

Large Capacity, High-Speed Horizontal Machining Center

HM1600

Combining exceptional cutting capability with high-speed and accuracy to optimize the machining of wind-power amplifier gear boxes, large-size dies and molds, diesel engine blocks and other large products.

Travel Distance

2400 x 1650 x 1750mm

Pallet Size

1600 x 1250mm

Maximum Workpiece Size (Diameter x Height)

∅2500 x 1850mm

Rapid Traverse Rate (X/Y/Z axes)

42m/min

Maximum Tool Mass

30kg

Maximum Tool Diameter

∅300mm

Maximum Tool Length

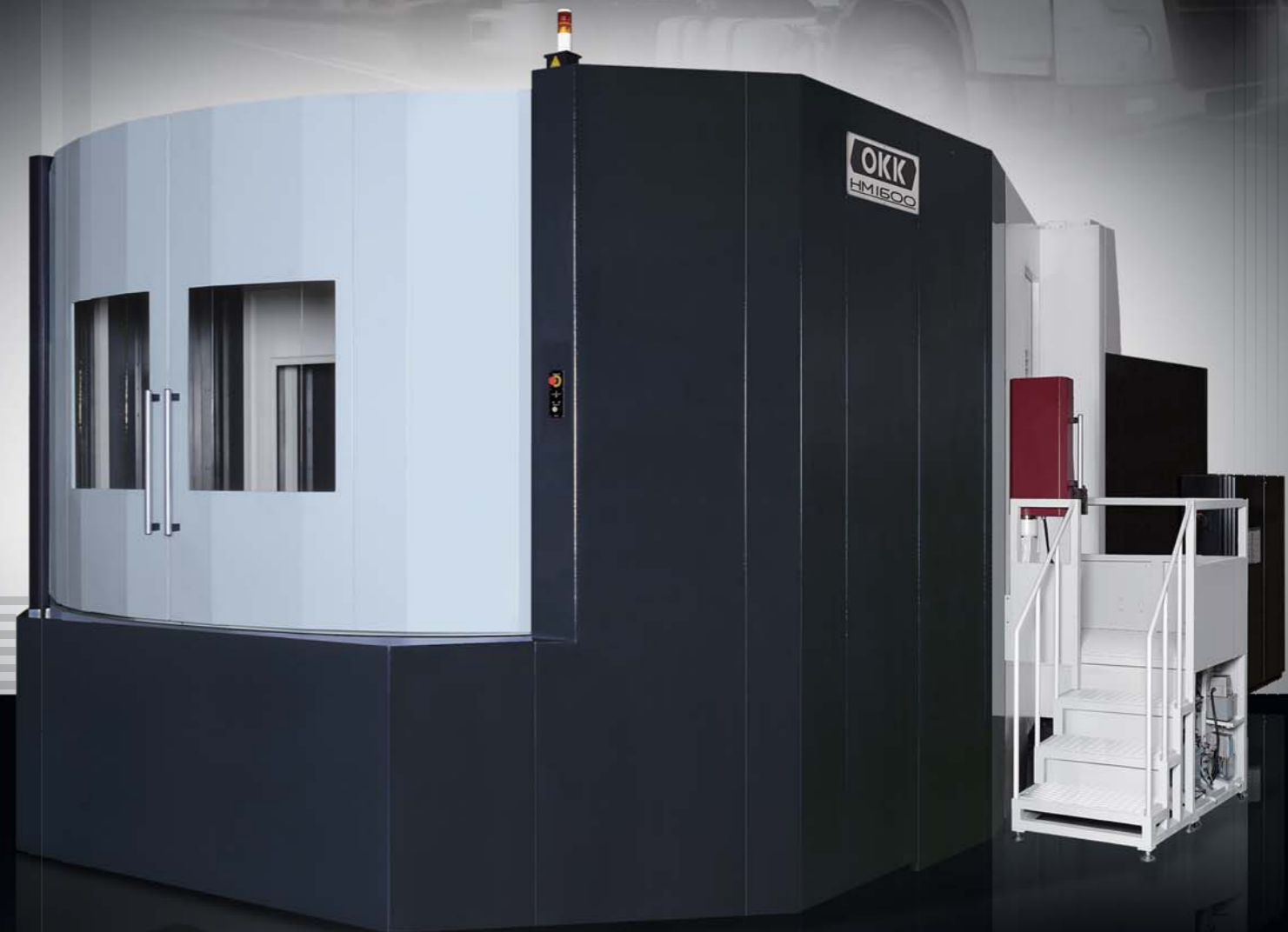
600mm

Number of Stored Tools

60tools *116, 176 or 236 tools can be stored optionally.

Maximum Load Mass

5000kg *8000 kg or 10000 kg can be loaded optionally.



Consistent machining performance is received by the precise synchronization of the control and the drives.

Synchronized control of the Y and Z axes drives and the large-diameter twin-lead ball screws

Provision of various types of spindles to respond to any users' demands

Three types of spindle specification.



The twin-lead ball screws on the Y and Z axes dampen vibrations. Focused efforts have resulted in the decrease in machining time, improving the machining accuracy, machined surface quality, contouring accuracy and extending the tool life.

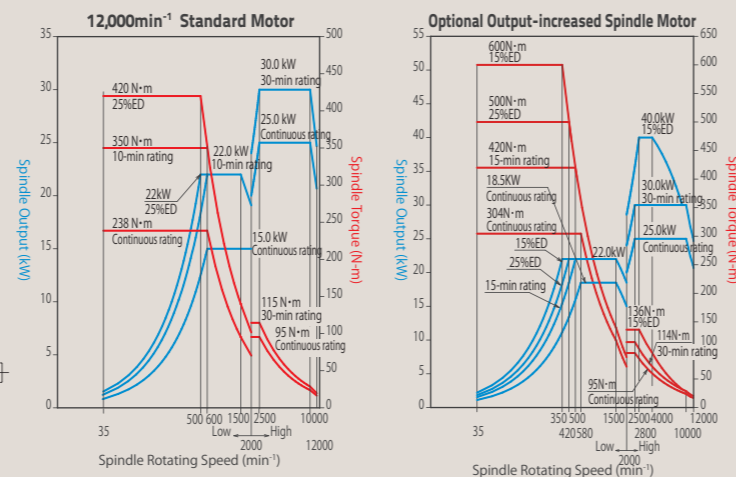
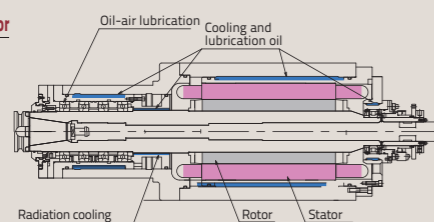
High-speed Spindle (MS)

For high-speed and high efficient machining of general parts

Spindle rotating speed: 35 through 12000 min⁻¹
 Spindle motor: 30 kW (30-min rating) / 25 kW (continuous rating)
 Maximum spindle torque: 420 N·m (25% ED rating) / 238 N·m (continuous rating)
 Spindle bearing bore diameter: ø100 mm

Optional Output-increased Spindle Motor

Spindle motor:
 40 kW (15% ED rating) / 25 kW (continuous rating)
 Maximum spindle torque:
 600 N·m (15% ED rating) / 304 N·m (continuous rating)



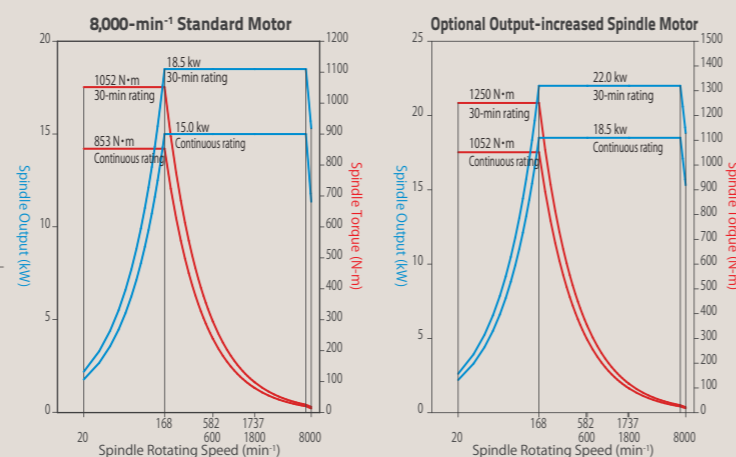
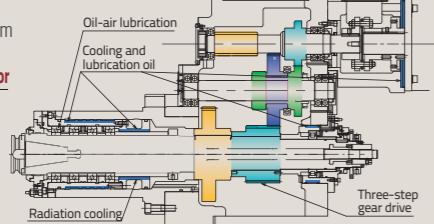
Gear-drive Spindle (Three-step Gear Drive)

For smoothly machining the hard-to-cut materials for heavy-duty parts

Spindle rotating speed: 20 through 8000 min⁻¹
 Spindle motor: 18.5 kW (30-min rating) / 15 kW (continuous rating)
 Maximum spindle torque: 1052 N·m (30-min rating) / 853 N·m (continuous rating)
 Spindle bearing bore diameter: ø120 mm

Optional Output-increased Spindle Motor

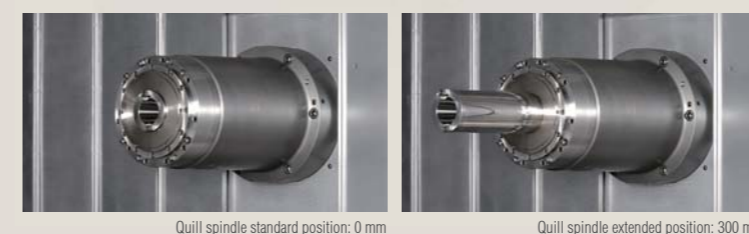
Spindle motor:
 22.0 kW (30-min rating) / 18.5 kW (continuous rating)
 Maximum spindle torque:
 1250 N·m (30-min rating) / 1052 N·m (continuous rating)



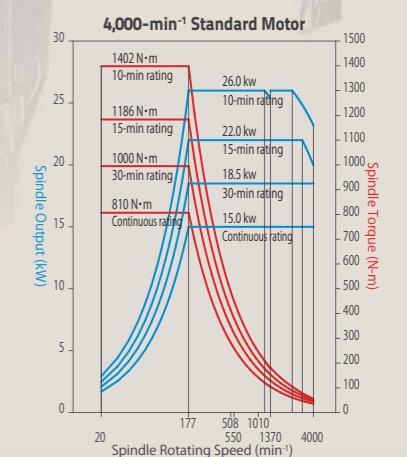
Two Position Locking Quill Style Spindle (Three-step Gear Drive)

The two position locking quill spindle can realize with a single chucking operation the machining that required two processes using the machining center and the boring machine. It allows a drastic reduction in the total machining time by reducing both the processes and the setup work that can take hours for the large-size parts.

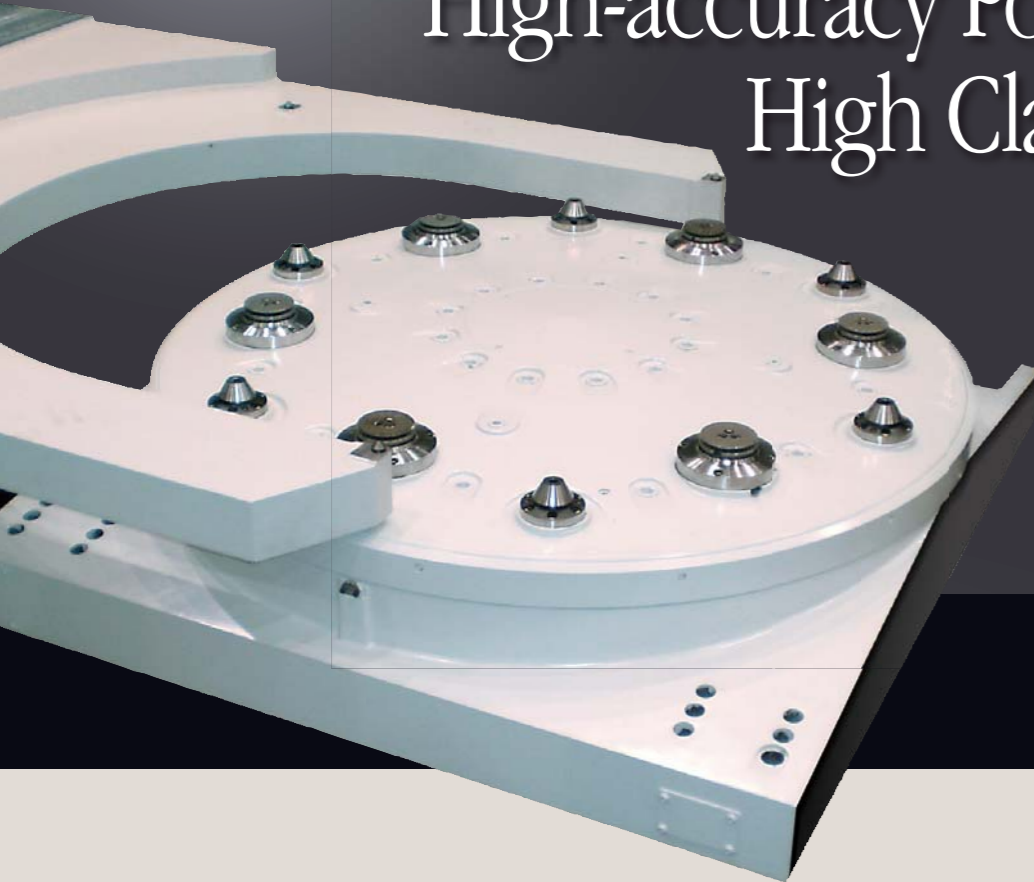
Spindle rotating speed: 20 through 4000 min⁻¹
 Spindle motor: 18.5 kW (30-min rating) / 15 kW (continuous rating)
 Maximum spindle torque:
 1000 N·m (30-min rating) / 810 N·m (continuous rating)
 Spindle bearing bore diameter: ø150 mm
 Quill spindle outside diameter: ø110 mm



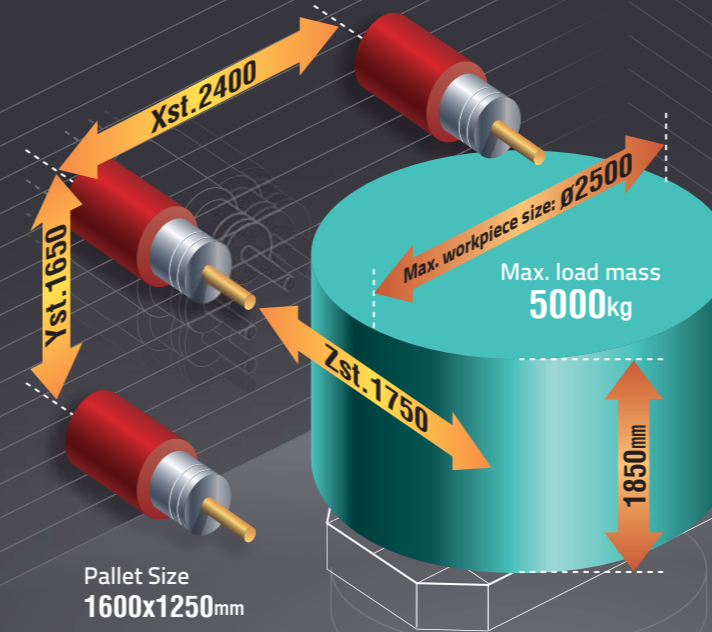
Quill spindle positioning in two positions (0/300 mm) OKK's original clamp device minimizes the drop in machining capability when the spindle is extended. (Patent pending)



High-accuracy Positioning and High Clamping Force



OKK's original six cylinder pallet clamping holds with a force of 284 kN and six taper cones produce high-accuracy positioning. The balanced clamping method and high clamping force delivers high cutting capability that is necessary for machining the large and heavy workpieces.

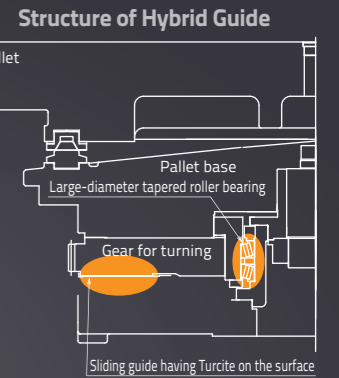


Hybrid guide supporting heavy workpiece Utilizing a large-diameter tapered roller bearing and the sliding guide surface on the B axis has produced a highly rigid table.

The built-in rotary table (BRT) is ideal for machining complicated workpieces and is included in the standard specification. It enables the 0.0001-degree minimum index angle.

Pallet Size **1600 x 1250mm**
 Maximum Workpiece Size (Diameter x Height) **Ø2500 x 1850mm**
 Maximum Load Mass **5000kg**

*8000 kg or 10000 kg can be loaded optionally. Note that the APC cannot be used for the 10000-kg specification.



Wide Machining Area available for Large Workpieces

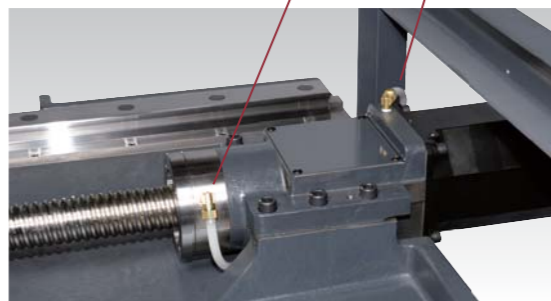
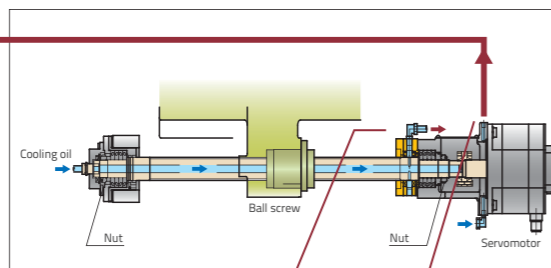
OKK pursued the ultimate superior accuracy, accessibility and operability by a thorough study of the heavy-duty cutting environment.

Forced Core Cooled Ball Screw and Double-anchoring Method

Lubrication Oil Temperature Controller



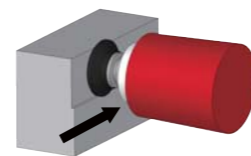
The forced core cooled ball screws are used on the X, Y and Z axes. Circulation of the temperature-controlled cooling oil on the surfaces of the ball screws, ball screw supports and motor mounting section minimizes the thermal displacement and provides continued accuracy over a long period of time.



The double-anchoring method is effective for improving the feed mechanism's rigidity and accuracy. Use of the method for the X, Y and Z axes improves the fine-feed and lost-motion characteristics and drastically increases the circular cutting accuracy.

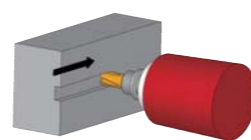
Cutting Data

Face Milling



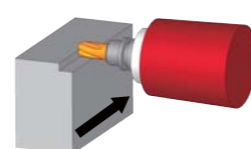
Type of machining	Face milling (φ125x6T)	
	Standard position (0 mm)	Extended position (300 mm)
Quill spindle position		
Spindle rotating speed	300min ⁻¹	300min ⁻¹
Width of cut	100mm	100mm
Depth of cut	6mm	2.5mm
Feed rate	1000mm/min	600mm/min
Cutting rate	600cm ² /min	150cm ² /min
Workpiece material	S45C	S45C

Grooving



Type of machining	Grooving (φ50x6T)	
	Standard position (0 mm)	
Spindle rotating speed	160 min ⁻¹	
Width of cut	50mm	
Depth of cut	25mm	
Feed rate	200mm/min	
Cutting rate	250cm ² /min	
Workpiece material	S45C	

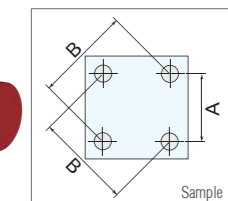
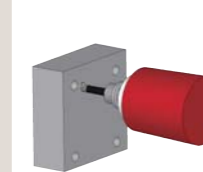
Side Milling



Type of machining	Side milling (φ50x6T)	
	Standard position (0 mm)	
Spindle rotating speed	160 min ⁻¹	
Width of cut	25mm	
Depth of cut	50mm	
Feed rate	200mm/min	
Cutting rate	250cm ² /min	
Workpiece material	S45C	

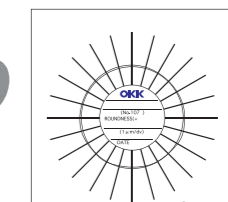
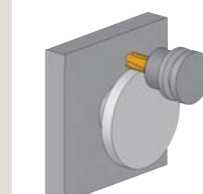
The above values are reference values and consider them only as a guide for the cutting capability.

Accuracy



A	200.000
B	282.843

Positioning Machining Accuracy (mm)		
Item	OKK tolerance	Example record
Axial direction	0.015	-0.004
Diagonal direction	0.015	-0.001
Difference in diameter	0.010	0.003



Circular Cutting Accuracy (mm)		
Item	OKK tolerance	Example record
Circularity	0.015	0.00413

Positioning Accuracy (mm)		
Item		
Positioning accuracy	When linear scale is not used	X:±0.0035/full length Y:±0.0030/full length Z:±0.0030/full length
	When linear scale is used	X:±0.0030/full length Y:±0.0025/full length Z:±0.0025/full length
Repeated positioning accuracy	When linear scale is not used	X/Y/Z:±0.0020/full length
	When linear scale is used	X/Y/Z:±0.0015/full length

Remarks
 1. The data shown above as an example are based on the short-time machining. The values may vary in the continuous machining.
 2. The data shown above as an example were obtained under the OKK's in-house cutting test conditions. The values may vary with the condition of the cutting tools and fixtures.
 3. The above accuracy data are the laboratory data obtained by installing the machine according to the OKK's foundation drawing and carrying out the inspection based on the OKK's inspection standard in the environment with constant temperature.

Improved Reliability and Durability

We have considered the measures for chip removal, ease of maintenance, etc. and thoroughly pursued the production efficiency in the long hours of operation.

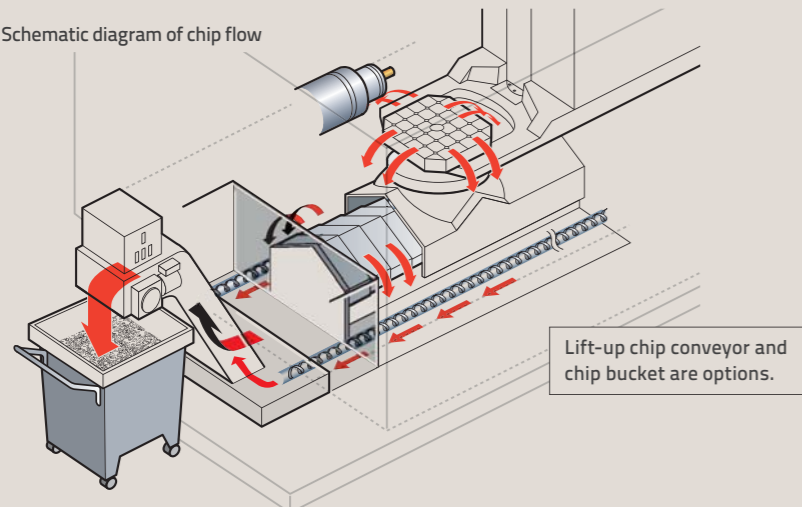
Design structure in consideration of safety, operability and even the environmental measures
We have improved largely the operability- and chip-processing-related problems that are specific to the large-size machines.

Thorough Chip Processing Measures

The shutter slots have been eliminated from the Y-axis upper and lower covers. Both the table main body and the Z-axis shutter have been steepened to avoid chips accumulation and improve the continuous machining reliability.

The wide troughs on both sides of the table can receive a large amount of chips. The chips and coolant in the troughs are completely transferred and ejected from the machine by means of the coil-type conveyors. The troughs also help to suppress the thermal displacement by sheltering the transfer of heat from chips and coolant to the bed.

Schematic diagram of chip flow

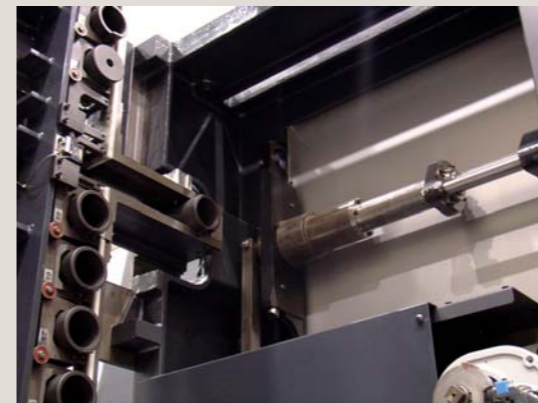


Ceiling Shower [Option]

A large amount of coolant can be jetted and sprayed evenly over the machine inside by using four 1.2-kW pumps dedicated to the ceiling shower. The high-capacity ceiling shower washes away chips from fixtures and workpieces and prevents chips from accumulating.



ATC [Automatic Tool Changer]



Consistent tool change operation and superior durability are ensured by use of the acknowledged OKK's original cam-controlled high-speed synchronizing tool changer (OKK patent).
The variable-speed ATC function included in the standard specification allows setting at the time of tool registration for the heavy tools and large-diameter tools so that the ATC turning speed slows down automatically to change those tools smoothly.

Maximum Tool Diameter
∅115mm
*∅300 mm when the adjoining tool pots are empty.

Maximum Tool Length
600mm
*For the multi-magazine that can store 176 or more tools, the maximum tool length for the tools stored in the 3rd or later magazines is restricted to 500 mm.

Maximum Tool Mass
30kg

Tool Exchange Time (tool-to-tool)
3.8s

Tool Exchange Time (cut-to-cut)
11.0s

Maximum Tool Moment
29.4N·m

APC [Automatic Pallet Changer]



APC [Automatic Pallet Changer]

The APC mechanism of HM1600 uses the direct-turn method consisting only of the pallet lift and turning mechanism so that the pallet exchange time is reduced and space-saving is realized. It can handle the table's maximum load mass of 8000 kg [option]. Since its design has taken into consideration the expansion for automation (6APC with automatically transferred pallet), it is easily compatible with the line configuration.

Maintenance

The daily inspected equipment are aggregated and installed below the lower steps for ease of maintenance.



No.	Name of Equipment
1	Hydraulic unit
2	B-axis and magazine automatic lubrication unit
3	Spindle oil-air lubrication unit
4	Air-filter regulator
5	Air dryer
6	Air lubricator
7	Oil separation unit
8	Grease automatic lubrication unit

Lift-up Chip Conveyor [Option]

We can provide various types of lift-up chip conveyors.

