216 540 04 67  
Fax: +90 216 540 04 87  
www.tungaloy.com.tr  
info@tungaloy.com.tr

### **Tungaloy Benelux b.v.**

Tjalk 70  
NL-2411 NZ Bodegraven, Netherlands  
Phone: +31 172 630 420  
Fax: +31 172 630 429  
www.tungaloy-benelux.com

### **Tungaloy Croatia**

Ulica bana Josipa Jelačića 87,  
10430 Samobor  
Phone: +385 1 3326 604  
Fax: +385 1 3327 683  
www.tungaloy.hr

### **Tungaloy Cutting Tool (Shanghai) Co., Ltd.**

Rm No 401 No.88 Zhabei  
Jiangchang No.3 Rd  
Shanghai 200436, China  
Phone: +86-21-3632-1880  
Fax: +86-21-3621-1918  
www.tungaloy.com/cn

### **Tungaloy Cutting Tool (Thailand) Co., Ltd.**

Interlink tower 4th Fl.  
1858/5-7 Bangna-Trad Road  
km.5 Bangna, Bangkok 10260  
Thailand  
Phone: +66-2-751-5711  
Fax: +66-2-751-5715  
www.tungaloy.co.th

### **Tungaloy Singapore (Pte.), Ltd.**

62 Ubi Road 1, #06-11 Oxley BizHub 2  
Singapore 408734  
Phone: +65-6391-1833  
Fax: +65-6299-4557  
www.tungaloy.com/sg

### **Tungaloy Vietnam**

LE 04-38, Lexington Residence  
67 Mai Chi Tho, Dist. 2,  
Ho Chi Minh City, Vietnam  
Phone: +84-8-37406660  
Fax: +84-8-37406662  
www.tungaloy.com/sg

### **Tungaloy India Pvt. Ltd.**

Indiabulls Finance Centre,  
Unit # 902-A, 9th Floor,  
Tower 1, Senapati Bapat Marg,  
Elphinstone Road (West),  
Mumbai -400013, India  
Phone: +91-22-6124-8804  
Fax: +91-22-6124-8899  
www.tungaloy.com/in

### **Tungaloy Korea Co., Ltd**

#1312, Byucksan Digital Valley 5-cha  
Beotkkot-ro 244, Geumcheon-gu  
153-788 Seoul, Korea  
Phone: +82-2-2621-6161  
Fax: +82-2-6393-8952  
www.tungaloy.com/kr

### **Tungaloy Malaysia Sdn Bhd**

50 K-2, Kelana Mall, Jalan SS6/14  
Kelana Jaya, 47301  
Petaling Jaya, Selangor Darul Ehsan  
Malaysia  
Phone: +603-7805-3222  
Fax: +603-7804-8563  
www.tungaloy.com/my

### **Tungaloy Australia Pty Ltd**

PO Box 2232, 68/1470  
Ferntree Gully Road, Knoxfield  
Victoria 3180, Australia  
Phone: +61-3-9755-8147  
Fax: +61-3-9755-6070  
www.tungaloy.com.au

### **PT. Tungaloy Indonesia**

Kompleks Grand Wisata Block AA-10 No.3-5  
Cibitung  
Bekasi 17510, Indonesia  
Phone: +62-21-8261-5808  
Fax: +62-21-8261-5809  
www.tungaloy.com/id



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