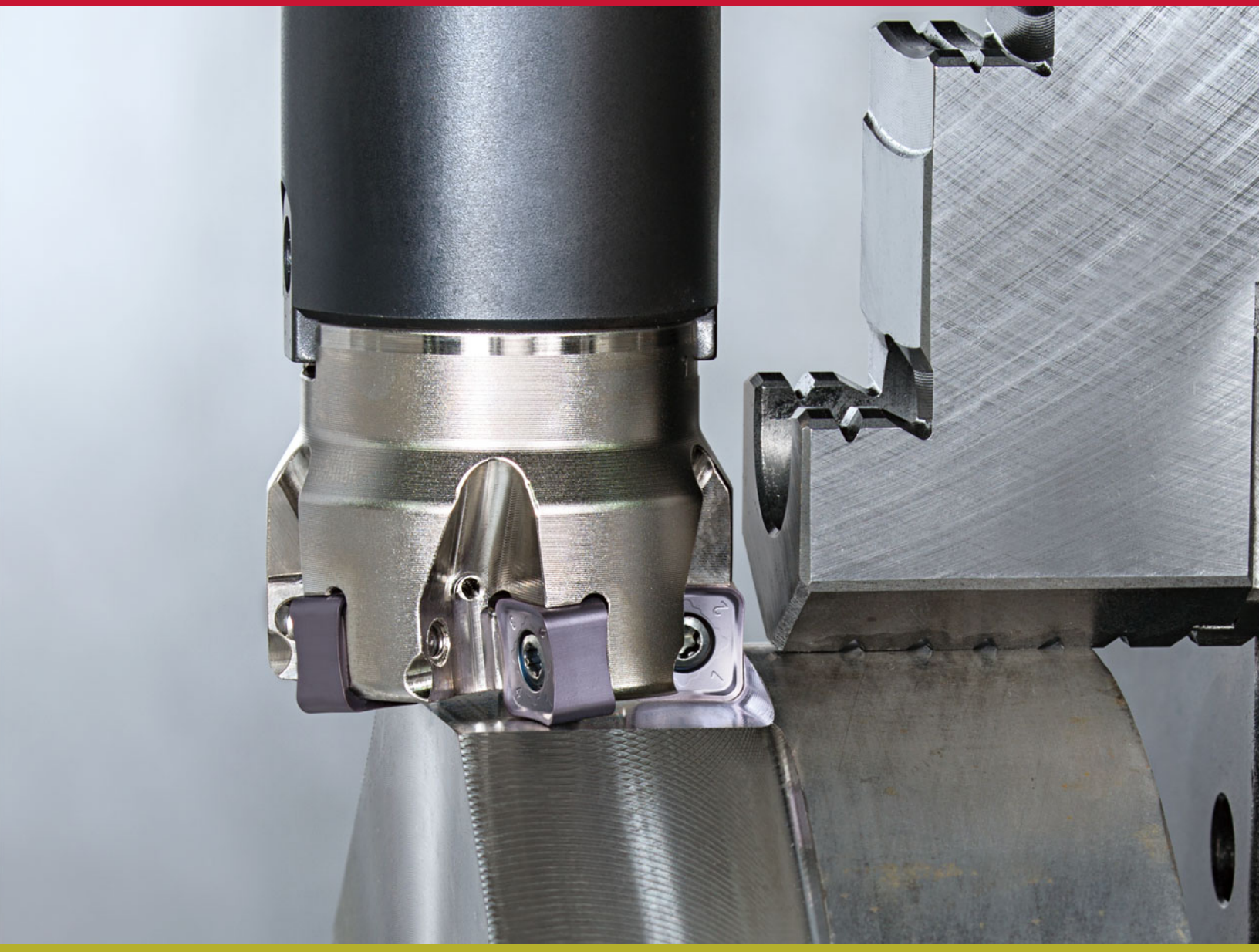
MillLine

UAD DOQMILL

www.tungaloyamerica.com

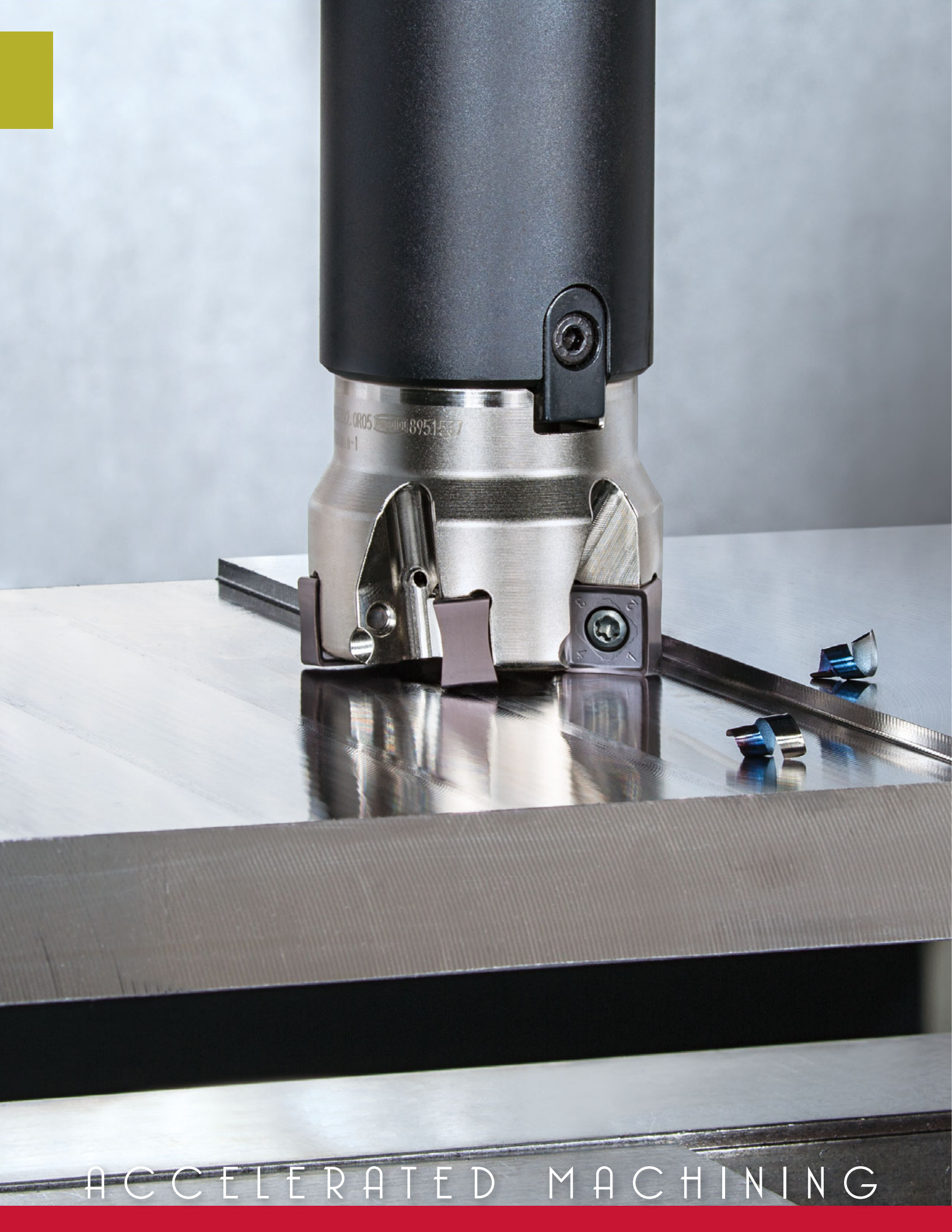
Tungaloy Report No. 522-US

# Face Milling Cutter with 8 Cutting Edge Insert for **Ultimate Clearance**



INDUSTRY 4.0

*FEED the SPEED!*



ACCELERATED MACHINING

MillLine

DOQMILL UAD

TUNGALOY

TUNGFORCE MILL

ACCELERATED MACHINING

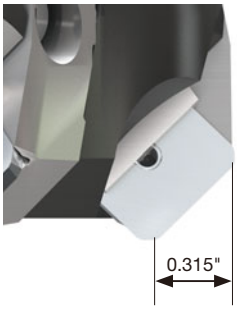
# Milling cutter with 8 cornered insert for high utilization in face milling operations

# Improves surface finishing quality around fixtures, clamping systems, and side walls.

## Face milling cutter with maximum clearance and economy

### Designed to avoid tool interference in rough and finish face milling operations

Provides better clearance and economy

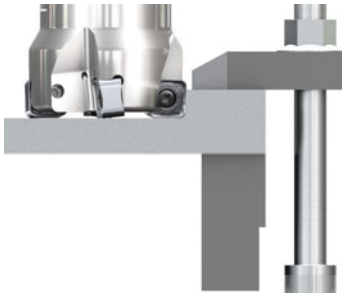



Conventional cutter
4 cutting edges


DOQMILL
8 cutting edges

No interference with side walls, fixtures, and clamping systems

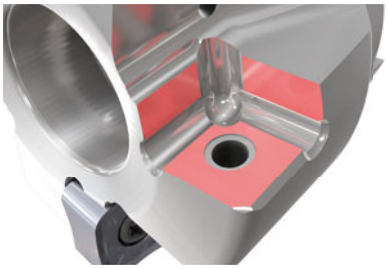
✓ Clear



✓ Clear

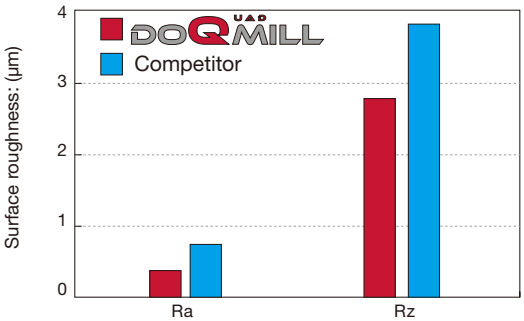
### High accuracy

M4 clamp screw and optimized insert seat ensure secure insert retention



### Wiper insert is also available for precision surface finish requirements

Available in R0.031" (with built-in wiper), R0.047", and R0.079"



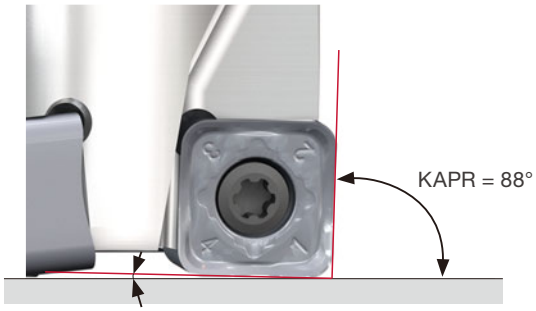

P Steel

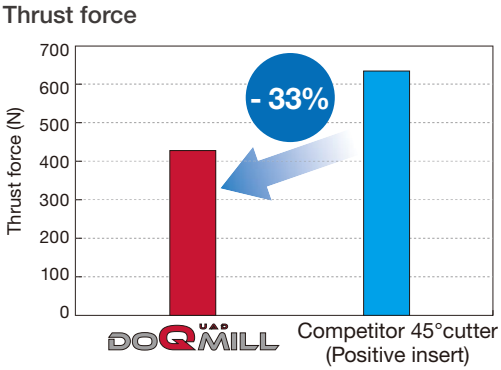
| | |
|---|---|
| Cutter | : THSN12U2.00B0.75R05 (ø = 2", z = 5) |
| Insert | : SNMU120608HNEN-MM AH3135 |
| Workpiece material | : 4140 (H) |
| Cutting speed | : *Vc* = 656 sfm |
| Feed per tooth | : *fz* = 0.006 ipt |
| Depth of cut | : *ap* = 0.020" |
| Width of cut | : *ae* = 1.2" |
| Coolant | : Wet |

# Cutter design optimized for low cutting force and chattering prevention

## The insert's cutting edge features a large rake angle which generates low cutting load, while the large entering angle reduces lifting of the workpiece to ensure stability.

→ Ideal for milling workpieces with thin wall/base or when the fixture is weak



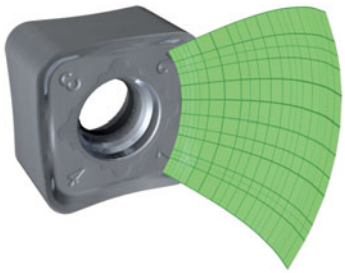




P Steel

| | |
|---|---|
| Cutter | : THSN12U2.00B0.75R05 (ø = 2", z = 1) |
| Insert | : SNMU120608HNEN-MM AH3135 |
| Workpiece material | : 1049 |
| Cutting speed | : *Vc* = 492 sfm |
| Feed per tooth | : *fz* = 0.006 ipt |
| Depth of cut | : *ap* = 0.118" |
| Width of cut | : *ae* = 1.2" |
| Coolant | : Wet |

## Stable cutting performance due to the concave shape cutting edges

Creates barrel-shape chips for effective chip evacuation, eliminating re-cutting in all operations including slotting.



Chip formation (slotting)

P Steel

| | |
|---|---|
| Cutter | : THSN12U2.00B0.75R05 (ø = 2", z = 5) |
| Insert | : SNMU120620EN-MM AH3135 |
| Workpiece material | : 4140 (270HB) |
| Cutting speed | : *Vc* = 656 sfm |
| Feed per tooth | : *fz* = 0.008 ipt |
| Depth of cut | : *ap* = 0.354" |
| Width of cut | : *ae* = 2" |
| Coolant | : Dry |

## Reinforced insert with resistance to fracture

### Comparison of insert toughness

Feed: *fz* (ipt)

| | 0.004 | 0.008 | 0.012 |
|---|---|---|---|
| DOQMILL | OK | OK | OK |
| Competitor | OK | OK | Fractured |

P Steel

| | |
|---|---|
| Cutter | : THSN12U2.00B0.75R05 (ø = 2", z = 5) |
| Insert | : SNMU120620EN-MM AH3135 |
| Workpiece material | : 4140 (270HB) |
| Cutting speed | : *Vc* = 656 sfm |
| Feed per tooth | : *fz* = 0.004 - 0.012 ipt |
| Depth of cut | : *ap* = 0.197" |
| Width of cut | : *ae* = 1.2" |
| Coolant | : Dry |

DOQUAD MILL
TUNGALOY

# Insert grades selection for various materials

- A total of four grades, including two CVD grades

## AH3135

P Steel M Stainless

- PVD grade for high fracture resistance
- Most suitable for steel and stainless steel in general cutting parameters

## AH120

P Steel K Cast iron

- PVD grade with a well-balanced wear and fracture resistance
- Ideal for general machining of steel and stainless steel

## T1215

K Cast iron

- CVD grade with outstanding wear and chipping resistance
- Best for cast iron at high-speed machining

## T3225

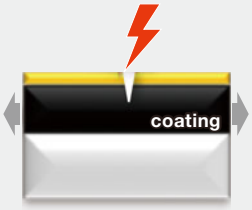
P Steel M Stainless

- CVD grade with excellent chipping and fracture resistance
- Most suited for steel and stainless steel at high-speed machining

### Special Surface Technology

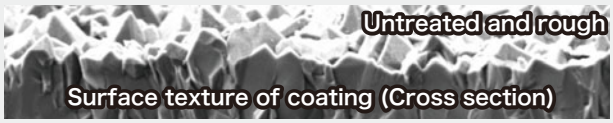
PREMIUMTEC
TUNGALOY


Indentation test on coating

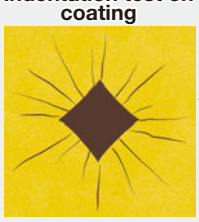


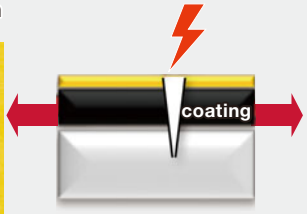

PremiumTec controls tensile residual stress and improves crack resistance.

### Conventional item



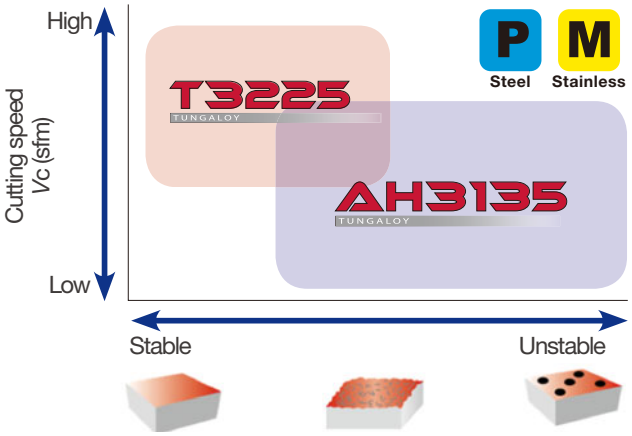

Indentation test on coating

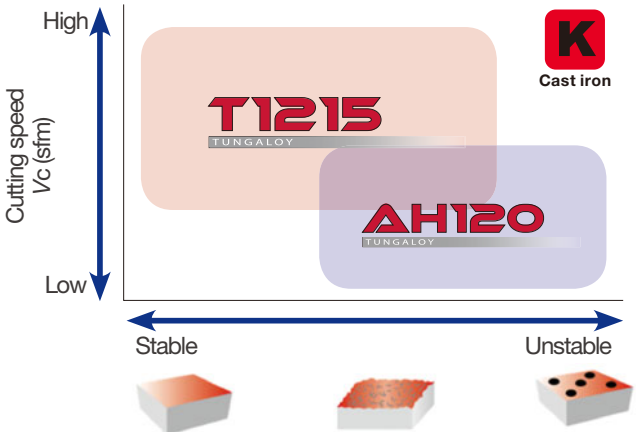





CVD coat by nature has high tensile residual stress allowing crack propagation easily.

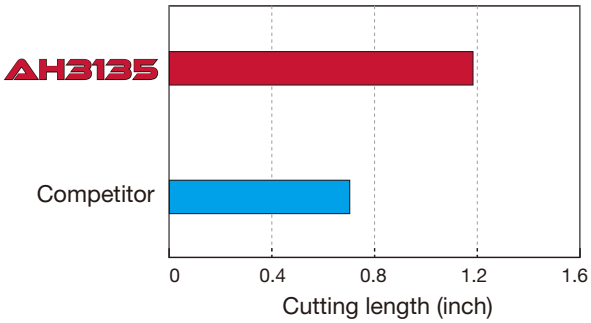
**PremiumTec technology enhances both smoothness and toughness on coating surface, improving resistance to chipping, built-up edge, and fracture.**



# Tool life

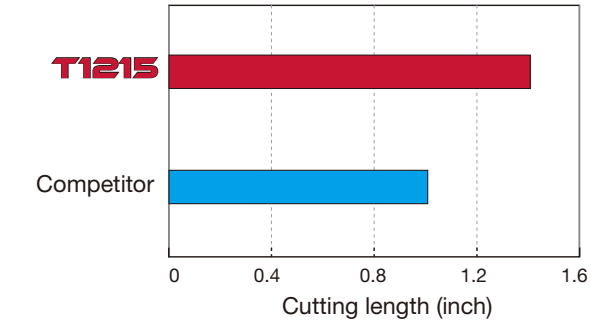
## - Tool life comparison in machining carbon steel




P
Steel

| | |
|---|---|
| Cutter | : THSN12U2.00B0.75R05 (ø = 2", z = 5) |
| Insert | : SNMU120620EN-MM AH3135 |
| Workpiece material | : 4140 (270HB) |
| Cutting speed | : *Vc* = 656 sfm |
| Feed per tooth | : *fz* = 0.007 ipt |
| Depth of cut | : *ap* = 0.118" |
| Width of cut | : *ae* = 1.2" |
| Coolant | : Dry |

## - Tool life comparison in machining ductile cast iron



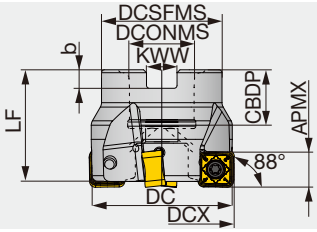

K
Cast iron

| | |
|---|---|
| Cutter | : THSN12U2.00B0.75R05 (ø = 2", z = 5) |
| Insert | : SNMU120620EN-MM T1215 |
| Workpiece material | : 80-55-06 (160HB) |
| Cutting speed | : *Vc* = 1148 sfm |
| Feed per tooth | : *fz* = 0.005 ipt |
| Depth of cut | : *ap* = 0.118" |
| Width of cut | : *ae* = 1.2" |
| Coolant | : Dry |

## THSN12

88° face mills with double sided square inserts

GAMP = +3°, GAMF = -11°




| Designation | APMX | DC | DCX | CICT | DCSFMS | LF | DCONMS | CBDP | KWW | b | WT(lb) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THSN12U2.00B0.75R04 | 0.374 | 2 | 2.024 | 4 | 1.85 | 1.575 | 0.75 | 0.75 | 0.315 | 0.197 | 0.92 | with | SNMU1206... |
| THSN12U2.00B0.75R05 | 0.374 | 2 | 2.024 | 5 | 1.85 | 1.575 | 0.75 | 0.75 | 0.315 | 0.197 | 0.91 | with | SNMU1206... |
| THSN12U2.50B0.75R04 | 0.374 | 2.5 | 2.524 | 4 | 1.85 | 1.575 | 0.75 | 0.75 | 0.315 | 0.197 | 1.22 | with | SNMU1206... |
| THSN12U2.50B0.75R06 | 0.374 | 2.5 | 2.524 | 6 | 1.85 | 1.575 | 0.75 | 0.75 | 0.315 | 0.197 | 1.22 | with | SNMU1206... |
| THSN12U3.00B1.00R05 | 0.374 | 3 | 3.024 | 5 | 1.969 | 1.969 | 1 | 1.024 | 0.374 | 0.236 | 2.12 | with | SNMU1206... |
| THSN12U3.00B1.00R08 | 0.374 | 3 | 3.024 | 8 | 1.969 | 1.969 | 1 | 1.024 | 0.374 | 0.236 | 2.09 | with | SNMU1206... |
| THSN12U4.00B1.50R06 | 0.374 | 4 | 4.024 | 6 | 3.15 | 1.969 | 1.5 | 1.299 | 0.626 | 0.394 | 3.64 | without | SNMU1206... |
| THSN12U4.00B1.50R08 | 0.374 | 4 | 4.024 | 8 | 3.15 | 1.969 | 1.5 | 1.299 | 0.626 | 0.394 | 3.55 | without | SNMU1206... |

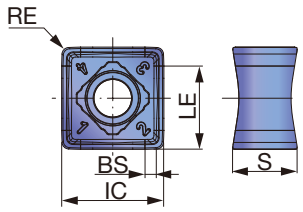
### SPARE PARTS



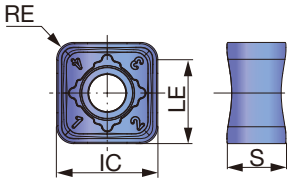
| Designation | Clamping screw | Torx bit | Grip |
|---|---|---|---|
| THSN12U... | CSPB-4 | BLDIP15/S7 | H-TB2W |

# INSERT

## SNMU120608HNEN-MM




## SNMU120612/20EN-MM




| | | AH120 | AH3135 | T1215 | T3225 |
|---|---|---|---|---|---|
| P | Steel | ☆ | ★ | | ★ |
| M | Stainless | | ★ | | ★ |
| K | Cast iron | ★ | | ★ | |
| N | Non-ferrous | | | | |
| S | Superalloys | ★ | ☆ | | |
| H | Hard materials | | | | |

★ : First choice
☆ : Second choice

| Designation | RE | APMX | Coated AH120 | AH3135 | T1215 | T3225 | LE | S | IC | BS |
|---|---|---|---|---|---|---|---|---|---|---|
| *SNMU120608HNEN-MM | 0.031 | 0.374 | ● | ● | ● | ● | 0.386 | 0.295 | 0.472 | 0.055 |
| *SNMU120612EN-MM | 0.047 | 0.374 | | ● | ● | | 0.425 | 0.285 | 0.472 | - |
| SNMU120620EN-MM | 0.079 | 0.374 | | ● | ● | | 0.394 | 0.276 | 0.472 | - |

*To be released in 2019 January

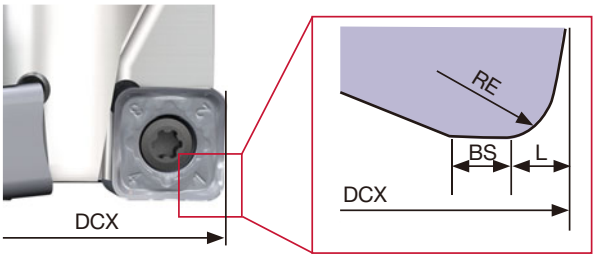
●: Line up

# STANDARD CUTTING CONDITIONS

| ISO | Workpiece materials | Hardness HB | Selection criteria | Recommended grade | Chip-breaker | Cutting speed *Vc* (sfm) | Feed per tooth *fz* (ipt) |
|---|---|---|---|---|---|---|---|
| P | Low carbon steels (1015, etc.) | - 200 HB | First choice | AH3135 | MJ | 328 - 820 | 0.002 - 0.012 |
| | | - 200 HB | Priority on wear resistance | T3225 | MJ | 656 - 1148 | 0.002 - 0.010 |
| | High carbon steels, alloyed steels (1055, 4140(H), etc.) | - 300 HB | First choice | AH3135 | MJ | 328 - 820 | 0.002 - 0.012 |
| | | - 300 HB | Priority on wear resistance | T3225 | MJ | 591 - 984 | 0.002 - 0.010 |
| | Prehardened steel (NAK80, PX5, etc.) | 30 - 40 HRC | First choice | AH3135 | MJ | 328 - 656 | 0.002 - 0.010 |
| | | 30 - 40 HRC | Priority on wear resistance | T3225 | MJ | 492 - 820 | 0.002 - 0.008 |
| M | Austenitic stainless steel (304,316, etc.) | - 200 HB | First choice | AH3135 | MJ | 328 - 656 | 0.002 - 0.010 |
| | | - 200 HB | Priority on wear resistance | T3225 | MJ | 328 - 820 | 0.002 - 0.008 |
| | Stainless cast steel (Hu etc.) | - | First choice | T3225 | MJ | 197 - 394 | 0.002 - 0.008 |
| | | - | Priority on fracture resistance | AH3135 | MJ | 197 - 394 | 0.002 - 0.008 |
| K | Grey cast iron (No.250, etc.) | 150 - 250 HB | First choice | T1215 | MJ | 328 - 1148 | 0.002 - 0.012 |
| | | 150 - 250 HB | Priority on fracture resistance | AH120 | MJ | 328 - 820 | 0.002 - 0.012 |
| | Ductile cast iron (65-45-12, etc.) | 150 - 250 HB | First choice | T1215 | MJ | 328 - 1148 | 0.002 - 0.010 |
| | | 150 - 250 HB | Priority on fracture resistance | AH120 | MJ | 262 - 656 | 0.002 - 0.012 |
| S | Titanium alloy (Ti-6Al-4V, etc.) | - 40 HRC | First choice | AH3135 | MJ | 98 - 197 | 0.002 - 0.008 |
| | Heat resistant alloy (Inconel718, etc.) | - 40 HRC | First choice | AH120 | MJ | 33 - 131 | 0.002 - 0.006 |
| H | Hardened steel (H13) | 40 - 50 HRC | First choice | AH3135 | MJ | 262 - 427 | 0.002 - 0.006 |
| | Hardened steel (D2, etc.) | 50 - 60 HRC | First choice | AH120 | MJ | 164 - 230 | 0.001 - 0.003 |

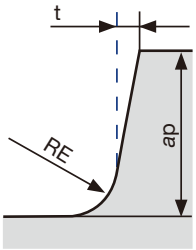
# Tool offset

To eliminate uncut amount in face milling operation, adjust the programming according to the offset (L) listed below.



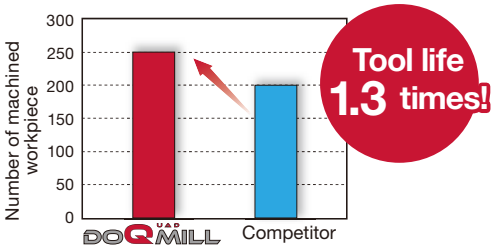
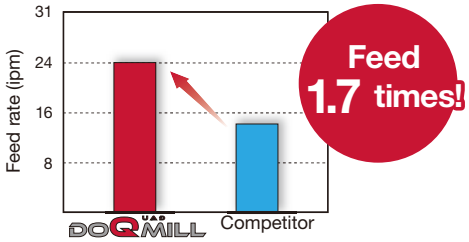

| Designation | RE | BS | L |
|---|---|---|---|
| SNMU120608HNEN-MM | 0.031 | 0.055 | 0.051 |
| SNMU120612EN-MM | 0.047 | - | 0.067 |
| SNMU120620EN-MM | 0.079 | - | 0.098 |

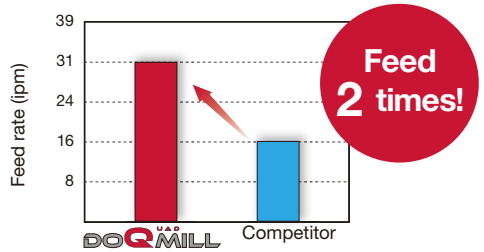
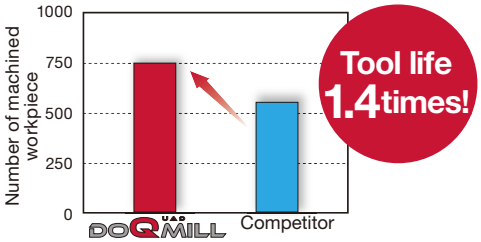
The following table shows the amount left over cut (t) when the cutter is considered as a shoulder milling cutter.




| Designation / *ap* (inch) | 0.039 | 0.079 | 0.118 | 0.157 | 0.197 | 0.236 | 0.276 | 0.315 | 0.354 | 0.374 |
|---|---|---|---|---|---|---|---|---|---|---|
| SNMU120608HNEN-MM | 0.0004 | 0.0016 | 0.0020 | 0.0020 | 0.0028 | 0.0035 | 0.0055 | 0.0079 | 0.0106 | 0.0106 |
| SNMU120612EN-MM | - | 0 | 0 | 0.0004 | 0.0008 | 0.0020 | 0.0035 | 0.0059 | 0.0087 | 0.0098 |
| SNMU120620EN-MM | - | 0 | 0 | 0 | 0.0008 | 0.0020 | 0.0035 | 0.0059 | 0.0087 | 0.0098 |

# PRACTICAL EXAMPLES

| | | | |
|---|---|---|---|
| Workpiece type | | Steering knuckle | Shaft |
| Cutter | | THSN12U2.00B0.75R04 (ø2", z = 4) | THSN12U2.00B0.75R04 (ø2", z = 4) |
| Insert | | SNMU120620EN-MM | SNMU120620EN-MM |
| Grade | | AH3135 | AH3135 |
| Workpiece material | | 65-45-12  K | Alloy steel (35HRC)  P |
| Cutting conditions | Cutting speed : *Vc* (sfm) | 466 | 774 |
| | Feed per tooth : *fz* (ipr) | 0.009 | 0.004 |
| | Feed speed : *Vf* (ipm) | 31.496 | 23.622 |
| | Depth of cut : *ap* (inch) | 0.079 | 0.079 |
| | Cutting width : *ae* (inch) | 1.181 | 1.378 |
| | Method of machining | Face milling | Face milling |
| | Coolant | External | External |
| | Machine | Vertical M/C | Vertical M/C |
| Results | |   Despite poor workpiece rigidity, DoQuad-Mill provided low cutting load and tool life predictability. |   Robust DoQuad-Mill improved machining efficiency over the competitor's shoulder milling cutter. |

| | | | |
|---|---|---|---|
| Workpiece type | | Shaft | Connecting rod |
| Cutter | | THSN12U2.00B0.75R04 (ø2", z = 4) | Special designed endmill (ø40mm, z = 3) |
| Insert | | SNMU120620EN-MM | SNMU120620EN-MM |
| Grade | | AH3135 | AH3135 |
| Workpiece material | | Alloy steel  P | Forged steel (28HRC)  P |
| Cutting conditions | Cutting speed : *Vc* (sfm) | 515 | 525 |
| | Feed per tooth : *fz* (ipr) | 0.008 | 0.004 |
| | Feed speed : *Vf* (ipm) | 31.496 | 15.039 |
| | Depth of cut : *ap* (inch) | 0.079 | 0.079 |
| | Cutting width : *ae* (inch) | 1.575 | 1.575 |
| | Method of machining | Shoulder milling | Shoulder milling |
| | Coolant | External supply | External supply |
| | Machine | Vertical M/C | Vertical M/C |
| Results | |   Conventional shoulder mill could not improve feed due to insert fracture. DoQuad-Mill doubled feed thanks to its high cutting edge integrity. |   Short insert life due to fracture was more common with conventional shoulder mill. DoQuad-Mill improved tool life thanks to its high cutting edge integrity. |

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