Machine Specifications

∗: Optional

		A99ε	A100ε
Travels	X, Y, Z axes	1250 × 1100 × 1250 mm	1700 × 1350 × 1400 mm
	Distance from pallet surface to spindle center	100 - 1200 mm	100 - 1450 mm
	Distance from pallet center to spindle gauge line plane	70 - 1320 mm	70 - 1470 mm
Pallet	Pallet working area	800 × 800 mm	1000 × 1000 mm
	Maximum workpiece size (dia. x height)	1450 × 1450 mm	1900 × 1500 mm
	Maximum pallet load (evenly distributed)	2000 Kg (* 3000 Kg)	3000 Kg (* 5000 Kg)
	Pallet surface configuration	24 x M16 tapped holes, 160 mm pitch (* 5 x 22 mm T-slots, 160 mm pitch)	24 x M16 tapped holes, 200 mm pitch (* 5 x 22 mm T-slots, 160 mm pitch)
	Minimum pallet indexing angle	5˚(72- division indexing tadle)	
	Pallet indexing time (90˚/180˚)	3.2 / 4.1 sec.	5.1 / 6.6 sec.
	Height to pallet surface	1400 mm	1500 mm
Spindle	Spindle speed range	20 - 12000 min⁻¹	
	No. of spindle speed ranges	2 steps with electric changeover	
	Spindle taper hole	7/24 No.50 taper (* HSK-A100)	
	Spindle bearing inner/outer diameter	115 /175 mm	
	Spindle drive motor (15 min/cont.)	AC30 / 25 kW	
	Spindle torque characteristic (25% ED/Cont.)	420 / 239 N·m	
	Spindle cooling / lubrication	Spindle core cooling / Under race lubrication	
Feedrates	Rapid traverse	50000 mm/min	
	Cutting feed	1 - 50000 mm/min	
Automatic tool changer	Type of tool shank	50T (JIS B6339) (* HSK-A100)	
	Type of retention knob	50P (JIS B6339) or MAS 403 P50T 1 type	
	Tool storage capacity	40 tools (* 90, 132, 188, 244, 302 tools)	
	Max. tool diameter	Without limitation: 125 mm; With limitation: 300 mm	
	Max. tool length	600 mm (* HSK-A100 : 690 mm)	
	Max. tool weight	20 kg 20 Nm (* 30 kg 30 Nm)	
	Tool changing time (including ATC shutter opening/closing time)	1.7 sec. (tool-to-tool)	
Automatic pallet changer	Number of pallets	2	
	Pallet changing time	23 sec.	35 sec.
Power sources (standard)	Electrical power supply	AC200/220 V±10% 91 kVA 50/60 Hz±2%	AC200/220 V±10% 95 kVA 50/60 Hz±2%
	Compressed air supply	0.5 ～ 0.8 MPa 600 Nl/min	
Machine size (standard)	Machine height	3528 mm	4300 mm
	Floor space	3880 × 8478 mm	4750 × 10005 mm
	Machine weight (including NC unit)	25000 kg	35000 kg
	Leveling method	3-point support	

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*The specifications in this catalog may be changed without prior notice to incorporate improvements resulting from ongoing R&D programs.
*The machines displayed in this catalog are fitted with optional equipment.

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Horizontal Machining Center

A99ε
A100ε

Horizontal machining centers that meet all the market demands for highspeed, superb accuracy and effective chip removal in continuous machining oflarge workpieces.



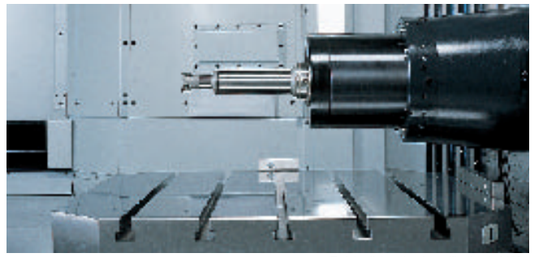
MAKINO

Optimum layout for machining large parts plus powerful cutting capabilities

Pallet working area A99ε ····· 800 × 800 mm
A100ε ····· 1000 × 1000 mm

Maximum pallet load A99ε ····· 2000 kg
A100ε ····· 3000 kg

Axis travels (XYZ) A99ε ····· 1250 × 1100 × 1250 mm
A100ε ····· 1700 × 1350 × 1400 mm



(T-slot pallet: optional specifications) A100ε

Minimum Z-axis distance of 70 mm

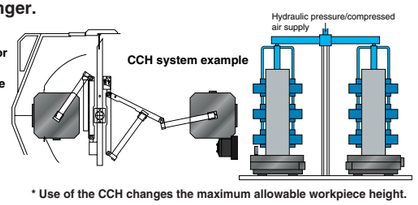
The minimum distance from the table center to the spindle gauge line plane is 70 mm for improved spindle approach to the workpiece. Even places near the center of the table can be machined by using short tool holders.

Maximum workpiece size for pallet changes

A99ε ····· 1450 mm dia. × 1450 mm
A100ε ····· 1900 mm dia. × 1500 mm

Relative to Y-axis travel of 1100 mm on the A99ε and 1350 mm on the A100ε, the pallet changer can accommodate a maximum workpiece height of 1450 mm on the A99ε and 1500 mm on the A100ε. This was done to facilitate the attachment of large jigs and also to secure ample space for the hydraulic pressure and compressed air supply units, including an on-pallet hydraulic pressure supply unit (CCH)
Hoses for supplying hydraulic pressure or compressed air to the pallet can be easily threaded through the hollow shaft of the pallet changer.

Hydraulic pressure or compressed air is easily supplied to the pallet through the hollow shaft of the pallet changer.



* Use of the CCH changes the maximum allowable workpiece height.

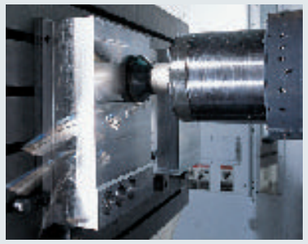
Maximum tool size

Maximum tool diameter	125 mm
with limitation	300 mm
Maximum tool length	600 mm
HSK specification	690 mm
Maximum tool weight	20 kg 20 Nm
optional specification	30 kg 30 Nm



A100ε

Cutting capabilities A100ε



125 mm dia. face mill (Steel: S55C)
Metal removal rates: 712 cm³/min (10 min)



125 mm dia. face mill (Aluminum: A5052)
Metal removal rates: 3400 cm³/min (30 min)



20 mm dia. end mill (Aluminum: A5052)
Metal removal rates: 2100 cm³/min (30 min)

GI control

These two photographs compare the performance of machines with and without GI control for an identical machining program (feedrate of 16 m/min).



With GI control
Excellent shape accuracy and outstanding machined surface quality are obtained even at high speed.



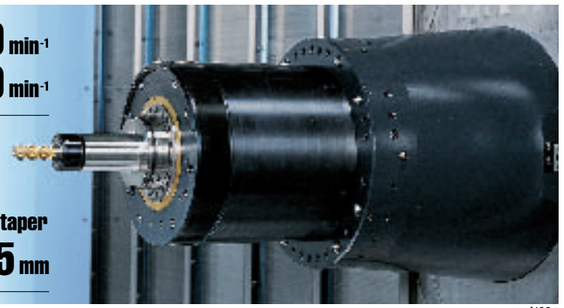
Without GI control
Deterioration of shape accuracy and machined surface quality.

High-speed operation significantly shortens machining times

Top spindle speed ····· (standard specification) 12000 min⁻¹
(optional specification: HSK-A100) 18000 min⁻¹

Spindle taper hole ····· 7/24 No.50 taper

Spindle bearing inner/outer diameter ·· 115 / 175 mm



A100ε

Spindle vibration (actual measured value) ····· 2 μm peak-to-peak / 10000 min⁻¹

The spindle is integrated with the rotor of the drive motor to reduce vibration during high-speed operation and to achieve faster spindle acceleration and deceleration. Minimal spindle vibration during high-speed operation enhances machined surface quality and extends tool life. Moreover, the No. 50 taper spindle accelerates rapidly to its top speed in approximately 6 seconds for a significant reduction of non-cutting time.

Spindle starting/stopping performance

Starting time	4.9 sec	10000 min⁻¹
	1.2 sec	6000 min⁻¹
Stopping time	3.6 sec	10000 min⁻¹
	1.8 sec	6000 min⁻¹

Feedrate ····· Rapid traverse (X / Y / Z) 50 m/min
(standard specification machine)

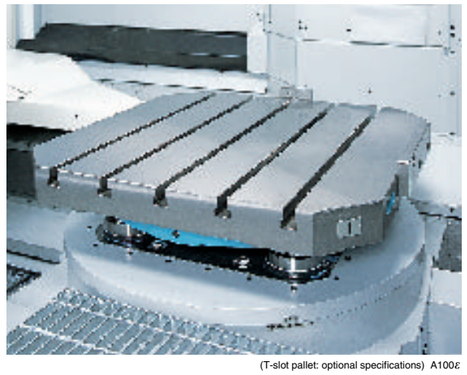


Ball screw cooling system

High-speed movement of the ball screws during long hours of operation generates heat that can affect accuracy and machining performance. To suppress heat generation, cooling oil controlled to the bed temperature is circulated through the hollow ball screws used in all the axes.
In addition, cooling oil is also circulated to the inside of the feed servomotors bracket so as to isolate the heat generated by the motors.

Table

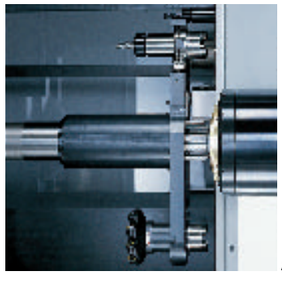
	minimum indexing angle	A99ε Indexing time (90° / 180°)	A100ε Indexing time (90° / 180°)
72-division indexing table (standard specification)	5°	3.2 / 4.1 sec.	5.1 / 6.6 sec.
360-division indexing table (optional specification)	1°	3.2 / 4.1 sec.	5.1 / 6.6 sec.
NC rotary table (optional specification)	0.0001°	2.1 / 3.0 sec.	2.5 / 4.0 sec.



(T-slot pallet: optional specifications) A100ε

Automatic tool changer (ATC)

	A99ε	A100ε
Tool-to-tool	1.7 sec.	1.7 sec.
Chip-to-chip	5.4 sec.	5.9 sec.



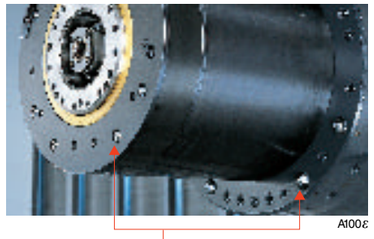
A99ε

Machining chamber free of chip buildup and wide center chip trough

16-nozzle coolant supply device

A total of sixteen coolant discharge nozzles are provided in the spindle end face and body. Coolant discharges from the spindle end face are designed for end mills and drilling, and those from the spindle body are for face mills and other large diameter tools. Buildup of chips on top of the spindle head is also prevented.





A100ε

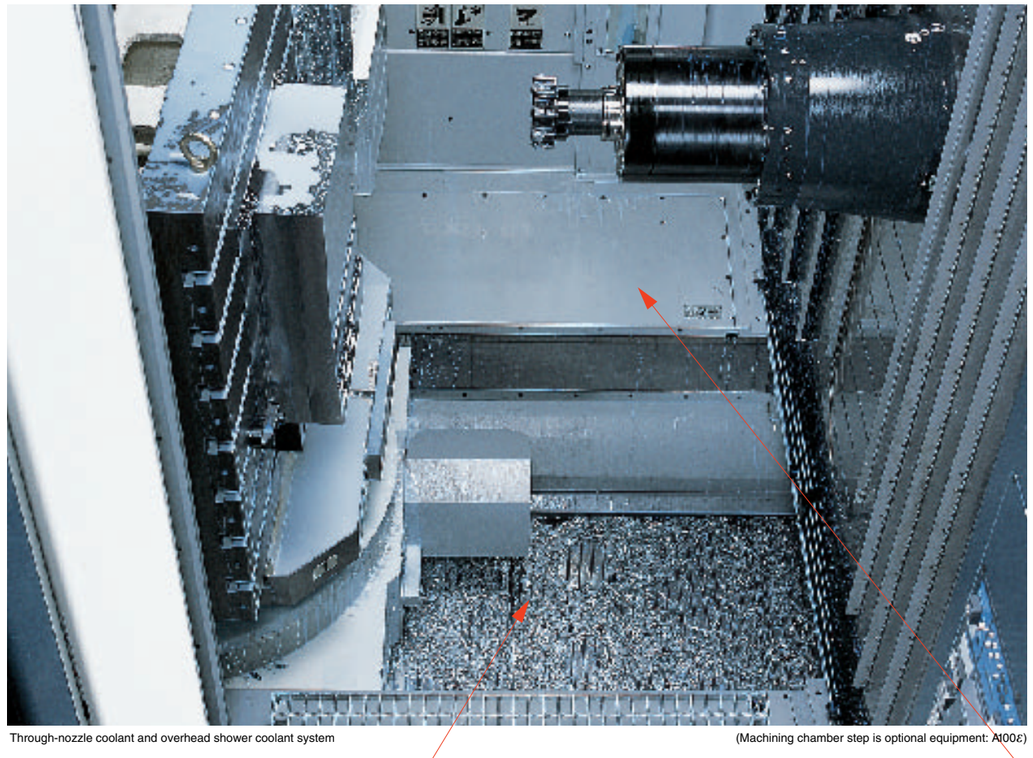
Ball nozzles are used to prevent chip buildup at the coolant discharge ports.



A100ε

Overhead shower coolant system and table washing coolant system (optional specifications)

With the overhead shower coolant system, nozzles provided in the splash guard ceiling discharge coolant to prevent buildup of chips scattered inside the splash guard (A99ε: 50 nozzles; A100ε: 32 nozzles). A table washing coolant system is also optionally available for flushing out chips lodged between the pallet and the table.



Through-nozzle coolant and overhead shower coolant system

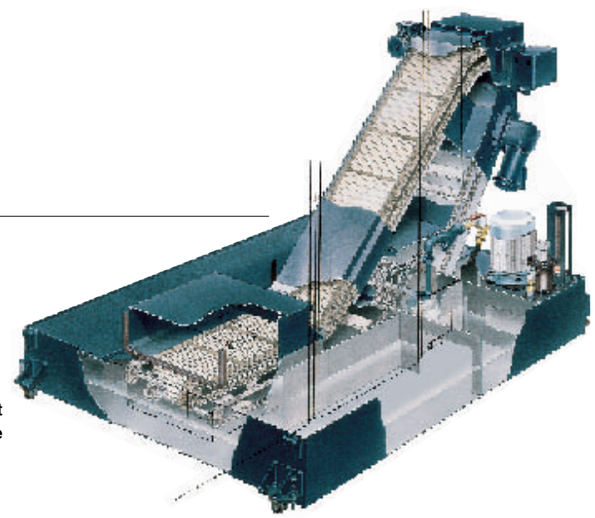
(Machining chamber step is optional equipment: A100ε)

Center chip trough

High-speed machining with a high rate of productivity generates incredibly large volumes of chips. A wide center chip trough (patent pending) is positioned directly under the table for efficient and reliable chip removal.
All chips and coolant are completely evacuated outside the machine by a hinged conveyor (A99ε: 600 mm, A100ε: 650 mm) inside the trough. The wide design of the trough also lessens the force of the coolant so as to reduce foaming in the coolant tank.

Two-level lift-up chip conveyor with built-in filtration system (optional specifications)

The conveyor inside the machine evacuates chips and coolant into the lift-up conveyor in the coolant tank. Large chips are transported by a hinged conveyor positioned at the upper level. Fine chips that fall through this conveyor are entirely swept out by a scraper conveyor located at the lower level and evacuated into the chip bucket.
The coolant is filtered by a rotary drum filtration unit built into the lift-up chip conveyor and flows through the inside of the drum into the clean tank.



Inclined panels of machining chamber

The machining chamber is constructed almost entirely of slanted or vertical panels to prevent chip buildup. Eliminating places for chips to collect improves reliability in continuous machining.

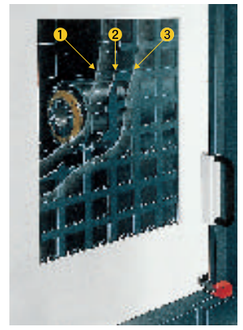
Accessibility and visibility



(optional equipment: A100ε)

Because the spindle moves to the operator's side, it is easy to check for tool wear, attach measuring instruments or perform other tasks.Machining Chanber Step (Optional equipment) is provided inside the machining chanber of the A100E, so that the operator can easilly check the machining condition of the large workpieces. This enables the operator to work safely without worrying about the slipping even after coolant is discharged.

A machine with excellent accessibility might be potentially dangerous, considering the possibility of flying tool chips during machining. To ensure operator safety, the splash guard window is made of tempered glass on the inside to prevent chip scratches and tough polycarbonate on the outside to



1 Tempered glass
2 Metal grid
3 Polycarbonate

Improved ease of regular maintenance



A100ε

The hydraulic pressure and compressed air supply units and other equipment requiring daily checking are located on the operator's side for easier maintenance.



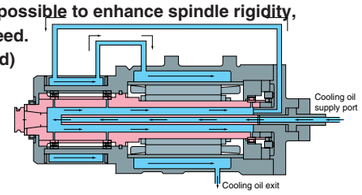
Regular maintenance guide

Items to be checked during regular maintenance are automatically shown on the screen on the inspection day, after operating the machine for one week, one month, six months, one year and two years.

Improved reliability in high-speed continuous machining

Spindle cooling and lubrication system

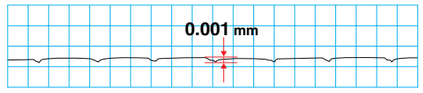
Both machines feature Makino's unique spindle core cooling system that circulates temperature-controlled cooling oil through the center of the rotating spindle to cool it directly from the inside. (Spindle core cooling system)
Moreover, with under race lubrication, cooling oil circulated through the spindle flows through holes in the inner bearing races to lubricate the bearings.
(Under race lubrication system)
The adoption of this patented cooling and lubrication system makes it possible to enhance spindle rigidity, accuracy and speed.
(Patents approved)



Spindle lubricant temperature controller

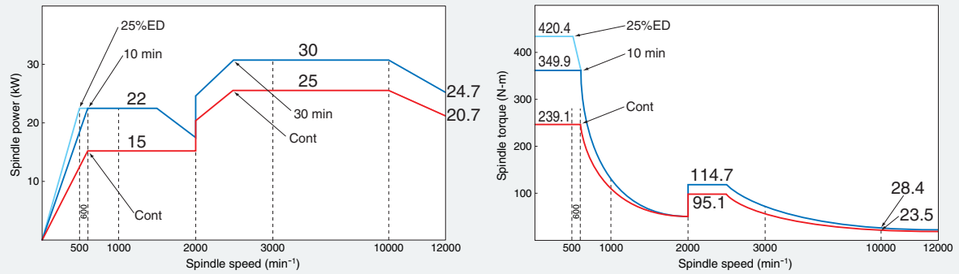
The controller houses two tanks, one for warm coolant adjusted to the machine temperature and the other for cool lubricant. Return lubricant from the spindle is mixed with both warm and cool lubricant to adjust its temperature to that of the machine before it is supplied to the spindle.
This contributes to stable machining accuracy by enabling the lubrication system to quickly follow sudden changes in spindle speed such as rapid acceleration from low to high speed.
(Patents approved)

Spindle thermal distortion ripple measured during operation at 10000 min^{-1}



(Actual measured value)

A99ε·A100ε Performance Characteristics of Standard Spindle



Static accuracy

Positioning accuracy	(without scale feedback) ±0.0030 mm (with scale feedback) ±0.0020 mm
Repeatability	(without scale feedback) ±0.0015 mm (with scale feedback) ±0.0010 mm
Pallet indexing accuracy	(NC index) ±2.0 sec (optional specification: NC rotary) ±3.0 sec
Pallet indexing repeatability	(NC index) ±1.0 sec (optional specification: NC rotary) ±2.0 sec
Pallet changing repeatability	±0.0050 mm
Squareness	0.008 mm / 500 mm

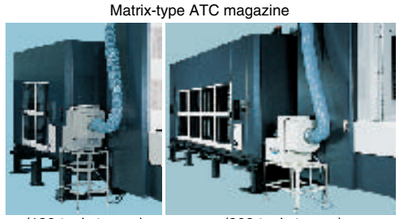


A100ε

Matrix-type ATC magazine

ATC magazines

Machine width for different ATC magazines	A99ε	A100ε
40-tools ATC	3871 mm	4750 mm
90, 132, 188, 244-tools ATC	4537 mm	5365 mm
302-tools ATC	4537 mm	5365 mm



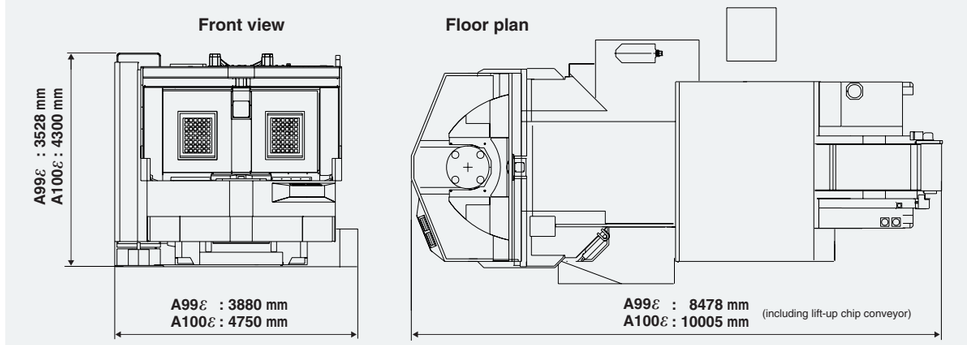
(132-tool storage) (302-tool storage)

A99ε



A100ε





Standard Specifications

- 20 - 12000 min^{-1} spindle
- Automatic spindle lubricant temperature controller
- Pallets with tapped holes
- 40-tool ATC
- Pallet changer (including pallets)
- Splash guard
- Coolant supply device
- Splash guard lighting device (1 fluorescent bulb)
- Signal light (1 yellow lamp)
- Sludge filter
- ATC door interlock
- Splash guard door interlock
- NC controller door interlock
- Portable manual pulse generator
- I/O interface and 100 V power outlet
- Rigid tap
- GI control
- Tool life monitoring function
- Automatic power shutoff
- Standard machine colors

Optional Specifications ● & Equipment ●

- 18000 min^{-1} spindle
- HSK-A100 shank
- ATC magazines (90, 132, 188, 244, 302-tool magazine)
- Tool loading station
- Moire scale feedback (0.1μm)
- T-slot type pallet specification
- 0.0001° NC rotary table
- 360-division indexing table
- 6-pallet magazine (with 6 WSS)
- Air blower
- Through-spindle coolant and air (1.5MPa, 3MPa, 7MPa)
- Overhead shower coolant system
  A99ε: 50 nozzles*
  (*47nozzles with Automatic workpiece measuring system)
  A100ε: 32 nozzles
- Table washing coolant system
- Angle plate coolant system
- Workpiece washing gun
- Terrace conver washing coolant system
- Coolant temperature controller (Required with 7 MPa through-spindle coolant)
- Mist collector
- Lift-up chip conveyor (rear unloading) (A99ε)
- Lift-up chip conveyor (right unloading) (A100ε)
- Angle plates (T-slot: 1, 2, 4-face angle plate)
- Rotary wiper for splash guard window
- Splash guard and ATC door lock
- Machining chamber step (A100ε)
- Portable manual pulse generator with position indicator
- Run hour meter (power ON, spindle ON, NC automatic ON)
- Signal light (2 or 3 lamps)
- Broken tool sensor (ATC side)
- Automatic workpiece measuring device
- Automatic tool length measuring device (retractable type)
- Cleaning tool for through-spindle coolant system
- Air dryer
- GI.3 control /Super GI.3 control
- Special customer-specified machine colors