

## Machine specifications

|                        |   |                                       |
|------------------------|---|---------------------------------------|
| Travels                | X × Y × Z axis  | 400 × 350 × 200 mm                    |
|                        | Distance from table surface to spindle gauge line plane | 100 - 300 mm                          |
| Table                  | Table working area                                      | 600 × 400 mm                          |
|                        | Maximum table load (evenly distributed)                 | 100 kg                                |
|                        | Table surface configuration                             | T slots (14H8 mm) × 5                 |
|                        | Height to table surface                                 | 800 mm                                |
| Spindle                | Speed range   | 400 - 45,000 min <sup>-1</sup>        |
|                        | Taper hole  | HSK-E32                               |
|                        | Bearing inner diameter                                  | 40 mm                                 |
|                        | Drive motor power                                       | 9.5 kW                                |
| Feedrates              | Rapid traverse (X and Y axis)<br>(Z axis)               | 16,000 mm/min<br>8,000 mm/min         |
|                        | Cutting feed (X and Y axis)<br>(Z axis)                 | 1 - 16,000 mm/min<br>1 - 8,000 mm/min |
| Automatic tool changer | Tool storage capacity                                   | 20 tools                              |
|                        | Maximum tool diameter                                   | 32 mm                                 |
|                        | Maximum tool length                                     | 120 mm                                |
|                        | Maximum tool weight                                     | 0.5 kg                                |
| Machine size           | Height  | 2,250 mm                              |
|                        | Width × depth   | 2,160 × 2,495 mm                      |
|                        | Weight  | 8,200 kg                              |
| Floor space            | Width × depth   | 3,000 × 4,500 mm                      |

## Standard specifications

- 45,000 min<sup>-1</sup> spindle
- HSK-E32
- 20 tools magazine
- Spindle temperature controller
- Automatic lubricant supply device
- Automatic air blower
- Fully enclosed splash guard
- Operator door lock (Operating mode specification)
- ATC door interlock
- 0.005 μm scale feedback
- Hybrid automatic tool length measuring device
- Splash guard lighting device
- Chip bucket
- Thermal Guard
- Portable manual pulse generator (with the handle enable button)
- Rigid tap
- Automatic power shutoff
- Super G1.4 control
- Data center
- Interface for automatic fire extinguisher system

## Optional specifications (●)

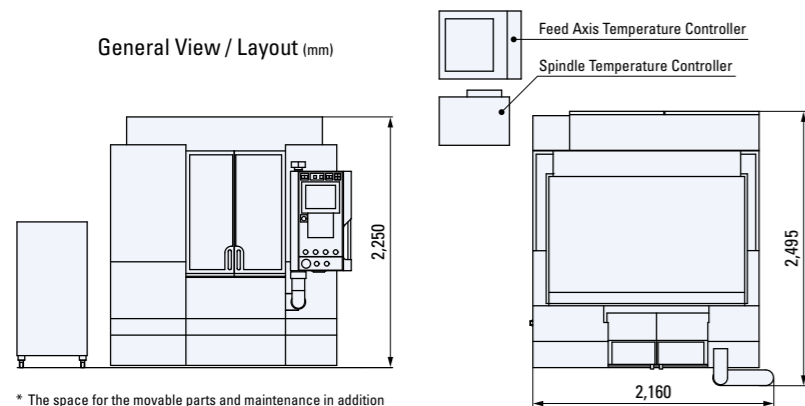
## Optional equipment (★)

- 40 tools magazine (including HSK pots)
- Preparation of BIG Air turbine spindle\*1 (80,000 min<sup>-1</sup>, 120,000 min<sup>-1</sup>)
- Rotary work head (DD motor specification)
- Automatic workpiece changer · WPS48-33S · WPS60-33S · WPS90-33S
- Nozzle coolant supply device
- ★ MQL device
- ★ Mist collector (including connection port)
- ★ Precision tool image measuring 2
- ★ Automatic workpiece measuring device (MARPOSS, optical type)
- ★ High accuracy automatic workpiece measuring device (RENISHAW, optical type)
- ★ Workpiece image measuring device
- Mirror surface finish solution
- ★ Signal light (3 levels)
- Bed and Column Stabilizer
- Thermal Chamber
- ★ Workpiece washing gun
- Operator door lock & ATC door lock (with automatic power shutoff function)
- ★ Coolant temperature controller (with heater)
- ★ Oil skimmer
- ★ Air dryer
- ★ Portable manual pulse generator with position indicator (with the handle enable button)
- ★ Circuit breaker

- \*1 - Includes items listed below.
- 24 tools magazine (Air turbine spindle 4 tools, standard tool 20 tools)
  - Positioning block (BIG Air turbine spindle)
  - Air booster (with air tank)
  - Air dryer with temperature control function
  - Tool magazine door lock

Note: Requires simultaneous selection of the precision tool image measuring. Not selectable with hybrid automatic tool length measuring device. Recommended to be selected together with mist collector. Not include air turbine spindle.

General View / Layout (mm)



\* The space for the movable parts and maintenance in addition to the space for the machine main body are required. For the details, please refer to the specifications.



<http://www.makino.co.jp>



Atsugi and Fuji Katsuyama works are certified for ISO14001 and ISO9001.

\*The specifications, figures, and overviews of products, peripheral devices and accessories in this catalogue may be changed without prior notice to incorporate improvements resulting from ongoing R&D programs.

\*The all products in this catalogue include the optional specifications and equipment.

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## Precision Micromachining Center

# iQ3000



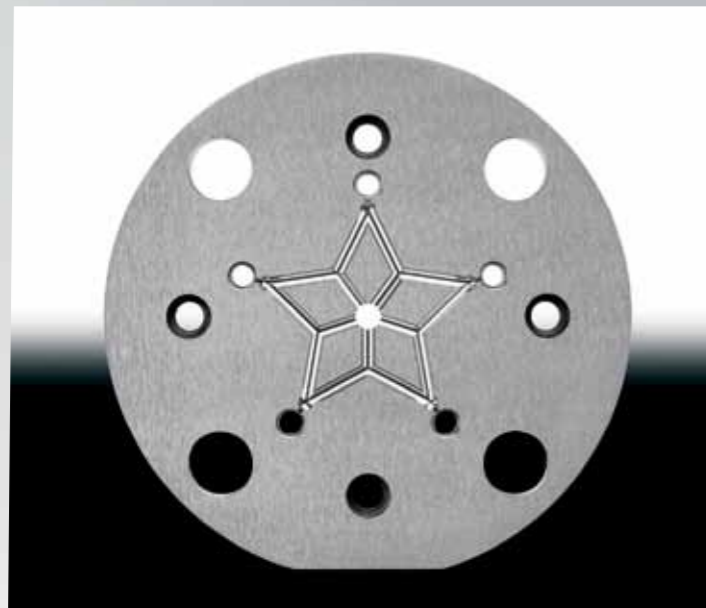
Progressing precise component parts  
**Mold for future**

iQ300



# Machining samples

## 1 μm\* center position error at maximum

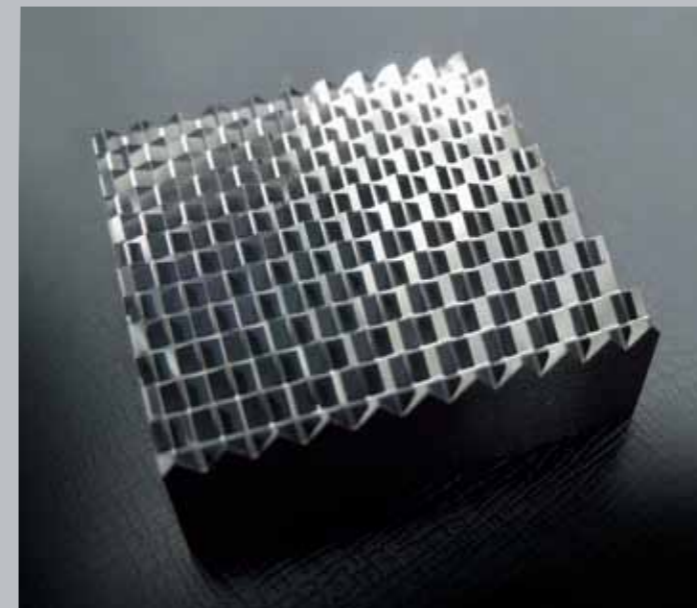


### Mold base plate for lens

**Material** : Stainless steel (STAVAX, 52HRC)  
**Size (diameter × height)** : 100 × 10 mm  
**Roundness of each hole** : 0.6 μm or less  
**Machining time** : 2 hr. 36 min

\*1 Actual value at Makino's assembly plant.

## Surface finish Ra 11 nm (Nano meters)



### Reflex reflector mold

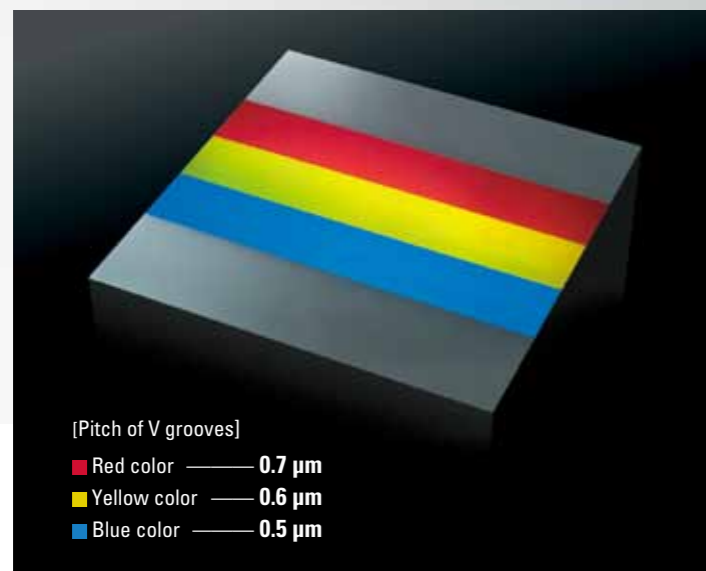
**Material** : Stainless steel (STAVAX, 54HRC)  
**Size (L×W×H)** : 60 × 60 × 20 mm

<Mirror finish with PCD\* tools>



[Surface finish]  
Ra 10.8 nm

## 0.5 - 0.7 μm pitch between V grooves



### Structural color by V-Groove gratings \*2 (3 colors)

(Super fine V grooves machining by hole machining)

**Material** : Non electrolytic Ni-P plating  
**Size (L×W×H)** : 30 × 30 × 10 mm  
**Tool used** : Single-crystal diamond bite



\*2 [Structural color]

Refers to the phenomenon of fine nano-structure coloring due to interference, refraction, diffraction, and scattering of light. In this case, the surface appears blue, yellow and red, due to V-grooves engraved in almost the same pitch intervals as the wavelength of the visible light from 500 to 800 nm.

## Cutting and grinding of cemented carbide with one machine



### Tool insert mold

**Material** : Tungsten carbide (87.5HRA, 70HRC)  
**Size (L×W×H)** : 13 × 13 × 20 mm  
**Machining time** : 8 hr. 35 min.

< Mirror finish with PCD\* tools >



< Grinding finish on the lateral face >



[Surface finish]  
Ra 20.7 nm

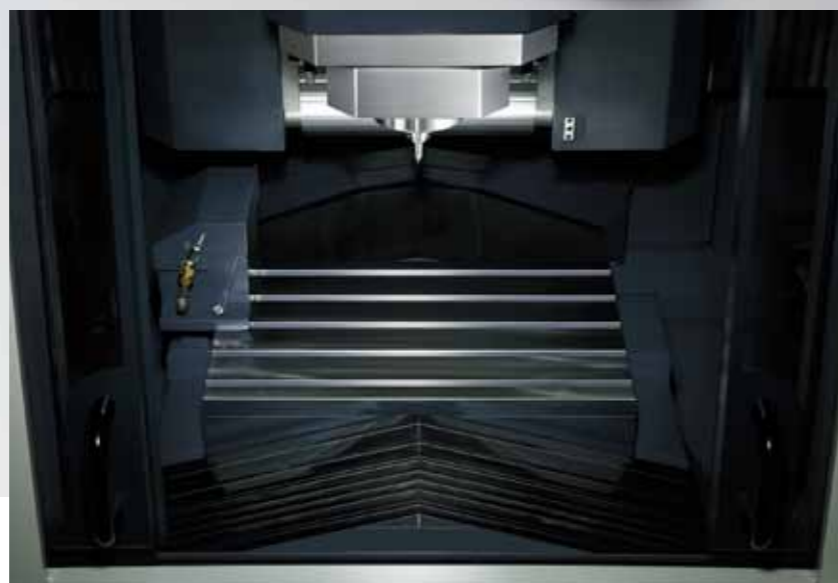
\*: PCD: Polycrystalline Diamond

# Thermal stability measures

- ◎ Spindle core and jacket cooling
- ◎ Linear motor cooling
- ◎ Thermal Guard
- ◎ Bed and column insulation
- ◎ Bed and Column Stabilizer\*
- ◎ Thermal Chamber\*
- ◎ Heat exhaust from power supply unit



Travels (X×Y×Z) : 400×350×200 mm  
 Spindle speed range : 400 - 45,000 min<sup>-1</sup>  
 Feedrate : 16,000 (mm/min) (X, Y axis)  
 8,000 (mm/min) (Z axis)

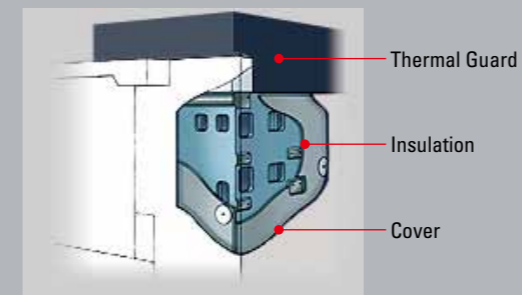


## Linear motor cooling

Cooling oil is circulated through the motor flanges to remove heat and control the motor temperature to that of the machine.

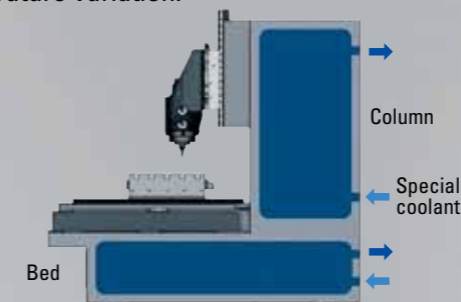
## Thermal Guard/Bed and column insulation

The entire machine is provided with covers from the floor to the machining chamber ceiling to suppress the effects of ambient temperature changes. In addition, the cast iron surfaces of the column and bed are covered with insulation to prevent machine attitude changes.



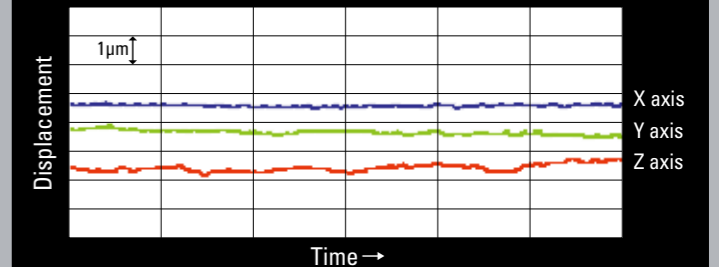
## Bed and Column Stabilizer\*

The bed and column are filled with a special coolant that is circulated internally to suppress machine attitude changes due to ambient temperature variation.



## Stable tool tip position to within 1 μm (12 hours)

Displacement in XYZ axes during full stroke operation



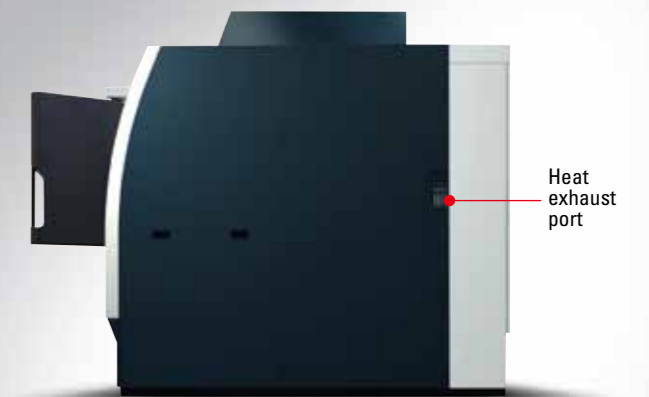
Spindle speed min<sup>-1</sup> : 45,000  
 Feedrate (mm/min) (X and Y axis) : 16,000  
 (Z axis) : 8,000

## Thermal Chamber\*

Temperature-controlled air is fed into the splash guard to keep the temperature inside the guard constant.

## Heat exhaust from power supply unit

Heat generated by the power supply unit is discharged from a side heat exhaust port to avoid affecting the machine.



\*:optional specification

\*:optional specification

# 45,000 min<sup>-1</sup> spindle

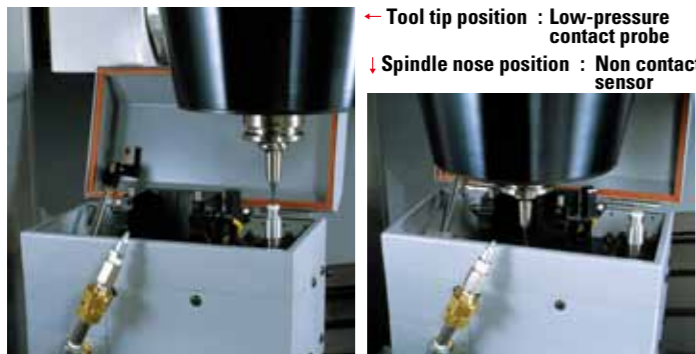
The spindle does not show any thermal growth, deflection or vibration even during long hours of machining at top speed.

- Taper hole : HSK-E32
- Speed range : 400 - 45,000 min<sup>-1</sup>
- Bearing inner : 40 mm diameter
- Power (cont.) : 9.5 kW
- Torque (cont.) : 2.0 N·m
- Cooling : Core and jacket
- Lubrication : Under race



## Keeps seam level differences within 0.8 μm

Hybrid automatic tool length measuring device (standard specification)



- ← Tool tip position : Low-pressure contact probe
- ↓ Spindle nose position : Non contact sensor

Capable of measuring tool of 0.03 mm diameter

## Measures the length and the diameter of finer tools

Precision tool image measuring 2 <Image processing system> (optional specification)



Display of measurement results  
<Measurement example>  
Tool diameter 0.2 mm  
Spindle speed 10000 min<sup>-1</sup>

Capable of measuring tool of 0.01 mm diameter

Note: requires calibration tool.

# Accuracy

| Static accuracy values      | Guaranteed (μm) | Actual (μm) |
|-----------------------------|-----------------|-------------|
| Positioning (full stroke)   | ±1.0            | ±0.4        |
| Repeatability (full stroke) | ±0.5            | ±0.1        |
| Straightness (full stroke)  | 3.0             | 0.7         |
|                             | (100 mm)        | 1.0         |
| Squareness (full stroke)    | 3.0             | 1.3         |
| Roundness                   | 3.0             | 0.6         |

\*Tolerances measured at Makino's assembly plant

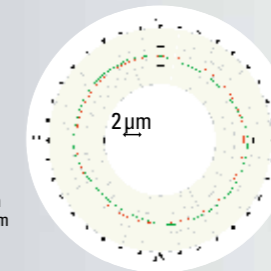
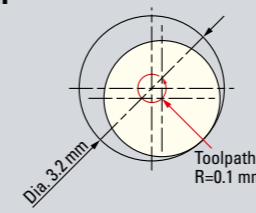
Test piece  
Circular machining with a toolpath radius of 0.1 mm

<Machining conditions>

Spindle speed : 20,000 min<sup>-1</sup>

Tool used : 3.0 mm diameter square endmill

Material : Tool steel (AISI P21, NAK55)



Roundness: 0.98 μm

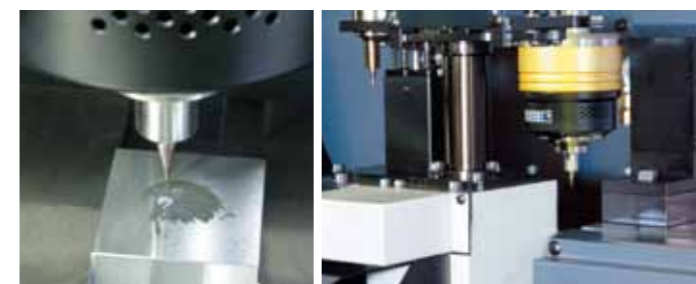
(actual measured value)

Cutting feed: 200 mm/min (actual feedrate)

## Increase efficiency and reliability of micro machining

Optimum for finishing with fine tools (smaller than 1.0 mm diameter)

Preparation of BIG Air turbine spindle (optional specification)



Machining time by 55% reduced\*1 Compatible to Automatic tool changer

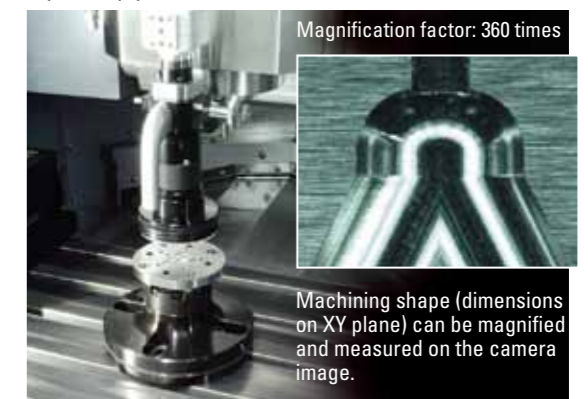
[Air turbine spindle] <Manufacturer> BIG DAISHOWA SEIKI CO LTD. (Customers have to prepare)

|                              | 80,000 min <sup>-1</sup>            | 120,000 min <sup>-1</sup>             |
|------------------------------|-------------------------------------|---------------------------------------|
| Model                        | : HSK-E32M-RBX7-4S-134-43           | : HSK-E32M-RBX12-4S-155-65            |
| Speed                        | : 60,000 - 80,000 min <sup>-1</sup> | : 100,000 - 120,000 min <sup>-1</sup> |
| Maximum tool diameter        | : 4 mm                              | : ←                                   |
| Maximum tool protrude length | : 16 mm                             | : ←                                   |

\*1: 0.1 mm radius ball endmill, 120,000 min<sup>-1</sup>

Non-contact measurement of workpiece on the machine

Workpiece image measuring device\*2 (optional equipment)



Machining shape (dimensions on XY plane) can be magnified and measured on the camera image.

\*2: Measurement in depth direction is not possible. Installation and removal of this device is manual. PC for observation and measurement to be prepared by the customer.

## Outstanding operating ease and efficient chip evacuation



### Design for good visibility



### Air and coolant systems

iQ300 is equipped with a 2-nozzle air blower (standard specification) and can be fitted with a 2-nozzle coolant supply device\*.

## Automation



### Automatic tool changer

Tool storage capacity : 20, 40\* tools  
 Maximum tool diameter / length : 32 / 120 mm  
 Maximum tool weight : 0.5 kg



### Automatic workpiece changer\*

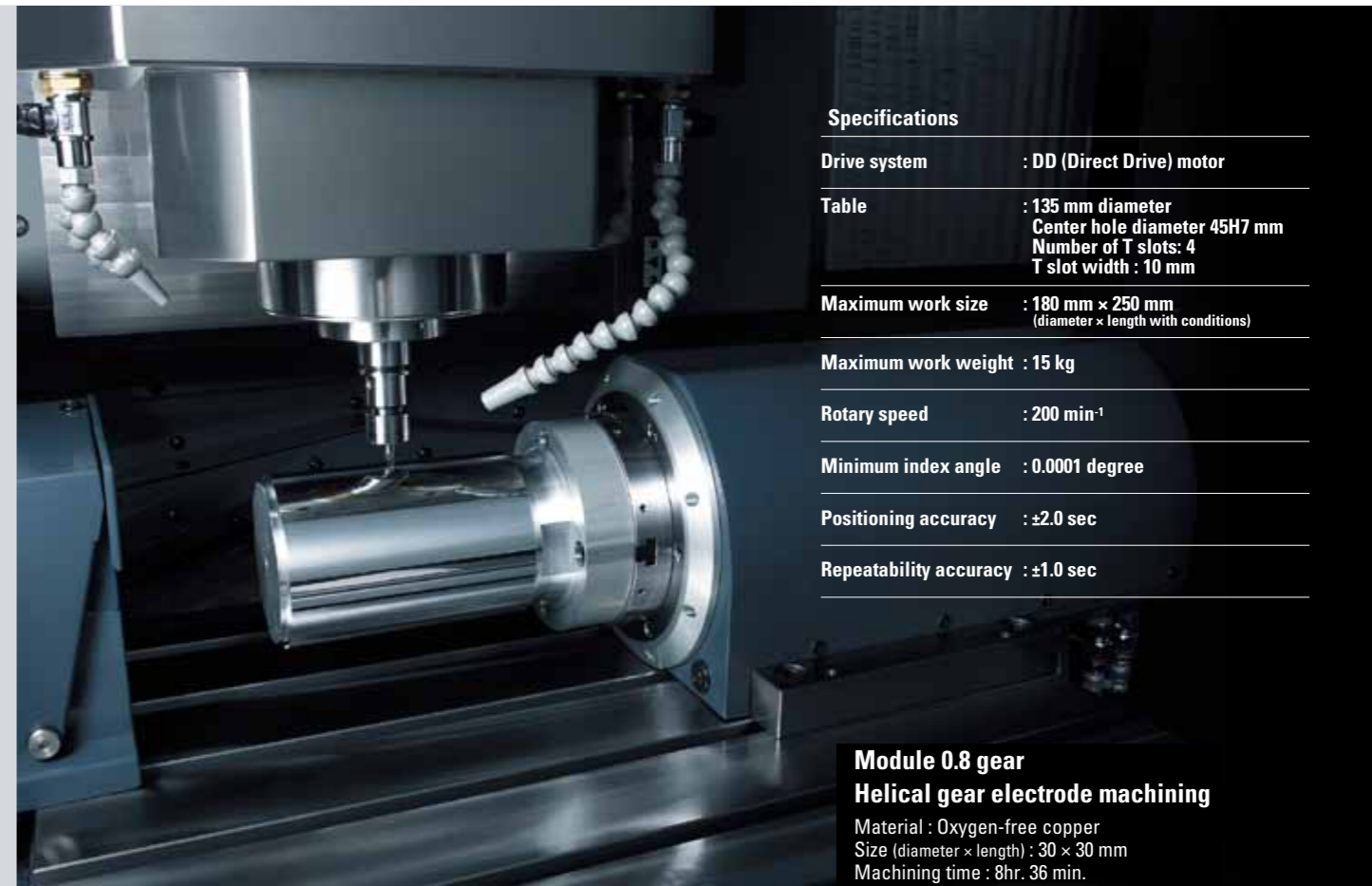
Enables continuous unmanned operation overnight or in weekends.

\*:optional specification

## High precision Rotary Work Head\*

— DD motor —

Minimal deflection during long hours of continuous indexing machining improves the efficiency of micro-machining.



### Specifications

|                        |   |
|------------------------|---|
| Drive system           | : DD (Direct Drive) motor   |
| Table                  | : 135 mm diameter<br>Center hole diameter 45H7 mm<br>Number of T slots: 4<br>T slot width : 10 mm |
| Maximum work size      | : 180 mm × 250 mm<br>(diameter × length with conditions)  |
| Maximum work weight    | : 15 kg   |
| Rotary speed           | : 200 min <sup>-1</sup>   |
| Minimum index angle    | : 0.0001 degree   |
| Positioning accuracy   | : ±2.0 sec  |
| Repeatability accuracy | : ±1.0 sec  |

### Module 0.8 gear Helical gear electrode machining

Material : Oxygen-free copper  
 Size (diameter × length) : 30 × 30 mm  
 Machining time : 8hr. 36 min.



**Gear accuracy**  
**JIS N4 grade** (0 grade of previous JIS)

### Machining sample with Rotary Work Head

#### Turning machining with single-crystal diamond bit

Material : Aluminum (A 1027)  
 Size (diameter × length) : 100 × 150 mm



**Surface finish** (Liner feed direction) : Ra 9.4 nm  
 (Rotary direction) : Ra 3.3 nm