Member IMC Group Tungaloy

DOFEED TUNGALOY

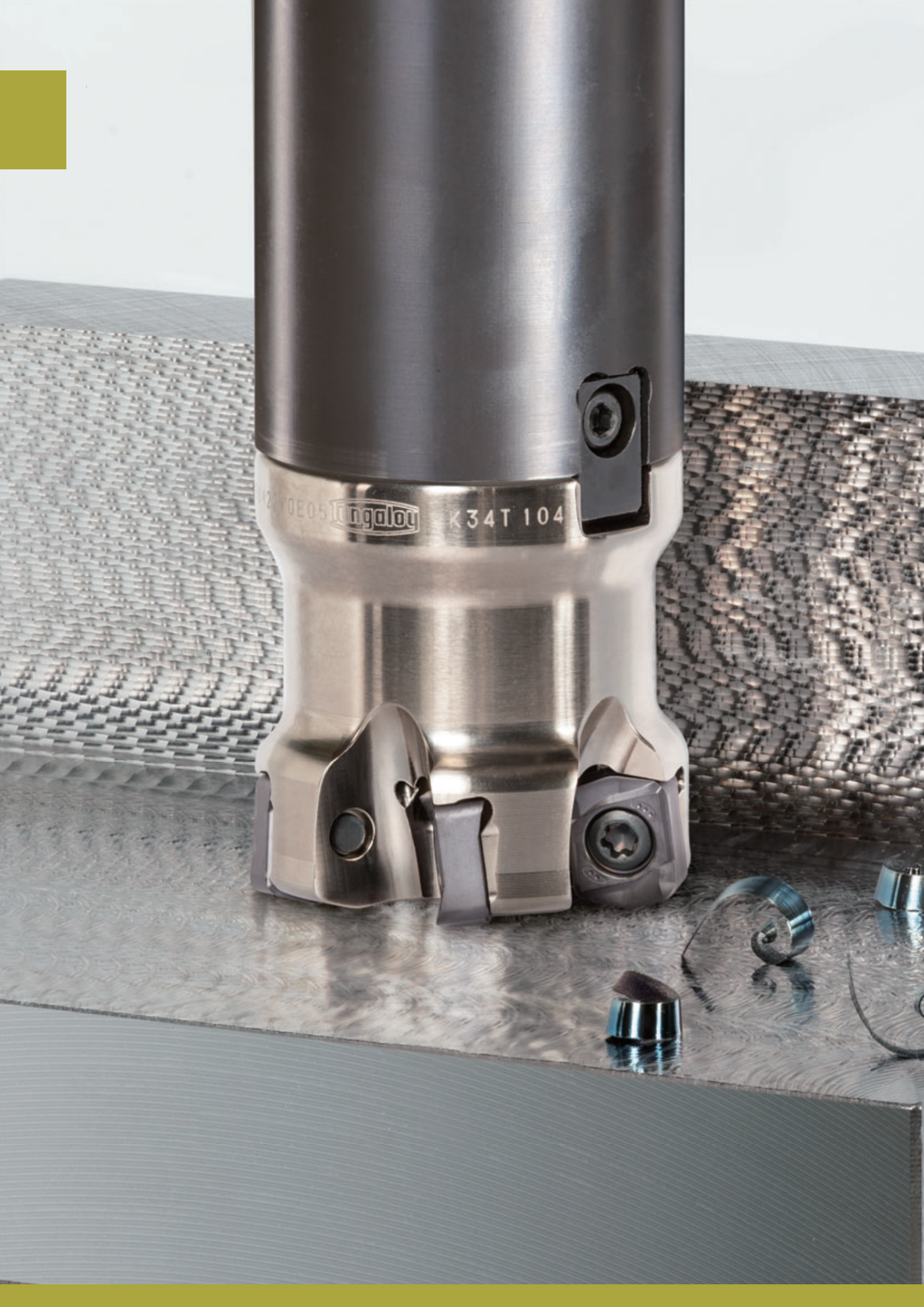
MillLine

MILLLINE

Tungaloy Report No. 403-G

www.tungaloy.com

# Innovative high-feed cutters offer **incredible productivity!**


Tungaloy
K34T 104

www.tungaloy.com

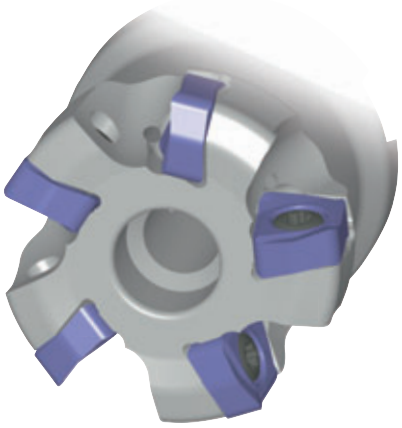
**Mill**Line

DOFEED
TUNGALOY

# High-feed cutters reduce machining time for a wide range of applications.

Member IMC Group
Tungaloy

# DOFEED
TUNGALOY

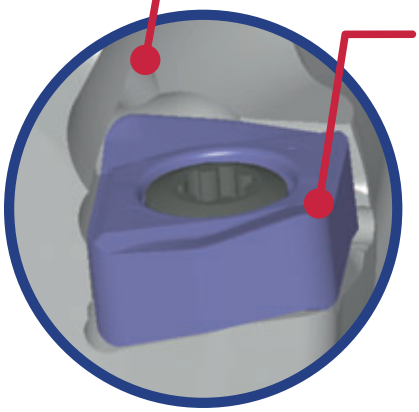


## Innovative high-feed cutters!

DoFeed offers outstanding productivity with close-pitch cutters and special insert geometry that reduces cutting force. The rich lineup of items meets a wide variety of application needs.

## Outstanding productivity

### Excellent chip evacuation prevents chip packing



- Air hole removes all chips away from the insert and cutter body.
- Large inclination forms ideal chips and controls the direction chips flow.


DOFEED
**Good**
Curl consistently at ideal length

**Competitor**
**Poor**
Crushed or unstable

| | |
|---|---|
| Cutter | : TXN06R050M22.0E05 |
| Insert | : LNMU06X5ZER-MJ |
| Grade | : AH725 |
| Workpiece material | : Carbon steels (S55C / C55) |
| Cutting speed | : *Vc* =180 m/min |
| Feed per tooth | : *fz* = 1.8 mm/t |
| Depth of cut | : *ap* =1.0 mm |
| Coolant | : Dry |
| Machine | : Vertical M/C, BT50 |

### Close pitch cutters for high productivity!

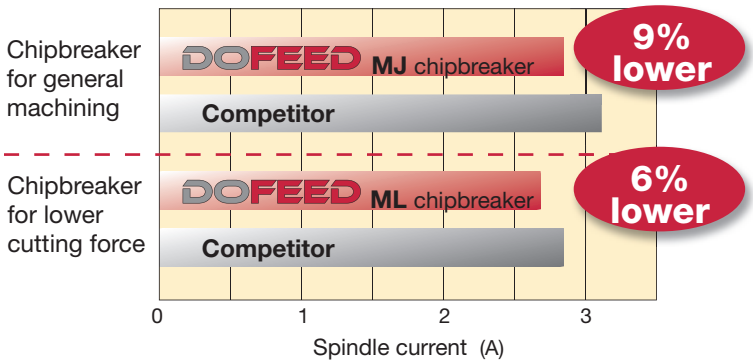
| Tool dia. ø*Dc* (mm) | No. of inserts (z) | | | Productivity improvement compared to competitor |
|---|---|---|---|---|
| | DOFEED | | Competitor | |
| | Coarse pitch | Close pitch | | |
| ø20 | 3 | 4 | 3 | 1.3 times |
| ø25 | 4 | 5 | 4 | 1.3 times |
| ø50 | 4 | 5 | 4 | 1.3 times |
| ø63 | 4 | 6 | 4 | 1.5 times |

Coarse-pitch cutters minimize vibration for tools on low-powered machines.

· ø20 and ø25 are based on EXN03 and HXN03 type
· ø50 and ø63 are based on TXN06 type

### Reduced chatter due to double-sided insert with low cutting forces

**Comparison of spindle load**

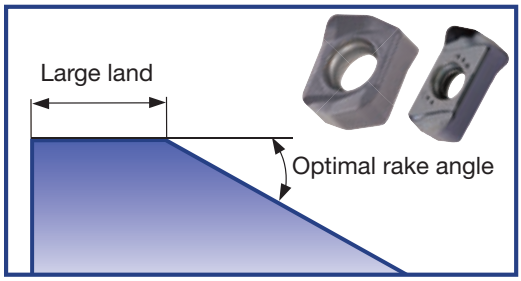



| | |
|---|---|
| Cutter | : EXN03R025M25.0-05 (ø25, z = 5) |
| Insert | : LNMU0303ZER-MJ / ML |
| Grade | : AH725 |
| Workpiece material | : Carbon steels (S55C / C55) |
| Cutting speed | : *Vc* = 250 (m/min) |
| Feed per tooth | : *fz* = 0.5 mm/t (1 insert) |
| Depth of cut | : *ap* = 0.5 mm |
| Width of cut | : *ae* = 25 mm (Slot milling) |
| Coolant | : Dry |
| Machine | : Vertical M/C, BT40 |

# Extensive application coverage with a large variety of items

## Three chipbreakers for all machining needs

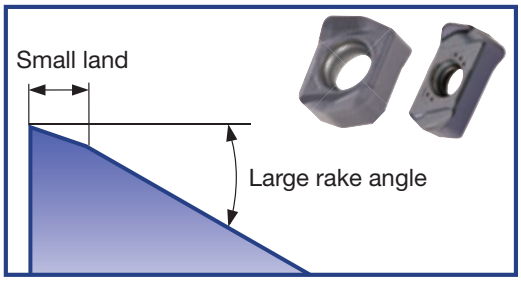
### MJ General machining




P K H
Steel Cast iron Hard Materials

4 cutting edges
- Excellent combination of sharpness and strength
- Ideal for machining steel, cast iron, and hardened steel

### ML Low cutting force




M S
Stainless Superalloys

4 cutting edges
- Exceptional sharpness
- Suitable for cutting stainless steel, titanium alloys, and other exotic materials
- Reduces chattering when cutting with low rigid set-ups

### W Wiper insert

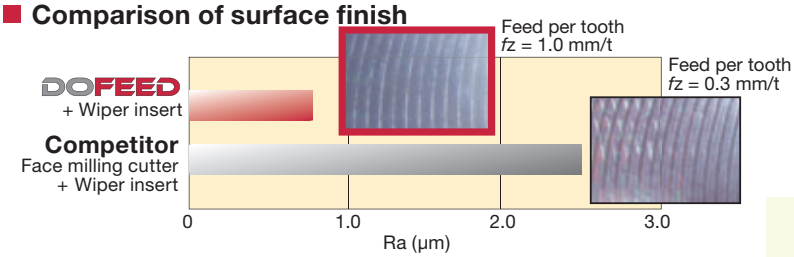

P M K S H
Steel Stainless Cast iron Superalloys Hard Materials

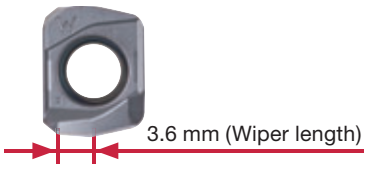
2 cutting edges
- Excellent surface finish while maintaining high productivity

## Cutting performance of wiper insert

### Excellent surface finish!

■ **Comparison of surface finish**

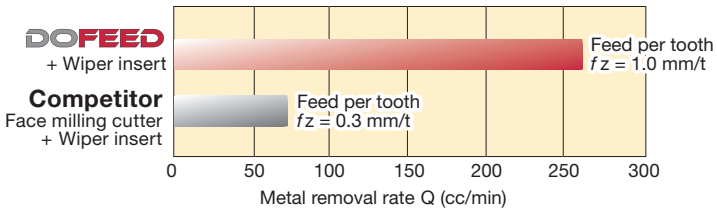



Wiper insert
**LNGU06X5ZER-W**

### Tripled metal removal rate!

■ **Comparison of metal removal rate**

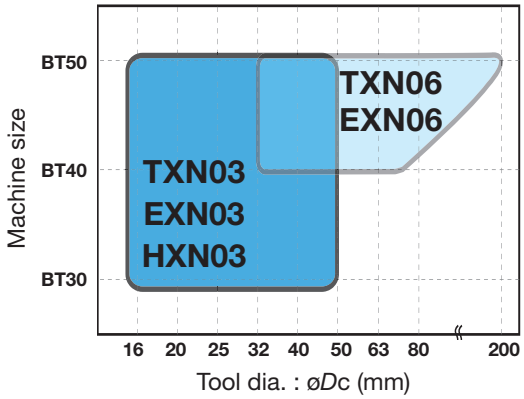



| | |
|---|---|
| Cutter | : TXN06R080M31.7-05 |
| Insert | : LNMU06X5ZER-ML x 3 |
| | : LNGU06X5ZER-W x 2 |
| Grade | : AH725 |
| Workpiece material | : S55C |
| Cutting speed | : *Vc* = 150 m/min |
| Depth of cut | : *ap* = 1.5 mm |
| Width of cut | : *ae* = 60 mm |
| Coolant | : Dry |
| Machine | : Vertical M/C, BT50 |

## Rich lineup of cutter bodies from ø16 to ø200 mm

| Insert | Bore type | Shank type | Modular type |
|---|---|---|---|
| **LNMU03**<br>  <br>Max. *ap* = 1.0 mm | **TXN03**<br>(ø*D*c = 40 - 50 mm)<br>  | **EXN03**<br>(ø*D*c = 16 - 35 mm)<br>  | **HXN03**<br>(ø*D*c = 16 - 32 mm)<br>  |
| **LN*U06**<br>  <br>Max. *ap* = 1.5 mm | **TXN06**<br>(ø*D*c = 50 - 200 mm)<br>  | **EXN06**<br>(ø*D*c = 32 - 40 mm)<br>  | |

■ **Applicable area**



# Grades with long tool life for a wide range of materials

*Special Surface Technology*

PREMIUMTEC
TUNGALOY

## AH725

P Steel, M Stainless, K Cast iron, S Superalloys, H Hard Materials

- Multi-purpose grade for various materials
- Suitable for exotic and hard materials
- Minimum abnormal wear due to highly tough substrate

## AH130

M Stainless, P Steel, S Superalloys

- Suitable for stainless steel
- Excellent chipping resistance achieved by highly tough substrate

## AH120

P Steel, K Cast iron

- Suitable for cast iron
- Excellent wear resistance achieved by substrate that withstands high temperature

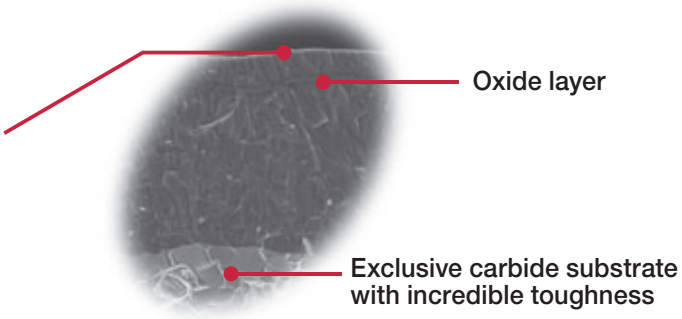
## AH3035

P Steel, H Hard Materials

*Special Surface Technology*

PREMIUMTEC
TUNGALOY

*Smooth insert surface prevents chip adhesion!*

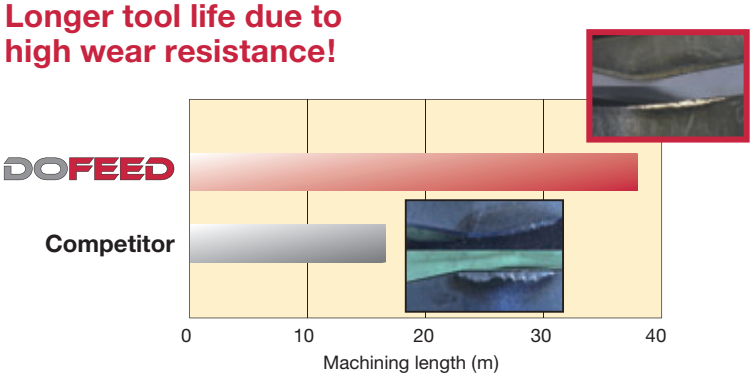



### Exclusively developed for high-speed milling

- Suitable for steel and hard materials
- Strong wear and oxidation resistance with thick coating and oxide layer

## Tool life

**Longer tool life due to high wear resistance!**



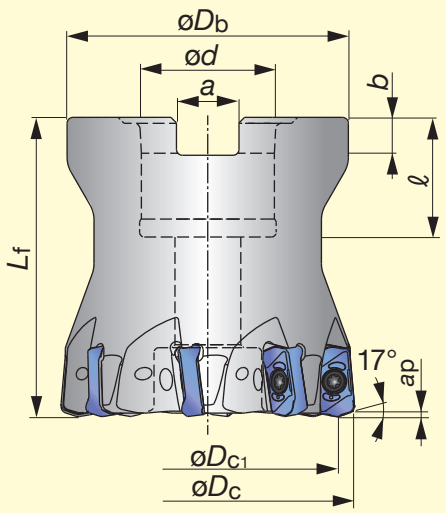

| | |
|---|---|
| Cutter | : TXN06R050M22.0E05 |
| Insert | : LNMU06X5ZER-ML |
| Grade | : AH3035 |
| Workpiece material | : Prehardened steel |
| Cutting speed | : *Vc* = 120 m/min |
| Feed per tooth | : *fz* = 1.0 mm/t |
| Depth of cut | : *ap* = 1.0 mm |
| Width of cut | : *ae* = 35 mm |
| Coolant | : Dry |
| Machine | : Vertical M/C, BT50 |

# Specification of AH3035

| Application | Grade | Substrate | | | Coating layer | | Features |
|---|---|---|---|---|---|---|---|
| | Application code | Relative density | Hardness (HRA) | T.R.S. (GPa) | Main Composition | Thickness (μm) | |
| P Steel, H Hard Materials | AH3035 P25 - P35 | 14.0 | 89.5 | 3.2 | Flash-Coating (Ti, Al)N, base | 5 | **For high-feed machining** Strong resistance to fracture and thermal shock |

# Cutter

## Bore type **TXN03**




LNMU03 type: Max. *ap* = 1.0 mm

Parts

| Descriptions | Parts Cat. No. |
|---|---|
| Clamping screw | **CSPB-2.5** |
| Wrench | **IP-8D** |

### Coarse pitch

| ISO / JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) | | | | | | | | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øDc | øDc1 | øDb | ød | ℓ | Lf | b | a | | | | |
| **TXN03R040M16.0E05** | ● | 5 | 40 | 33.6 | 35 | 16 | 18 | 40 | 5.6 | 8.4 | 0.2 | with | CM8X30H | **LNMU03...** |
| **TXN03R050M22.0E05** | ● | 5 | 50 | 43.6 | 47 | 22 | 20 | 50 | 6.3 | 10.4 | 0.5 | with | CM10X30H | **LNMU03...** |

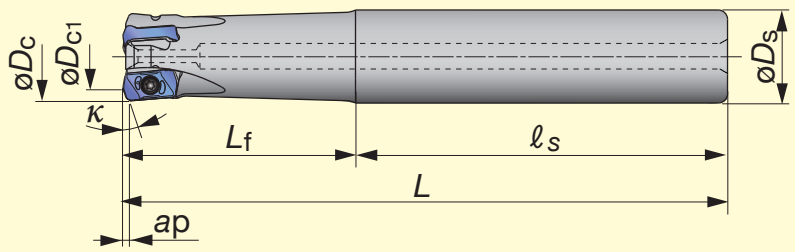
### Close pitch

| ISO Cat. No. | Stock | No. of inserts | Dimensions (mm) | | | | | | | | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øDc | øDc1 | øDb | ød | ℓ | Lf | b | a | | | | |
| **TXN03R040M16.0E06** | ● | 6 | 40 | 33.6 | 35 | 16 | 18 | 40 | 5.6 | 8.4 | 0.2 | with | CM8X30H | **LNMU03...** |
| **TXN03R050M22.0E08** | ● | 8 | 50 | 43.6 | 47 | 22 | 20 | 50 | 6.3 | 10.4 | 0.5 | with | CM10X30H | **LNMU03...** |

| JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) | | | | | | | | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øDc | øDc1 | øDb | ød | ℓ | Lf | b | a | | | | |
| **TXN03R050M22.2-08** | ● | 8 | 50 | 43.6 | 47 | 22.225 | 20 | 50 | 5 | 8 | 0.5 | with | CM10X30H | **LNMU03...** |

● : Stocked items

## Shank type **EXN03**




LNMU03 type: Max. *ap* = 1.0 mm

Parts

| Descriptions | Parts Cat. No. |
|---|---|
| Clamping screw | **CSPB-2.5** |
| Wrench | **IP-8D** |

## Coarse pitch

| ISO / JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) | | | | | | | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øDc | øDc1 | øDs | L | Lf | ℓs | κ | | | |
| EXN03R016M16.0-02 | ● | 2 | 16 | 9.6 | 16 | 100 | 30 | 70 | 15° | 0.2 | with | LNMU03... |
| EXN03R018M16.0-02 | ● | 2 | 18 | 11.5 | 16 | 100 | 30 | 70 | 17° | 0.2 | with | LNMU03... |
| EXN03R020M20.0-03 | ● | 3 | 20 | 13.5 | 20 | 130 | 50 | 80 | 17° | 0.3 | with | LNMU03... |
| EXN03R022M20.0-03 | ● | 3 | 22 | 15.5 | 20 | 130 | 50 | 80 | 17° | 0.3 | with | LNMU03... |
| EXN03R025M25.0-04 | ● | 4 | 25 | 18.5 | 25 | 140 | 60 | 80 | 17° | 0.5 | with | LNMU03... |
| EXN03R028M25.0-04 | ● | 4 | 28 | 21.5 | 25 | 140 | 60 | 80 | 17° | 0.5 | with | LNMU03... |
| EXN03R030M32.0-04 | ● | 4 | 30 | 23.5 | 32 | 150 | 70 | 80 | 17° | 0.8 | with | LNMU03... |
| EXN03R032M32.0-05 | ● | 5 | 32 | 25.5 | 32 | 150 | 70 | 80 | 17° | 0.8 | with | LNMU03... |
| EXN03R035M32.0-05 | ● | 5 | 35 | 28.6 | 32 | 150 | 35 | 115 | 17° | 0.9 | with | LNMU03... |

## Close pitch

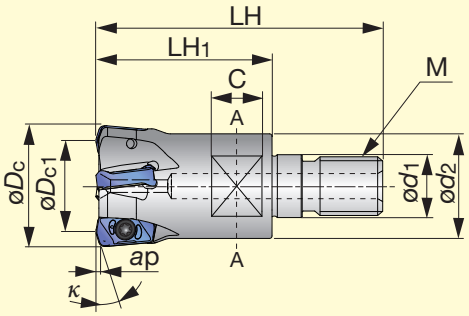
| ISO / JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) | | | | | | | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øDc | øDc1 | øDs | L | Lf | ℓs | κ | | | |
| EXN03R020M20.0-04 | ● | 4 | 20 | 13.5 | 20 | 130 | 50 | 80 | 17° | 0.3 | with | LNMU03... |
| EXN03R022M20.0-04 | ● | 4 | 22 | 15.5 | 20 | 130 | 50 | 80 | 17° | 0.3 | with | LNMU03... |
| EXN03R025M25.0-05 | ● | 5 | 25 | 18.5 | 25 | 140 | 60 | 80 | 17° | 0.5 | with | LNMU03... |
| EXN03R028M25.0-05 | ● | 5 | 28 | 21.5 | 25 | 140 | 60 | 80 | 17° | 0.5 | with | LNMU03... |
| EXN03R030M32.0-05 | ● | 5 | 30 | 23.5 | 32 | 150 | 70 | 80 | 17° | 0.8 | with | LNMU03... |
| EXN03R032M32.0-06 | ● | 6 | 32 | 25.5 | 32 | 150 | 70 | 80 | 17° | 0.9 | with | LNMU03... |
| EXN03R035M32.0-06 | ● | 6 | 35 | 28.5 | 32 | 150 | 35 | 115 | 17° | 0.9 | with | LNMU03... |

## Long type

| ISO / JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) | | | | | | | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | øDc | øDc1 | øDs | L | Lf | ℓs | κ | | | |
| EXN03R016M16.0-02L | ● | 2 | 16 | 9.6 | 16 | 150 | 50 | 100 | 15° | 0.2 | with | LNMU03... |
| EXN03R018M16.0-02L | ● | 2 | 18 | 11.5 | 16 | 150 | 25 | 125 | 17° | 0.2 | with | LNMU03... |
| EXN03R020M20.0-03L | ● | 3 | 20 | 13.5 | 20 | 160 | 80 | 80 | 17° | 0.3 | with | LNMU03... |
| EXN03R022M20.0-03L | ● | 3 | 22 | 15.5 | 20 | 160 | 30 | 130 | 17° | 0.4 | with | LNMU03... |
| EXN03R025M25.0-04L | ● | 4 | 25 | 18.5 | 25 | 180 | 100 | 80 | 17° | 0.6 | with | LNMU03... |
| EXN03R028M25.0-04L | ● | 4 | 28 | 21.5 | 25 | 180 | 35 | 145 | 17° | 0.7 | with | LNMU03... |
| EXN03R030M32.0-04L | ● | 4 | 30 | 23.5 | 32 | 200 | 120 | 80 | 17° | 0.9 | with | LNMU03... |
| EXN03R032M32.0-05L | ● | 5 | 32 | 25.5 | 32 | 200 | 120 | 80 | 17° | 1.1 | with | LNMU03... |
| EXN03R035M32.0-05L | ● | 5 | 35 | 28.5 | 32 | 200 | 35 | 165 | 17° | 1.2 | with | LNMU03... |

● : Stocked items

## Modular type **HXN03**




A-A cross section

LNMU03 type: Max. *ap* = 1.0 mm

Parts

| Descriptions | Parts Cat. No. |
|---|---|
| Clamping screw | **CSPB-2.5** |
| Wrench | **IP-8D** |

### Coarse pitch

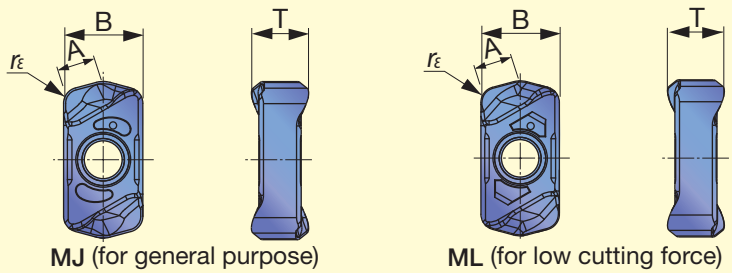
| ISO / JIS Cat. No. | Stock | No. of Inserts | Dimensions (mm) øDc | øDc1 | LH | LH1 | C | E | ød1 | ød2 | κ | M | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HXN03R016MM08-02** | ● | 2 | 16 | 9.5 | 42 | 25 | 8 | 10 | 8.5 | 12.8 | 15° | M8 | 0.03 | with | **LNMU03...** |
| **HXN03R018MM08-02** | ● | 2 | 18 | 11.5 | 42 | 25 | 8 | 10 | 8.5 | 14.5 | 17° | M8 | 0.04 | with | **LNMU03...** |
| **HXN03R020MM10-03** | ● | 3 | 20 | 13.55 | 49 | 30 | 10 | 15 | 10.5 | 17.8 | 17° | M10 | 0.06 | with | **LNMU03...** |
| **HXN03R022MM10-03** | ● | 3 | 22 | 15.55 | 49 | 30 | 10 | 15 | 10.5 | 17.8 | 17° | M10 | 0.06 | with | **LNMU03...** |
| **HXN03R025MM12-04** | ● | 4 | 25 | 18.50 | 57 | 35 | 10 | 17 | 12.5 | 20.8 | 17° | M12 | 0.10 | with | **LNMU03...** |
| **HXN03R028MM12-04** | ● | 4 | 28 | 21.56 | 57 | 35 | 10 | 17 | 12.5 | 23.0 | 17° | M12 | 0.12 | with | **LNMU03...** |
| **HXN03R030MM16-04** | ● | 4 | 30 | 23.57 | 63 | 40 | 12 | 22 | 17.0 | 28.8 | 17° | M16 | 0.19 | with | **LNMU03...** |
| **HXN03R032MM16-05** | ● | 5 | 32 | 25.50 | 63 | 40 | 12 | 22 | 17.0 | 28.8 | 17° | M16 | 0.20 | with | **LNMU03...** |

### Close pitch

| ISO / JIS Cat. No. | Stock | No. of Inserts | Dimensions (mm) øDc | øDc1 | LH | LH1 | C | E | ød1 | ød2 | κ | M | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HXN03R020MM10-04** | ● | 4 | 20 | 13.5 | 49 | 30 | 10 | 15 | 10.5 | 17.8 | 17° | M10 | 0.06 | with | **LNMU03...** |
| **HXN03R022MM10-04** | ● | 4 | 22 | 15.5 | 49 | 30 | 10 | 15 | 10.5 | 17.8 | 17° | M10 | 0.07 | with | **LNMU03...** |
| **HXN03R025MM12-05** | ● | 5 | 25 | 18.5 | 57 | 35 | 10 | 17 | 12.5 | 20.8 | 17° | M12 | 0.11 | with | **LNMU03...** |
| **HXN03R028MM12-05** | ● | 5 | 28 | 21.5 | 57 | 35 | 10 | 17 | 12.5 | 23.0 | 17° | M12 | 0.12 | with | **LNMU03...** |
| **HXN03R030MM16-05** | ● | 5 | 30 | 23.5 | 63 | 40 | 12 | 22 | 17.0 | 28.8 | 17° | M16 | 0.20 | with | **LNMU03...** |
| **HXN03R032MM16-06** | ● | 6 | 32 | 25.5 | 63 | 40 | 12 | 22 | 17.0 | 28.8 | 17° | M16 | 0.21 | with | **LNMU03...** |

# Insert

### **LNMU03** type



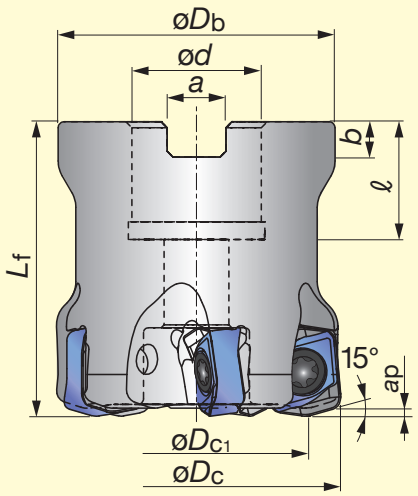

**MJ** (for general purpose) **ML** (for low cutting force)

| Cat. No. | Accuracy | Honing | Grades AH725 | AH130 | AH3035 | Dimensions (mm) A | B | T | rε |
|---|---|---|---|---|---|---|---|---|---|
| **LNMU0303ZER-MJ** | M | with | ● | ● | ● | 3.2 | 6.0 | 4.3 | 1.2 |
| **LNMU0303ZER-ML** | M | with | ● | ● | ● | 3.2 | 6.0 | 4.3 | 1.2 |

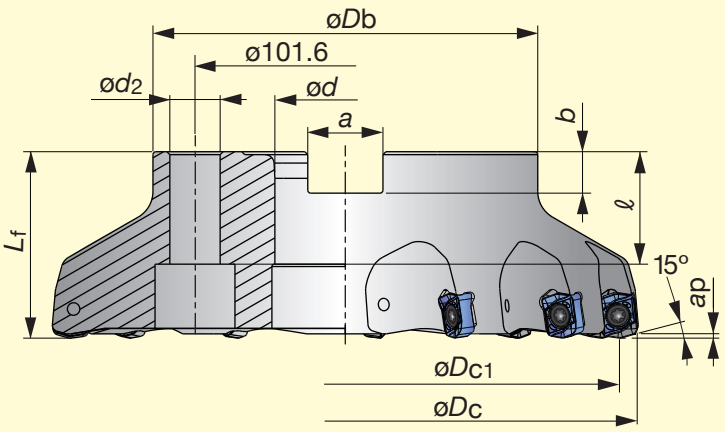
● : Stocked items

# Cutter

## Bore type **TXN06**




**øDc = 200 mm**




LNMU06 type: Max. *ap* = 1.5 mm

Parts

| Descriptions | | Parts Cat. No. | |
|---|---|---|---|
| | | ≤ ø125 | ø160, 200 |
| Clamping screw | | CSPB-5 | |
| Wrench | Bit | BLD IP20/S7 | BLD IP20/M7 |
| | Handle | H-TBS | |

## Coarse pitch

| ISO Cat. No. | Stock | No. of inserts | Dimensions (mm) øDc | øDc1 | øDb | ød | ød2 | ℓ | Lf | b | a | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TXN06R050M22.0E04 | ● | 4 | 50 | 37.6 | 47 | 22 | - | 20 | 50 | 6.3 | 10.4 | 0.4 | with | FSHM10-40H | LN*U06... |
| TXN06R052M22.0E04 | ● | 4 | 52 | 39.6 | 50 | 22 | - | 20 | 50 | 6.3 | 10.4 | 0.5 | with | FSHM10-40H | LN*U06... |
| TXN06R063M22.0E04 | ● | 4 | 63 | 50.6 | 59 | 22 | - | 20 | 50 | 6.3 | 10.4 | 0.8 | with | CM10X30H | LN*U06... |
| TXN06R066M27.0E04 | ● | 4 | 66 | 53.6 | 63 | 27 | - | 22 | 50 | 7 | 12.4 | 0.8 | with | CM12X30H | LN*U06... |
| TXN06R080M27.0E05 | ● | 5 | 80 | 67.6 | 76 | 27 | - | 22 | 63 | 7 | 12.4 | 1.6 | with | CM12X30H | LN*U06... |
| TXN06R100M32.0E06 | ● | 6 | 100 | 87.6 | 96 | 32 | - | 25 | 63 | 8.0 | 14.4 | 2.2 | with | CM16X40H | LN*U06... |
| TXN06R125M40.0E08 | ● | 8 | 125 | 112.6 | 100 | 40 | - | 37 | 63 | 9.0 | 16.4 | 3.0 | with | TMBA-M20H | LN*U06... |
| TXN06R160M40.0E10 | ● | 10 | 160 | 147.6 | 100 | 40 | - | 37 | 63 | 9.0 | 16.4 | 5.0 | with | TMBA-M20H | LN*U06... |
| TXN06R200M60.0E12 | ● | 12 | 200 | 187.6 | 130 | 60 | 18 | 38 | 63 | 14.0 | 25.7 | 7.2 | without | - | LN*U06... |

| JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) øDc | øDc1 | øDb | ød | ød2 | ℓ | Lf | b | a | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TXN06R050M22.2-04 | ● | 4 | 50 | 37.6 | 47 | 22.225 | - | 20 | 50 | 5 | 8 | 0.4 | with | CM10X30H | LN*U06... |
| TXN06R063M22.2-04 | ● | 4 | 63 | 50.6 | 59 | 22.225 | - | 20 | 50 | 5 | 8 | 0.8 | with | CM10X30H | LN*U06... |
| TXN06R080M31.7-05 | ● | 5 | 80 | 67.6 | 76 | 31.75 | - | 32 | 63 | 8 | 12.7 | 1.6 | with | CM16X40H | LN*U06... |
| TXN06R100M31.7-06 | ● | 6 | 100 | 87.6 | 96 | 31.75 | - | 32 | 63 | 8.0 | 12.7 | 2.2 | with | CM16X40H | LN*U06... |
| TXN06R125M38.1-08 | ● | 8 | 125 | 112.6 | 100 | 38.1 | - | 43 | 63 | 10.0 | 15.9 | 3.0 | with | TMBA-M20H | LN*U06... |
| TXN06R160M50.8-10 | ● | 10 | 160 | 147.6 | 100 | 50.8 | - | 46 | 63 | 11.0 | 19.0 | 4.6 | with | TMBA-M24H | LN*U06... |
| TXN06R200M47.6-12 | ● | 12 | 200 | 187.6 | 130 | 47.625 | 17 | 38 | 63 | 14.0 | 25.4 | 7.7 | without | - | LN*U06... |

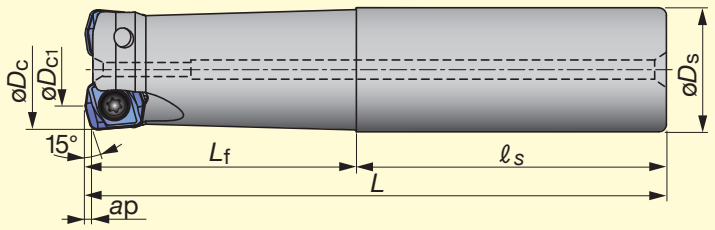
● : Stocked items

## Close pitch

| ISO Cat. No. | Stock | No. of inserts | Dimensions (mm) øDc | øDc1 | øDb | ød | ød2 | ℓ | Lf | b | a | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TXN06R050M22.0E05 | ● | 5 | 50 | 37.6 | 47 | 22 | - | 20 | 50 | 6.3 | 10.4 | 0.4 | with | FSHM10-40H | LN*U06... |
| TXN06R052M22.0E05 | ● | 5 | 52 | 39.6 | 49 | 22 | - | 20 | 50 | 6.3 | 10.4 | 0.5 | with | FSHM10-40H | LN*U06... |
| TXN06R063M22.0E06 | ● | 6 | 63 | 50.6 | 59 | 22 | - | 20 | 50 | 6.3 | 10.4 | 0.8 | with | CM10X30H | LN*U06... |
| TXN06R066M27.0E06 | ● | 6 | 66 | 53.6 | 63 | 27 | - | 22 | 50 | 7 | 12.4 | 0.8 | with | CM12X30H | LN*U06... |
| TXN06R080M27.0E08 | ● | 8 | 80 | 67.6 | 76 | 27 | - | 22 | 63 | 7 | 12.4 | 1.6 | with | CM12X30H | LN*U06... |

| JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) øDc | øDc1 | øDb | ød | ød2 | ℓ | Lf | b | a | Weight (kg) | Air hole | Center bolt | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TXN06R050M22.2-05 | ● | 5 | 50 | 37.6 | 47 | 22.225 | - | 20 | 50 | 5 | 8 | 0.4 | with | FSHM10-40H | LN*U06... |
| TXN06R063M22.2-06 | ● | 6 | 63 | 50.6 | 59 | 22.225 | - | 20 | 50 | 5 | 8 | 0.8 | with | CM10X30H | LN*U06... |
| TXN06R080M31.7-08 | ● | 8 | 80 | 67.6 | 76 | 31.75 | - | 32 | 63 | 8 | 12.7 | 1.6 | with | CM16X40H | LN*U06... |

## Shank type **EXN06**




LNMU06 type: Max. *ap* = 1.5 mm

Parts

| Descriptions | Parts Cat. No. |
|---|---|
| Clamping screw | **CSPB-5** |
| Wrench | **IP-20D** |

## Coarse pitch

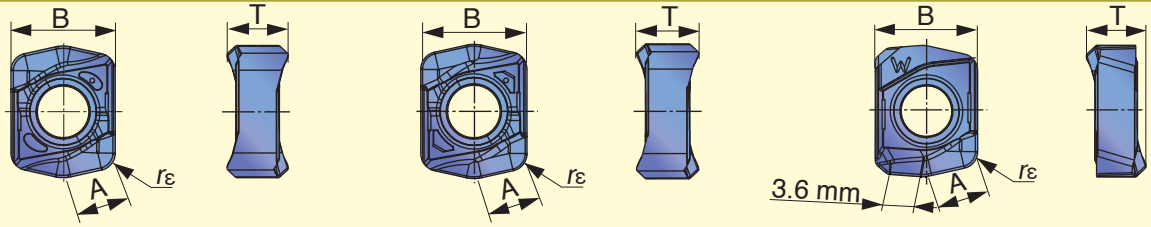
| ISO / JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) øDc | øDc1 | øDs | L | Lf | ℓ s | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EXN06R032M32.0-02 | ● | 2 | 32 | 19.7 | 32 | 150 | 70 | 80 | 0.8 | with | LN*U06... |
| EXN06R035M32.0-02 | ● | 2 | 35 | 22.7 | 32 | 150 | 45 | 105 | 0.9 | with | LN*U06... |
| EXN06R040M32.0-03 | ● | 3 | 40 | 27.7 | 32 | 150 | 45 | 105 | 0.9 | with | LN*U06... |

## Long type

| ISO / JIS Cat. No. | Stock | No. of inserts | Dimensions (mm) øDc | øDc1 | øDs | L | Lf | ℓ s | Weight (kg) | Air hole | Insert |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EXN06R032M32.0-02L | ● | 2 | 32 | 19.7 | 32 | 200 | 120 | 80 | 1.1 | with | LN*U06... |
| EXN06R035M32.0-02L | ● | 2 | 35 | 22.7 | 32 | 200 | 45 | 155 | 1.2 | with | LN*U06... |
| EXN06R040M32.0-03L | ● | 3 | 40 | 27.7 | 32 | 220 | 45 | 175 | 1.3 | with | LN*U06... |

# Insert

## LNMU06 type




**MJ** (for general purpose) **ML** (for low cutting force) **W** (Wiper insert)

| Cat. No. | Accuracy | Honing | Grades AH725 | AH120 | AH130 | AH3035 | Dimensions (mm) A | B | T | rε |
|---|---|---|---|---|---|---|---|---|---|---|
| LNMU06X5ZER-MJ | M | with | ● | ● | ● | ● | 6 | 12 | 7 | 2 |
| LNMU06X5ZER-ML | M | with | ● | ● | ● | ● | 6 | 12 | 7 | 2 |
| New LNGU06X5ZER-W | G | with | ● | | | | 6 | 12 | 7 | 2 |

● : Stocked items

# Standard cutting conditions TXN03 / EXN03 / HXN03 type

| ISO | Workpiece material | Hardness | Priority | Grades | Chip-breaker | Cutting speed *Vc* (m/min) | Feed per tooth: *fz* (mm/t) Tool dia: ø*Dc* (mm) ø16~ ø22 | ø25 ~ ø50 | Plunging |
|---|---|---|---|---|---|---|---|---|---|
| P | Carbon steels S45C, S55C etc. C45, C55 etc. | ~ 300HB | First choice | **AH725** | **MJ** | 100 - 300 | 0.5 -1.2 | 0.5 - 1.5 | 0.1 |
| | | | For low cutting force | **AH725** | **ML** | 100 - 300 | 0.5 - 0.7 | 0.5 - 1.0 | 0.1 |
| | | | For impact resistance | **AH3035** | **MJ** | 100 - 300 | 0.5 -1.2 | 0.5 - 1.5 | 0.1 |
| | Alloy steels SCM440, SCr415 etc. 42CrMo4, 17Cr3 etc. | ~ 300HB | First choice | **AH725** | **MJ** | 100 - 200 | 0.5 -1.2 | 0.5 - 1.5 | 0.1 |
| | | | For low cutting force | **AH725** | **ML** | 100 - 200 | 0.5 - 0.7 | 0.5 - 1.0 | 0.1 |
| | | | For impact resistance | **AH3035** | **MJ** | 100 - 200 | 0.5 -1.2 | 0.5 - 1.5 | 0.1 |
| | Prehardened steels NAK80, PX5 etc. | 30 ~ 40HRC | - | **AH3035** | **ML** | 100 - 200 | 0.5 - 0.7 | 0.5 - 1.0 | 0.1 |
| M | Stainless steels SUS304, SUS316 etc. X5CrNi18-10, X5CrNiMo17-12-2 etc. | ~ 200HB | First choice | **AH130** | **ML** | 100 - 150 | 0.3 - 0.5 | 0.3 - 0.7 | 0.08 |
| | | | For impact resistance | **AH130** | **MJ** | 100 - 150 | 0.3 - 0.8 | 0.3 - 0.8 | 0.08 |
| K | Grey cast irons FC250, FC300 / GG25, GGG30 etc. | 150 ~ 250HB | First choice | **AH725** | **MJ** | 100 - 300 | 0.5 - 1.2 | 0.5 - 1.5 | 0.1 |
| | | | For low cutting force | **AH725** | **ML** | 100 - 300 | 0.5 - 0.7 | 0.5 - 1.0 | 0.1 |
| | Ductile cast irons FCD400 / GGG40 etc. | 150 ~ 250HB | First choice | **AH725** | **MJ** | 80 - 200 | 0.5 - 1.2 | 0.5 - 1.5 | 0.1 |
| | | | For low cutting force | **AH725** | **ML** | 80 - 200 | 0.5 - 0.7 | 0.5 - 1.0 | 0.1 |
| S | Titanium alloys Ti-6Al-4V etc. | ~ 40HRC | - | **AH725** | **ML** | 30 - 60 | 0.3 - 0.5 | 0.3 - 0.7 | 0.08 |
| | Heat-resistant alloys Inconel, Hastelloy etc. | ~ 40HRC | - | **AH725** | **MJ** | 20 - 50 | 0.1 - 0.2 | 0.1 - 0.3 | 0.05 |
| H | Hardened steels SKD61 X40CrMoV5-1 etc. | 40 ~ 50HRC | First choice For wear resistance | **AH3035 AH725** | **MJ** | 80 - 130 | 0.1 - 0.2 | 0.1 - 0.3 | 0.05 |
| | Hardened steels SKD11 X153CrMoV12 etc. | 50 ~ 60HRC | First choice For impact resistance | **AH725 AH3035** | **MJ** | 50 - 70 | 0.03 - 0.05 | 0.03 - 0.07 | 0.03 |

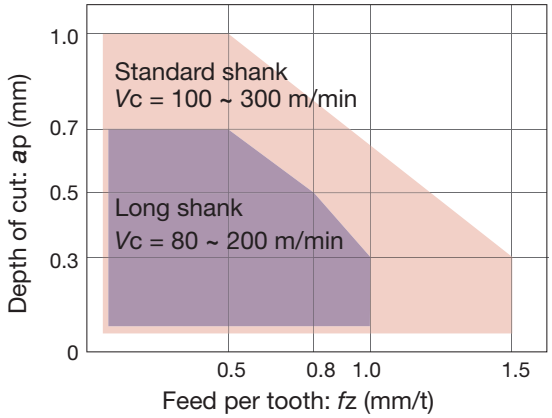
· When chips stay in the cutting zone during slotting or pocketing, use air blast to remove chips from the work area.

· Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.

## Cautionary points in use

### The use of a standard or long shank

When using a long shank, please lower the cutting conditions (*Vc*, *fz*, *ap*) to 70% of the maximum conditions for the standard shank.




Tool dia.: ø*Dc* = ø16 ~ 35 mm
Workpeice: S55C / C55 (200HB)
**L/D ratio of overhang**
Standard shank: L/D ≤ 3
Long shank: L/D = 4

Tool dia.: ø*D*c (mm), Number of revolutions: *n* ($min^{-1}$), Feed speed: *V*f (mm/min), Max. depth of cut: *a*p = 1.0 mm

| ø16, z = 2 | | ø18, z = 2 | | ø20 | | | ø22 | | | ø25 | | | ø28 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *V*f | | | *V*f | | | *V*f | | | *V*f | |
| *n* | *V*f | *n* | *V*f | *n* | z = 3 | z = 4 | *n* | z = 3 | z = 4 | *n* | z = 4 | z = 5 | *n* | z = 4 | z = 5 |
| 3,980 | 6,370 | 3,540 | 5,660 | 3,180 | 7,630 | 10,180 | 2,890 | 6,940 | 9,250 | 2,550 | 10,200 | 12,750 | 2,270 | 9,080 | 11,350 |
| *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | | |
| 3,980 | 4,780 | 3,540 | 4,250 | 3,180 | 5,720 | 7,630 | 2,890 | 5,200 | 6,940 | 2,550 | 8,160 | 10,200 | 2,270 | 7,260 | 9,080 |
| *Vc* = 200 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | | |
| 3,980 | 6,370 | 3,540 | 5,660 | 3,180 | 7,630 | 10,180 | 2,890 | 6,940 | 9,250 | 2,550 | 10,200 | 12,750 | 2,270 | 9,080 | 11,350 |
| *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | | |
| 2,980 | 4,770 | 2,650 | 4,240 | 2,390 | 5,740 | 7,650 | 2,170 | 5,210 | 6,940 | 1,910 | 7,640 | 9,550 | 1,710 | 6,840 | 8,550 |
| *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | | |
| 2,980 | 3,580 | 2,650 | 3,180 | 2,390 | 4,300 | 5,740 | 2,170 | 3,910 | 5,210 | 1,910 | 6,110 | 7,640 | 1,710 | 5,470 | 6,840 |
| *Vc* = 150 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | | |
| 2,980 | 4,770 | 2,650 | 4,240 | 2,390 | 5,740 | 7,650 | 2,170 | 5,210 | 6,940 | 1,910 | 7,640 | 9,550 | 1,710 | 6,840 | 8,550 |
| *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | | |
| 2,980 | 3,580 | 2,650 | 3,180 | 2,390 | 4,300 | 5,740 | 2,170 | 3,910 | 5,210 | 1,910 | 6,110 | 7,640 | 1,710 | 5,470 | 6,840 |
| *Vc* = 150 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | | |
| 2,390 | 1,910 | 2,120 | 1,700 | 1,910 | 2,290 | 3,060 | 1,740 | 2,090 | 2,780 | 1,530 | 3,060 | 3,830 | 1,360 | 2,720 | 3,400 |
| *Vc* = 120 m/min, *fz* = 0.4 mm/t | | | | | | | | | | | | | | | |
| 2,390 | 2,390 | 2,120 | 2,120 | 1,910 | 2,870 | 3,820 | 1,740 | 2,610 | 3,480 | 1,530 | 3,670 | 4,590 | 1,360 | 3,264 | 4,080 |
| *Vc* = 120 m/min, *fz* = 0.5 mm/t | | | | | | | | | | | | | | | |
| 3,980 | 6,370 | 3,540 | 5,660 | 3,180 | 7,630 | 10,180 | 2,890 | 6,940 | 9,250 | 2,550 | 10,200 | 12,750 | 2,270 | 9,080 | 11,350 |
| *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | | |
| 3,980 | 4,780 | 3,540 | 4,250 | 3,180 | 5,720 | 7,630 | 2,890 | 5,200 | 6,940 | 2,550 | 8,160 | 10,200 | 2,270 | 7,260 | 9,080 |
| *Vc* = 200 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | | |
| 2,980 | 4,770 | 2,650 | 4,240 | 2,390 | 5,740 | 7,650 | 2,170 | 5,210 | 6,940 | 1,910 | 7,640 | 9,550 | 1,710 | 6,840 | 8,550 |
| *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | | |
| 2,980 | 3,580 | 2,650 | 3,180 | 2,390 | 4,300 | 5,740 | 2,170 | 3,910 | 5,210 | 1,910 | 6,110 | 7,640 | 1,710 | 5,470 | 6,840 |
| *Vc* = 150 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | | |
| 800 | 640 | 710 | 570 | 640 | 770 | 1,020 | 580 | 700 | 930 | 510 | 1,020 | 1,280 | 450 | 900 | 1,130 |
| *Vc* = 40 m/min, *fz* = 0.4 mm/t | | | | | | | | | | | | | | | |
| 600 | 180 | 530 | 160 | 480 | 216 | 290 | 430 | 190 | 260 | 380 | 300 | 290 | 340 | 270 | 260 |
| *Vc* = 30 m/min, *fz* = 0.15 mm/t | | | | | | | | | | | | | | | |
| 1,990 | 600 | 1,770 | 530 | 1,590 | 720 | 950 | 1,450 | 650 | 870 | 1,270 | 1,020 | 1,270 | 1,140 | 910 | 1,140 |
| *Vc* = 100 m/min, *fz* = 0.15 mm/t | | | | | | | | | | | | | | | |
| 1,190 | 100 | 1,060 | 80 | 950 | 114 | 150 | 870 | 100 | 140 | 760 | 150 | 190 | 680 | 140 | 170 |
| *Vc* = 60 m/min, *fz* = 0.04 mm/t | | | | | | | | | | | | | | | |

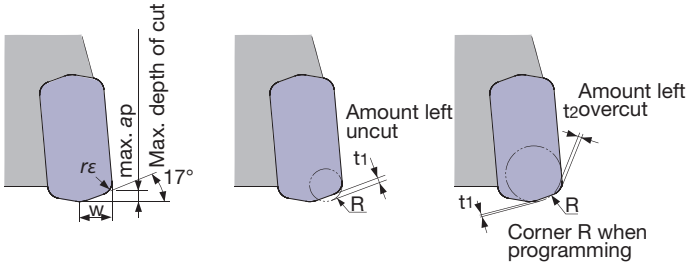
· The above table shows the conditions for standard shank type cutters. When using long shank type cutters, the number of teeth may be different. In this case, the cutting conditions should be changed by referring to: “The usage of standard and long shanks” shown in previous page.

· Cutting conditions are generally limited by the rigidity and power of the machine and the rigidity of the workpiece. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

## Cautionary points in use

### Tool geometry on programming

When programming for CAM, the tool should be considered as a radius cutter. Usually, the corner radius should be set as R = 1.5 mm. If a larger radius is used, overcutting will occur. The following table shows the amount left uncut (t1) and overcut (t2).

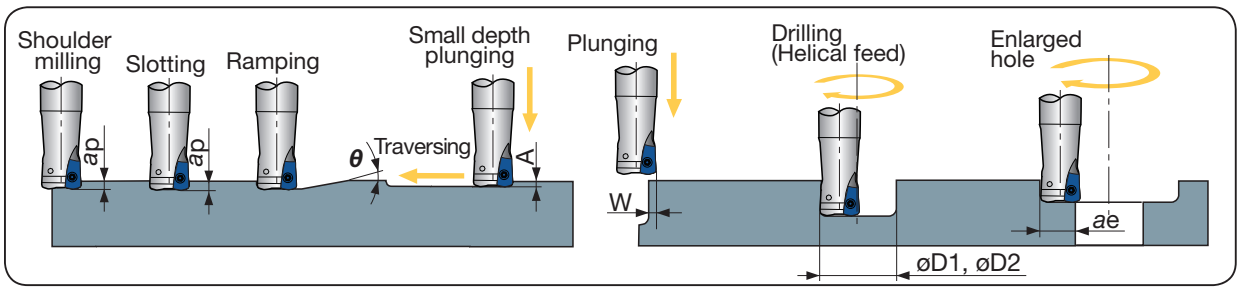



| Max. depth of cut max ap (mm) | Corner radius $r_\varepsilon$ (mm) | W (mm) | Corner R when program-ming | Amount left uncut $t_1$ (mm) | Amount left overcut $t_2$ (mm) |
|---|---|---|---|---|---|
| 1.0 | 1.2 | 3.0 | 1.0 | 0.6 | - |
| 1.0 | 1.2 | 3.0 | 1.5 | 0.5 | - |
| 1.0 | 1.2 | 3.0 | 2.0 | 0.25 | 0.08 |
| 1.0 | 1.2 | 3.0 | 2.5 | 0.14 | 0.26 |

Each value in table is calculated theoretically at the maximum condition.

| | ø30 | | | ø32 | | | ø35 | | | ø40 | | | ø50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| n | Vf | | n | Vf | | n | Vf | | n | Vf | | n | Vf | |
| | z = 4 | z = 5 | | z = 5 | z = 6 | | z = 5 | z = 6 | | z = 5 | z = 6 | | z = 5 | z = 8 |
| 2,120 | 8,480 | 10,600 | 1,990 | 9,950 | 11,940 | 1,820 | 9,100 | 10,920 | 1,590 | 7,950 | 9,540 | 1,270 | 6,350 | 10,160 |
| | *Vc* = 200 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | |
| 2,120 | 6,780 | 8,480 | 1,990 | 7,960 | 9,550 | 1,820 | 7,280 | 8,740 | 1,590 | 6,360 | 7,630 | 1,270 | 5,080 | 8,130 |
| | *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | |
| 2,120 | 8,480 | 10,600 | 1,990 | 9,950 | 11,940 | 1,820 | 9,100 | 10,920 | 1,590 | 7,950 | 9,540 | 1,270 | 6,350 | 10,160 |
| | *Vc* = 200 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | |
| 1,590 | 6,360 | 7,950 | 1,490 | 7,450 | 8,940 | 1,360 | 6,800 | 8,160 | 1,190 | 5,950 | 7,140 | 950 | 4,750 | 5,700 |
| | *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | |
| 1,590 | 5,090 | 6,360 | 1,490 | 5,960 | 7,150 | 1,360 | 5,440 | 6,530 | 1,190 | 4,760 | 5,710 | 950 | 3,800 | 4,560 |
| | *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | |
| 1,590 | 6,360 | 7,950 | 1,490 | 7,450 | 8,940 | 1,360 | 6,800 | 8,160 | 1,190 | 5,950 | 7,140 | 950 | 4,750 | 5,700 |
| | *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | |
| 1,590 | 5,090 | 6,360 | 1,490 | 5,960 | 7,150 | 1,360 | 5,440 | 6,530 | 1,190 | 4,760 | 5,710 | 950 | 3,800 | 4,560 |
| | *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | |
| 1,270 | 2,540 | 3,180 | 1,190 | 2,980 | 3,570 | 1,090 | 2,730 | 3,270 | 950 | 2,380 | 2,850 | 760 | 1,900 | 3,040 |
| | *Vc* = 120 m/min, *fz* = 0.5 mm/t | | | | | | | | | | | | | |
| 1,270 | 3,050 | 3,810 | 1,190 | 3,570 | 4,280 | 1,090 | 3,270 | 3,920 | 950 | 2,850 | 3,420 | 760 | 2,280 | 3,650 |
| | *Vc* = 120 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | |
| 2,120 | 8,480 | 10,600 | 1,990 | 9,950 | 11,940 | 1,820 | 9,100 | 10,920 | 1,590 | 7,950 | 9,540 | 1,270 | 6,350 | 10,160 |
| | *Vc* = 200 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | |
| 2,120 | 6,780 | 8,480 | 1,990 | 7,960 | 9,550 | 1,820 | 7,280 | 8,740 | 1,590 | 6,360 | 7,630 | 1,270 | 5,080 | 8,130 |
| | *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | |
| 1,590 | 6,360 | 7,950 | 1,490 | 7,450 | 8,940 | 1,360 | 6,800 | 8,160 | 1,190 | 5,950 | 7,140 | 950 | 4,750 | 5,700 |
| | *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | |
| 1,590 | 5,090 | 6,360 | 1,490 | 5,960 | 7,150 | 1,360 | 5,440 | 6,530 | 1,190 | 4,760 | 5,710 | 950 | 3,800 | 4,560 |
| | *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | |
| 420 | 840 | 1,050 | 400 | 1,000 | 1,200 | 360 | 900 | 1,080 | 320 | 800 | 960 | 250 | 630 | 1,000 |
| | *Vc* = 40 m/min, *fz* = 0.5 mm/t | | | | | | | | | | | | | |
| 320 | 260 | 240 | 300 | 300 | 270 | 270 | 270 | 240 | 240 | 240 | 220 | 190 | 190 | 230 |
| | *Vc* = 30 m/min, *fz* = 0.2 mm/t | | | | | | | | | | | | | |
| 1,060 | 850 | 1,060 | 990 | 990 | 1,190 | 910 | 910 | 1,090 | 800 | 800 | 960 | 640 | 640 | 1,020 |
| | *Vc* = 100 m/min, *fz* = 0.2 mm/t | | | | | | | | | | | | | |
| 640 | 130 | 160 | 600 | 150 | 180 | 550 | 140 | 170 | 480 | 120 | 140 | 380 | 100 | 150 |
| | *Vc* = 60 m/min, *fz* = 0.05 mm/t | | | | | | | | | | | | | |

# Applications




| Cat. No. | Tool dia. øDc (mm) | Max. depth of cut ap (mm) | Max. ramping angle θ | Max. plunging depth A (mm) | Max. cutting width in plunging W (mm) | Min. machinable hole dia. øD1 (mm) | Max. machinable hole dia. øD2 (mm) | Max. cutting width in enlarged hole ae (mm) |
|---|---|---|---|---|---|---|---|---|
| **E/HXN03R016M...** | ø16 | 1.0 | 2.1° | 0.3 | 3.5 | 22 | 30 | 12.5 |
| **E/HXN03R018M...** | ø18 | 1.0 | 1.7° | 0.3 | 3.5 | 26 | 34 | 14.5 |
| **E/HXN03R020M...** | ø20 | 1.0 | 1.4° | 0.3 | 3.5 | 30 | 38 | 16.5 |
| **E/HXN03R022M...** | ø22 | 1.0 | 1.2° | 0.3 | 3.5 | 34 | 42 | 18.5 |
| **E/HXN03R025M...** | ø25 | 1.0 | 1.0° | 0.3 | 3.5 | 40 | 48 | 21.5 |
| **E/HXN03R028M...** | ø28 | 1.0 | 0.8° | 0.3 | 3.5 | 46 | 54 | 24.5 |
| **E/HXN03R030M...** | ø30 | 1.0 | 0.7° | 0.3 | 3.5 | 50 | 58 | 26.5 |
| **E/HXN03R032M...** | ø32 | 1.0 | 0.7° | 0.3 | 3.5 | 54 | 62 | 28.5 |
| **EXN03R035M32.0...** | ø35 | 1.0 | 0.6° | 0.3 | 3.5 | 60 | 68 | 31.5 |
| **TXN03R040M16.0...** | ø40 | 1.0 | 0.5° | 0.3 | 3.5 | 70 | 78 | 36.5 |
| **TXN03R050M-22....** | ø50 | 1.0 | 0.4° | 0.3 | 3.5 | 90 | 98 | 46.5 |

· For ø*D*c above ø33 mm, slot milling, ramping or contouring is not recommended as chips may be re-cut

# Standard cutting conditions TXN06 / EXN06 type

| ISO | Workpiece material | Hardness | Priority | Grades | Chip-breaker | Cutting speed *Vc* (m/min) | Feed per tooth: *fz* (mm/t) Tool dia: *øDc* (mm) ø32 ~ ø80 | Feed per tooth: *fz* (mm/t) Plunging |
|---|---|---|---|---|---|---|---|---|
| P | Carbon steels S45C, S55C etc. C45, C55 etc. | - 300HB | First choice | AH725 | MJ | 100 - 300 | 0.5 - 1.5 | 0.15 |
| | | | For wear resistance | AH120 | | | | |
| | | | For impact resistance | AH3035 | | | | |
| | Alloy steels SCM440, SCr415 etc. 42CrMo4, 17Cr3 etc. | - 300HB | First choice | AH725 | MJ | 100 - 200 | 0.5 - 1.5 | 0.15 |
| | | | For wear resistance | AH120 | | | | |
| | | | For impact resistance | AH3035 | | | | |
| | Prehardened steels NAK80, PX5 etc. | 30 - 40HRC | - | AH3035 | ML | 100 - 200 | 0.5 - 1.0 | 0.15 |
| M | Stainless steels SUS304, SUS316 etc. X5CrNi18-10, X5CrNiMo17-12-2 etc. | - 200HB | First choice | AH130 | ML | 100 - 150 | 0.3 - 0.7 | 0.1 |
| | | | For impact resistance | AH130 | MJ | 100 - 150 | 0.3 - 0.8 | 0.1 |
| K | Grey cast irons FC250, FC300 / GG25, GGG30 etc. | 150 - 250HB | First choice | AH120 | MJ | 100 - 300 | 0.5 - 1.5 | 0.15 |
| | | | For low cutting force | AH120 | ML | 100 - 300 | 0.5 - 1.0 | 0.15 |
| | Ductile cast irons FCD400 / GGG40 etc. | 150 - 250HB | First choice | AH120 | MJ | 80 - 200 | 0.5 - 1.5 | 0.15 |
| | | | For low cutting force | AH120 | ML | 80 - 200 | 0.5 - 1.0 | 0.15 |
| S | Titanium alloys Ti-6Al-4V etc. | - 40HRC | - | AH725 | ML | 30 - 60 | 0.3 - 0.7 | 0.08 |
| | Heat-resistant alloys Inconel, Hastelloy etc. | - 40HRC | - | AH725 | MJ | 20 - 50 | 0.1 - 0.3 | 0.05 |
| H | Hardened steels SKD61 X40CrMoV5-1 etc. | 40 - 50HRC | First choice For wear resistance | AH3035 AH725 | MJ | 80 - 130 | 0.1 - 0.3 | 0.05 |
| | Hardened steels SKD11 X153CrMoV12 etc. | 50 - 60HRC | First choice For impact resistance | AH725 AH3035 | MJ | 50 - 70 | 0.03 - 0.07 | 0.03 |

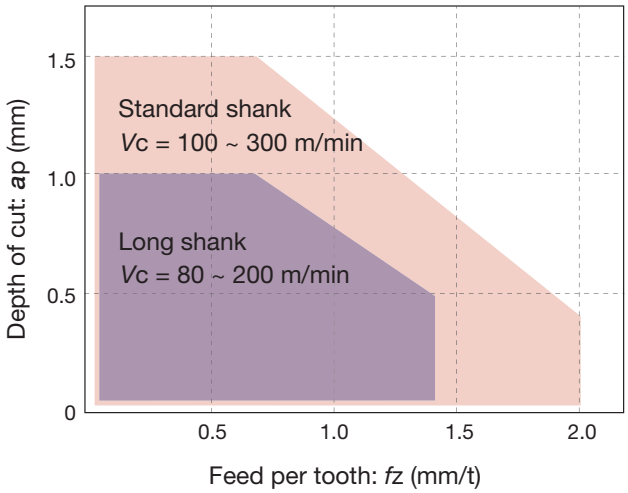
· When chips stay in the cutting zone during slotting or pocketing, use an air blast to remove chips from the work area.

· Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.

## Cautionary points in use

### The use of a standard or long shank

When using a long shank, please lower the cutting conditions (*Vc*, *fz*, *ap*) to 70% of the maximum conditions for the standard shank.




Tool dia.: *øDc* = ø32 ~ 40 mm
Workpiece: S55C / C55 (200HB)
**L/D ratio of overhang**
Standard shank: L/D ≤ 3
Long shank: L/D = 4

| Tool dia.: øDc (mm), Number of revolutions: *n* (min$^{-1}$), Feed speed: *Vf* (mm/min), Max. depth of cut: *ap* = 1.5 mm, No. of inserts: z | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ø32, z = 2 | | ø35, z = 2 | | ø40, z = 3 | | ø50 | | | ø52 | | | ø63 | | |
| *n* | *Vf* | *n* | *Vf* | *n* | *Vf* | *n* | *Vf* z = 4 | *Vf* z = 5 | *n* | *Vf* z = 4 | *Vf* z = 5 | *n* | *Vf* z = 4 | *Vf* z = 6 |
| 1,990 | 3,980 | 1,820 | 3,640 | 1,590 | 4,770 | 1,270 | 5,080 | 6,350 | 1,220 | 4,880 | 6,100 | 1,010 | 4,040 | 6,060 |
| *Vc* = 200 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | | |
| 1,490 | 2,980 | 1,360 | 2,720 | 1,190 | 3,570 | 950 | 3,800 | 4,750 | 920 | 3,680 | 4,600 | 760 | 3,040 | 4,560 |
| *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | | |
| 1,490 | 2,380 | 1,360 | 2,180 | 1,190 | 2,860 | 950 | 3,040 | 3,800 | 920 | 2,940 | 3,680 | 760 | 2,430 | 3,650 |
| *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | |
| 1,190 | 1,190 | 1,090 | 1,090 | 950 | 1,430 | 760 | 1,520 | 1,900 | 730 | 1,460 | 1,830 | 610 | 1,220 | 1,830 |
| *Vc* = 120 m/min, *fz* = 0.5 mm/t | | | | | | | | | | | | | | |
| 1,190 | 1,430 | 1,090 | 1,310 | 950 | 1,710 | 760 | 1,820 | 2,280 | 730 | 1,750 | 2,190 | 610 | 1,470 | 2,200 |
| *Vc* = 120 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | |
| 1,990 | 2,390 | 1,820 | 2,180 | 1,590 | 2,860 | 1,270 | 3,050 | 3,810 | 1,220 | 4,880 | 6,100 | 1,010 | 2,430 | 3,640 |
| *Vc* = 200 m/min, *fz* = 0.6 mm/t | | | | | | | | | | | | | | |
| 1,990 | 3,180 | 1,820 | 2,910 | 1,590 | 3,820 | 1,270 | 4,060 | 5,080 | 1,220 | 3,900 | 4,880 | 1,010 | 3,230 | 4,850 |
| *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | |
| 1,490 | 2,980 | 1,360 | 2,720 | 1,190 | 3,570 | 950 | 3,800 | 4,750 | 920 | 3,680 | 4,600 | 760 | 3,040 | 4,560 |
| *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | | | | | | | |
| 1,490 | 2,380 | 1,360 | 2,180 | 1,190 | 2,860 | 950 | 3,040 | 3,800 | 920 | 2,940 | 3,680 | 760 | 2,430 | 3,650 |
| *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | | | | | | | |
| 400 | 400 | 360 | 360 | 320 | 480 | 250 | 500 | 630 | 240 | 480 | 600 | 200 | 400 | 600 |
| *Vc* = 40 m/min, *fz* = 0.5 mm/t | | | | | | | | | | | | | | |
| 300 | 120 | 270 | 110 | 240 | 140 | 190 | 150 | 190 | 180 | 140 | 180 | 150 | 120 | 180 |
| *Vc* = 30 m/min, *fz* = 0.2 mm/t | | | | | | | | | | | | | | |
| 990 | 400 | 910 | 360 | 800 | 480 | 640 | 510 | 640 | 610 | 490 | 610 | 510 | 410 | 610 |
| *Vc* = 100 m/min, *fz* = 0.2 mm/t | | | | | | | | | | | | | | |
| 600 | 60 | 550 | 60 | 480 | 70 | 380 | 80 | 100 | 370 | 75 | 90 | 300 | 60 | 90 |
| *Vc* = 60 m/min, *fz* = 0.05 mm/t | | | | | | | | | | | | | | |

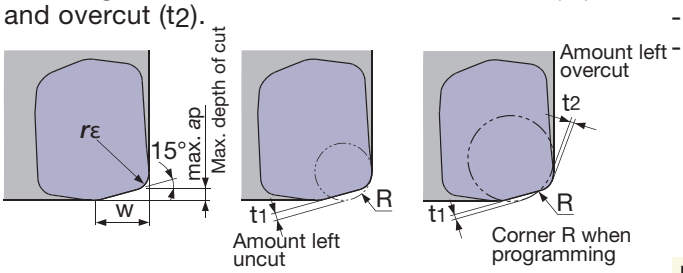
· The above table shows the conditions for standard shank type cutters. When using long shank type cutters, the number of teeth may be different. In this case, the cutting conditions should be changed by referring to: “The usage of standard and long shanks” shown in previous page.

· Cutting conditions are generally limited by the rigidity and power of the machine and the rigidity of the workpiece. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

## Cautionary points in use

### Tool geometry on programming

When programming for CAM, the tool should be considered as a radius cutter. Usually, the corner radius should be set as R = 3.0 mm. If a larger radius is used, overcutting will occur. The following table shows the amount left uncut ($t_1$) and overcut ($t_2$).




| Max. depth of cut max *ap* (mm) | Corner radius $r_\varepsilon$ | W (mm) | Corner R when program-ming | Amount left uncut $t_1$ (mm) | Amount left overcut $t_2$ (mm) |
|---|---|---|---|---|---|
| 1.5 | 2.0 | 6.0 | 2.0 | 1.0 | - |
| | | | 3.0 | 0.77 | - |
| | | | 4.0 | 0.54 | 0.26 |

Each value in table is calculated theoretically at the maximum condition.

### Notes for using wiper inserts

- Place the wiper insert in the pocket with W mark shown on the top. (Fig. 1)
- Two corners are available for each wiper insert.
- The cutting edge of the wiper insert has the same sharpness as the standard insert. (Fig. 2)
- Avoid ramping operations with wiper inserts.
- Wiper inserts can be used together with standard inserts for general high-feed face milling and contouring.
  - For high-feed machining: *fz* = 1.2 mm/t
    Use 1 wiper insert for every 3 MJ or ML inserts
  - For high surface quality: *fz* = 0.6 mm/t
    Use 1 wiper insert for every 6 MJ or ML inserts

Fig. 1

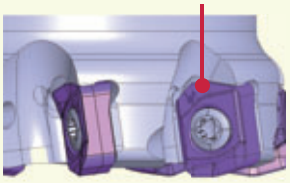
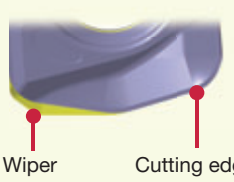
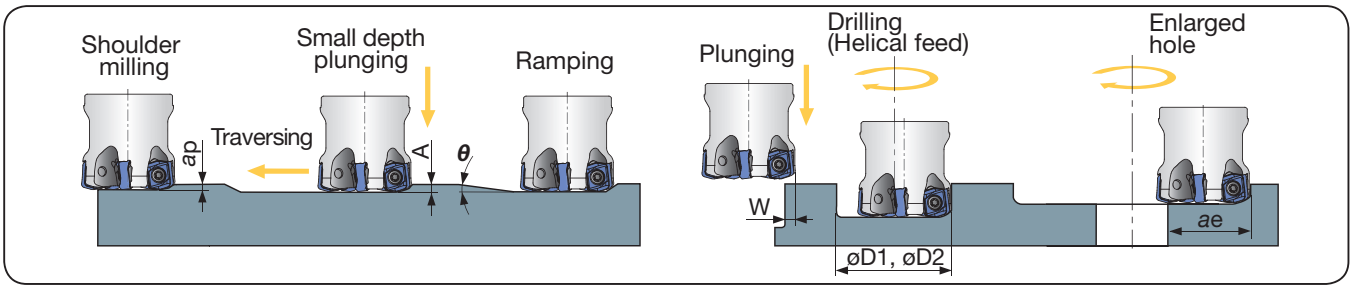



Fig. 2



| | ø66 | | | ø80 | | | ø100 | | ø125 | | ø160 | | ø200 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *Vf* | | *n* | *Vf* | | *n* | *Vf* | *n* | *Vf* | *n* | *Vf* | *n* | *Vf* |
| | | z = 4 | z = 6 | | z = 5 | z = 8 | | | | | | | | |
| | 960 | 3,840 | 5,760 | 800 | 4,000 | 6,400 | 637 | 3,822 | 510 | 4,076 | 398 | 3,981 | 318 | 3,822 |
| | | | | | | *Vc* = 200 m/min, *fz* = 1.0 mm/t | | | | | | | | |
| | 720 | 2,880 | 4,320 | 600 | 3,000 | 4,800 | 478 | 2,866 | 382 | 3,057 | 299 | 2,986 | 239 | 2,866 |
| | | | | | | *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | |
| | 720 | 2,300 | 3,460 | 600 | 2,400 | 3,840 | 478 | 2,293 | 382 | 2,446 | 299 | 2,389 | 239 | 2,293 |
| | | | | | | *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | |
| | 580 | 1,160 | 1,740 | 480 | 1,200 | 1,920 | 382 | 1,146 | 306 | 1,223 | 239 | 1,194 | 191 | 1,146 |
| | | | | | | *Vc* = 120 m/min, *fz* = 0.5 mm/t | | | | | | | | |
| | 580 | 1,390 | 2,090 | 480 | 1,440 | 2,300 | 382 | 1,376 | 306 | 1,468 | 239 | 1,433 | 191 | 1,376 |
| | | | | | | *Vc* = 120 m/min, *fz* = 0.6 mm/t | | | | | | | | |
| | 960 | 3,840 | 5,760 | 800 | 2,400 | 3,840 | 637 | 3,822 | 510 | 4,076 | 398 | 3,981 | 318 | 3,822 |
| | | | | | | *Vc* = 200 m/min, *fz* = 0.6 mm/t | | | | | | | | |
| | 960 | 3,070 | 4,610 | 800 | 3,200 | 5,120 | 637 | 3,057 | 510 | 3,261 | 398 | 3,185 | 318 | 3,057 |
| | | | | | | *Vc* = 200 m/min, *fz* = 0.8 mm/t | | | | | | | | |
| | 720 | 2,880 | 4,320 | 600 | 3,000 | 4,800 | 478 | 2,866 | 382 | 3,057 | 299 | 2,986 | 239 | 2,866 |
| | | | | | | *Vc* = 150 m/min, *fz* = 1.0 mm/t | | | | | | | | |
| | 720 | 2,300 | 3,460 | 600 | 2,400 | 3,840 | 478 | 2,293 | 382 | 2,446 | 299 | 2,389 | 239 | 2,293 |
| | | | | | | *Vc* = 150 m/min, *fz* = 0.8 mm/t | | | | | | | | |
| | 190 | 380 | 570 | 160 | 400 | 640 | 127 | 382 | 102 | 408 | 80 | 398 | 64 | 382 |
| | | | | | | *Vc* = 40 m/min, *fz* = 0.5 mm/t | | | | | | | | |
| | 140 | 110 | 170 | 120 | 120 | 190 | 96 | 115 | 76 | 122 | 60 | 119 | 48 | 115 |
| | | | | | | *Vc* = 30 m/min, *fz* = 0.2 mm/t | | | | | | | | |
| | 480 | 380 | 580 | 400 | 400 | 640 | 318 | 382 | 255 | 408 | 199 | 398 | 159 | 382 |
| | | | | | | *Vc* = 100 m/min, *fz* = 0.2 mm/t | | | | | | | | |
| | 290 | 60 | 85 | 240 | 60 | 100 | 191 | 57 | 153 | 61 | 119 | 60 | 96 | 57 |
| | | | | | | *Vc* = 60 m/min, *fz* = 0.05 mm/t | | | | | | | | |

# Applications

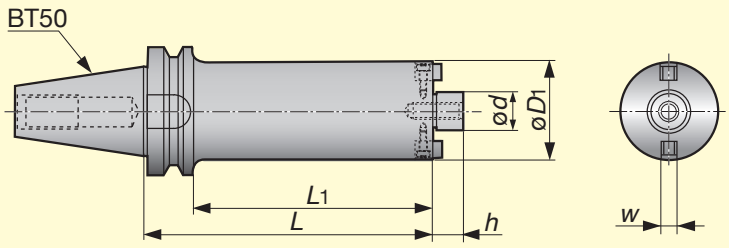



| Cat. No. | Tool dia. øDc (mm) | Max. depth of cut ap (mm) | Max. ramping angle θ | Max. plunging depth A (mm) | Max. cutting width in plunging W (mm) | Min. machinable hole dia. øD1 (mm) | Max. machinable hole dia. øD2 (mm) | Max. cutting width in enlarged hole ae (mm) |
|---|---|---|---|---|---|---|---|---|
| **EXN06R032M32.0...** | ø32 | 1.5 | 2.0° | 0.5 | 6.0 | 47 | 59 | 25 |
| **EXN06R035M32.0...** | ø35 | 1.5 | 1.7° | 0.5 | 6.0 | 53 | 65 | 28 |
| **EXN06R040M32.0...** | ø40 | 1.5 | 1.3° | 0.5 | 6.0 | 63 | 75 | 33 |
| **TXN06R050M...** | ø50 | 1.5 | 0.9° | 0.5 | 6.0 | 83 | 95 | 43 |
| **TXN06R052M...** | ø52 | 1.5 | 0.8° | 0.5 | 6.0 | 85 | 97 | 45 |
| **TXN06R063M...** | ø63 | 1.5 | 0.6° | 0.5 | 6.0 | 109 | 121 | 56 |
| **TXN06R066M...** | ø66 | 1.5 | 0.5° | 0.5 | 6.0 | 112 | 124 | 59 |
| **TXN06R080M...** | ø80 | 1.5 | 0.5° | 0.5 | 6.0 | 143 | 155 | 73 |

· For ø*Dc* above ø100 mm, slot milling, ramping or contouring is not recommended as chips may be re-cut

# Arbors

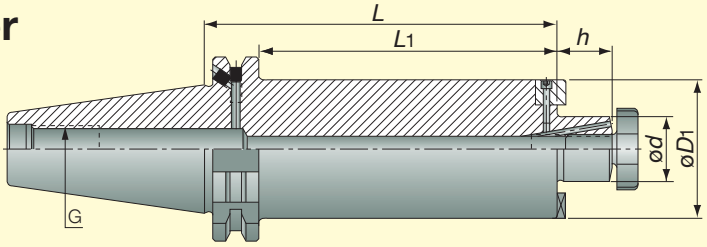
## BT50




※No through air hole.

| ISO / JIS Cat. No. | Stock | Dimensions (mm) | | | | | | Weight (kg) | Applicable TAC mills |
|---|---|---|---|---|---|---|---|---|---|
| | | *L* | *L*1 | ø*D*1 | ø*d* | *h* | *w* | | |
| BT50-FMC22-138-47 | ● | 138 | 100 | 47 | 22 | 18 | 10 | 5.2 | TXN0*R050M22.0E** |
| BT50-FMC22-188-47 | ● | 188 | 150 | 47 | 22 | 18 | 10 | 5.9 | TXN0*R050M22.0E** |
| BT50-FMC22-243-47 | ● | 243 | 205 | 47 | 22 | 18 | 10 | 6.5 | TXN0*R050M22.0E** |
| BT50-FMC22-293-47 | ● | 293 | 255 | 47 | 22 | 18 | 10 | 7.2 | TXN0*R050M22.0E** |
| BT50-FMC22-178-59 | ● | 178 | 140 | 59 | 22 | 18 | 10 | 6.8 | TXN06R063M22.0E** |
| BT50-FMC22-238-59 | ● | 238 | 200 | 59 | 22 | 18 | 10 | 8 | TXN06R063M22.0E** |
| BT50-FMC22-308-59 | ● | 308 | 270 | 59 | 22 | 18 | 10 | 9.5 | TXN06R063M22.0E** |
| BT50-FMC22-373-59 | ● | 373 | 335 | 59 | 22 | 18 | 10 | 10.9 | TXN06R063M22.0E** |
| BT50-FMA31.75-215-76 | ● | 215 | 177 | 76 | 31.75 | 30 | 12.7 | 10 | TXN06R080M31.7-** |
| BT50-FMA31.75-295-76 | ● | 295 | 257 | 76 | 31.75 | 30 | 12.7 | 12.9 | TXN06R080M31.7-** |
| BT50-FMA31.75-375-76 | ● | 375 | 337 | 76 | 31.75 | 30 | 12.7 | 15.8 | TXN06R080M31.7-** |
| BT50-FMA31.75-275-96 | ● | 275 | 237 | 96 | - | - | - | 16.8 | TXN06R100M31.7-** |
| BT50-FMA31.75-375-96 | ● | 375 | 337 | 96 | - | - | - | 23 | TXN06R100M31.7-** |

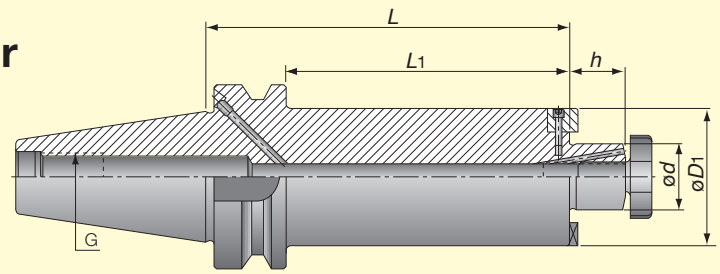
## DIN69871
## Shell Mill Holder




| ISO Cat. No. | Stock | Dimensions (mm) | | | | | | Weight (kg) | Applicable TAC mills |
|---|---|---|---|---|---|---|---|---|---|
| | | *L* | *L*1 | ø*D*1 | ø*d* | *h* | G | | |
| DIN6987150SEM22X48X200C | | 200 | 181 | 48 | 22 | 19 | M24 | 5.0 | TXN06R05*M22.0E** |
| DIN6987150SEM22X61X300C | | 300 | 281 | 61 | 22 | 19 | M24 | 8.8 | TXN06R063M22.0E** |
| DIN6987150SEM27X61X300C | | 300 | 281 | 61 | 27 | 21 | M24 | 8.8 | TXN06R066M27.0E** |

● : Stocked items

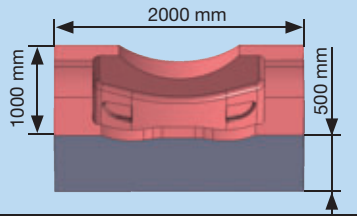
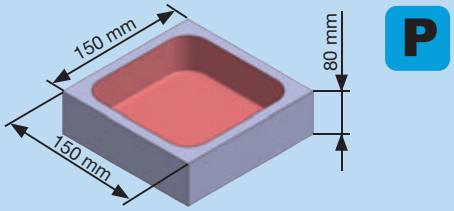
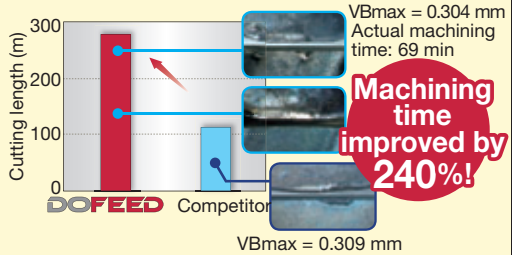
## BT MAS 403
## Shell Mill Holder

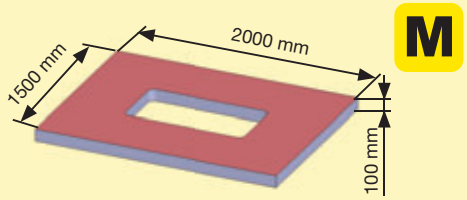
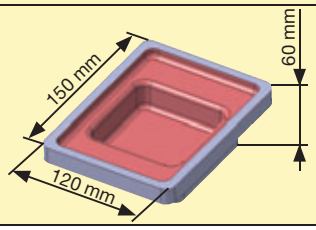
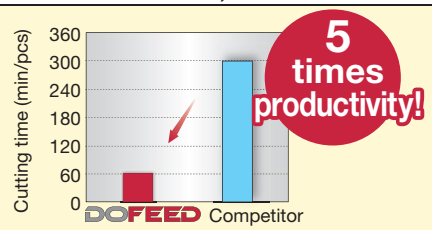


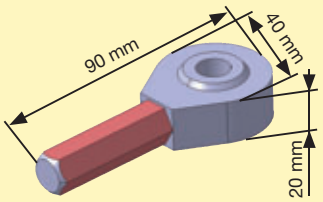
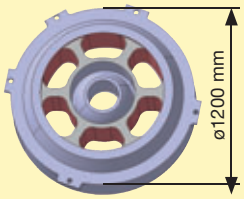
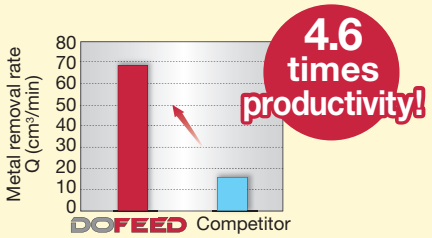

| ISO Cat. No. | Stock | Dimensions (mm) | | | | | | Weight (kg) | Applicable TAC mills |
|---|---|---|---|---|---|---|---|---|---|
| | | *L* | *L*1 | ø*D*1 | ø*d* | *h* | G | | |
| BT50SEM22X48X220C | | 220 | 182 | 48 | 22 | 19 | M24 | 5.1 | TXN06R05*M22.0E** |
| BT50SEM22X61X320C | | 320 | 282 | 61 | 22 | 19 | M24 | 8.9 | TXN06R063M22.0E** |
| BT50SEM27X61X320C | | 320 | 282 | 61 | 27 | 21 | M24 | 8.9 | TXN06R066M27.0E** |

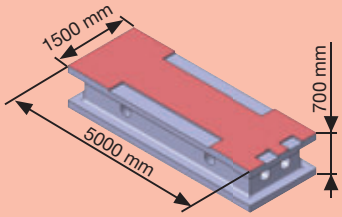
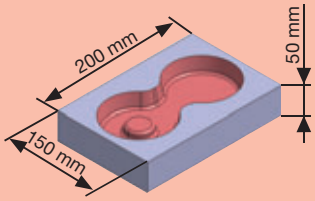
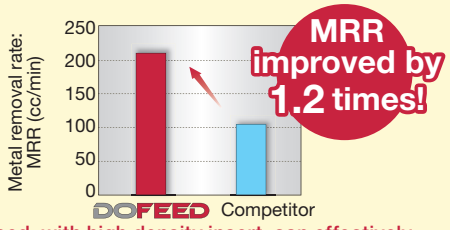
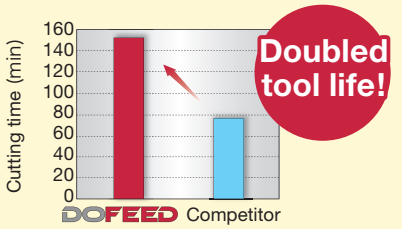
● : Stocked items

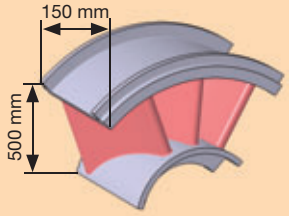
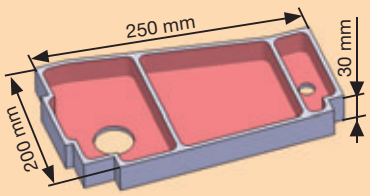
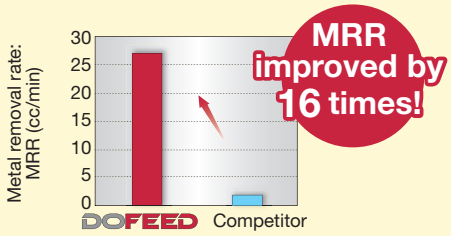
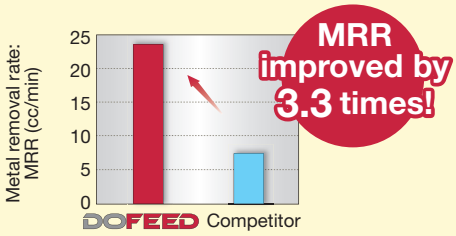
# Practical examples

| Workpiece type | | Die & Mould / Back block | Machine parts |
|---|---|---|---|
| Cutter | | TXN06R063M22.2-06 (ø63, z = 6) | EXN03R025M25.0-05 (ø25, z = 5) |
| Insert | | LNMU06X5ZER-MJ | LNMU0303ZER-MJ |
| Grade | | AH3035 | AH725 |
| Workpiece material | | Prehardened steel HPM7 (HRC30) | Prehardened steel (40HRC) |
| | |   |   |
| Cutting conditions | Cutting speed: *Vc* (m/min) | 115 | 100 |
| | Feed per tooth: *fz* (mm/t) | 0.7 | 0.8 |
| | Depth of cut: *ap* (mm) | 1.1 | 0.5 |
| | Width of cut: *ae* (mm) | 42 | 18 |
| | Process | Contour milling | Pocket milling |
| | Coolant | Air blow | Dry (air) |
| | Machine | Vertical M/C, BT50 | Vertical M/C, BT40 |
| Results | |   AH3035 grade showed better chipping resistance than competitor improving tool life by 50%. |   |

| Workpiece type | | Machine frame | Die & Mould |
|---|---|---|---|
| Cutter | | TXN06R080M31.7-08 (ø80, z = 8) | EXN03R020M20.0-04 (ø20, z = 4) |
| Insert | | LNMU06X5ZER-ML x 7 / LNGU06X5ZER-W x 1 | LNMU0303ZER-MJ |
| Grade | | AH130 / AH725 | AH130 |
| Workpiece material | | SUS304 / X5CrNi18-9 | SUS420 / X20Cr13 |
| | |  |  |
| Cutting conditions | Cutting speed: *Vc* (m/min) | 100 | 110 |
| | Feed per tooth: *fz* (mm/t) | 0.4 | 0.8 |
| | Feed speed: *Vf* (mm/min) | 1273 | - |
| | Depth of cut: *ap* (mm) | 0.5 | 0.8 |
| | Width of cut: *ae* (mm) | 60 | 19 |
| | Process | Face milling | Slot milling |
| | Coolant | Wet | Air blow |
| | Machine | Vertical M/C, BT50 | Vertical M/C, #50 / 11 kW |
| Results | |  <br>Competitor's tool took 300 minutes for roughing and finishing. DoFeed with wiper insert reduces time for finishing and improves total productivity by 5 times that of the competitor. |  <br>DoFeed shows 4 times the tool life against competitor & 190% increase in metal removal rate. |

| Workpiece type | | Automotive / Rod end | Power generation / Frame of blade |
|---|---|---|---|
| Cutter | | EXN03R032M32.0-06 (ø32, z = 6) | EXN03R032M32.0-06 (ø32, z = 6) |
| Insert | | LNMU0303ZER-ML | LNMU0303ZER-ML |
| Grade | | AH130 | AH130 |
| Workpiece material | | SUS630 / X5CrNiCuNb16-4 | SUS410 / X12Cr13 |
| | |  |  |
| Cutting conditions | Cutting speed: *Vc* (m/min) | 70 | 120 |
| | Feed per tooth: *fz* (mm/t) | 0.15 | 0.6 |
| | Depth of cut: *ap* (mm) | 1 | 0.8 |
| | Width of cut: *ae* (mm) | 40 | 20 |
| | Process | Face milling | Shoulder milling |
| | Coolant | Internal supply | Internal supply |
| | Machine | Turning center / 7.5 kW | Vertical M/C, BT50 |
| Results | |  <br>DoFeed is a versatile cutter and was used against a shoulder milling cutter, achieving double tool life. |  <br>DoFeed was tested against a shoulder milling tool offering 4.6 times productivity and 1.5 times higher tool life with double the number of corners. |

| Workpiece type | | Large machine parts | Die & mould |
|---|---|---|---|
| Cutter | | TXN06R200M47.6-12 (ø200, z = 12) | HXN03R020MM10-04 (ø20, z = 4) |
| Insert | | LNMU06X5ZER-MJ | LNMU0303ZER-MJ |
| Grade | | AH120 | AH725 |
| Workpiece material | | FCD600 / 600-3 | FCD600 / 600-3 |
| | |  K |  K |
| Cutting conditions | Cutting speed: *Vc* (m/min) | 150 | 190 |
| | Feed per tooth: *fz* (mm/t) | 1.0 | 0.4 |
| | Depth of cut: *ap* (mm) | 0.5 | 0.3 |
| | Width of cut: *ae* (mm) | 150 | 9 |
| | Process | Face milling | Pocket milling |
| | Coolant | Dry | Dry (air) |
| | Machine | Horizontal M/C, BT50 | Vertical M/C, BT40 |
| Results | |  DoFeed, with high density insert, can effectively increase productivity. Lower cutting forces reduce chattering, achieving 1.5 times tool life. |  Due to the lower cutting forces, DoFeed can increase the productivity 4 times higher. AH725 grade can effectively reduce sudden fracture, achieving double tool life. |

| Workpiece type | | Turbine blade | Aerospace component |
|---|---|---|---|
| Cutter | | EXN03R030M32.0-05 (ø30, z = 5) | EXN03R025M25.0-05 (ø25, z = 5) |
| Insert | | LNMU0303ZER-ML | LNMU0303ZER-ML |
| Grade | | AH725 | AH725 |
| Workpiece material | | Heat resistant cast steel | Ti-6Al-4V (36HRC) |
| | |  S |  S |
| Cutting conditions | Cutting speed: *Vc* (m/min) | 70 | 50 |
| | Feed per tooth: *fz* (mm/t) | 0.5 | 0.7 |
| | Depth of cut: *ap* (mm) | 0.5 | 0.5 |
| | Width of cut: *ae* (mm) | 30 | 25 |
| | Process | Shoulder milling | Pocket milling |
| | Coolant | Wet | Wet |
| | Machine | Vertical M/C, BT50 | Vertical M/C, BT40 |
| Results | |  Tripled cutting speed and super high feed milling offer 16 times higher productivity. |  7.3 times higher feed machining that drastically improves productivity. |

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