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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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3 μm 300 × 300 mm
30h (3°C)

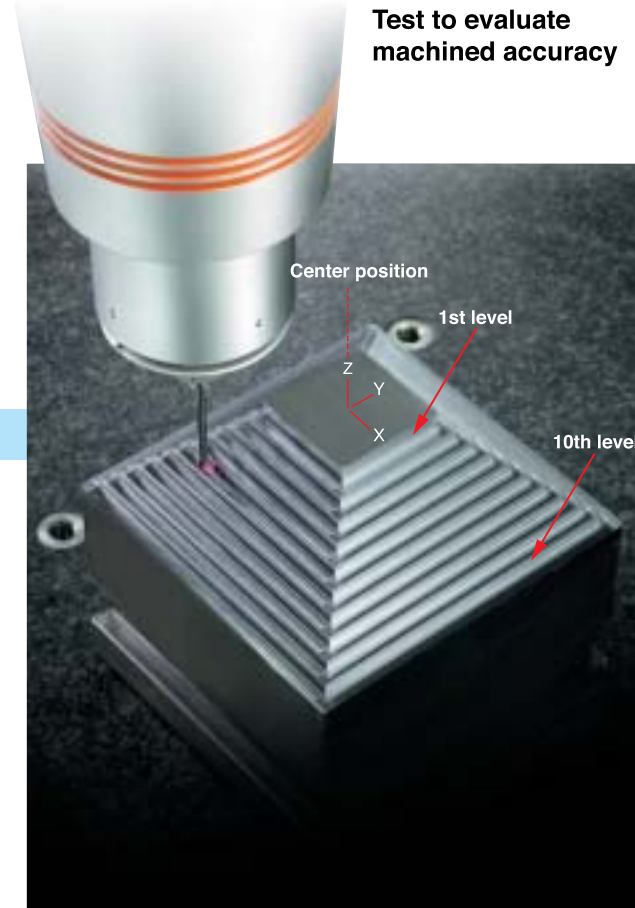
A high precise machine tool should "move accurately according to the command and input value".

However, temperature variation in shop floor and heat generated by machine itself affects the machine attitude.

The V56i is improved to achieve the machine accuracies during long machining hours by eliminating internal and external effects.

Maximum center position error → 1.9 μm
(After 24 hours of continuous machining)

Test to evaluate machined accuracy

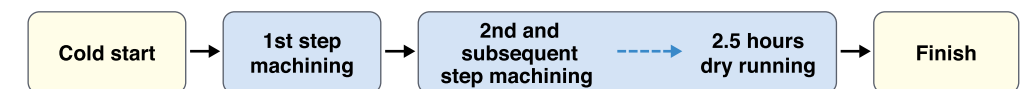


In this test cut on V56i, a 10 steps pyramid is machined, and machine evaluation is been done on positional accuracy to check the machine behavior.
By the V56i, 10 steps pyramid was machined, every step face after 2.5 hours dry running after the 1st step face.

©Measured results

Number of step	Total time (hours)	Center positioning error (μm)	
		X-axis	Y-axis
1st (base line)	0.15	0	0
2nd	2.80	-0.3	-0.9
3rd	5.45	-0.7	-1.3
4th	8.10	-1.2	-1.1
5th	10.75	-1.1	-1.7
6th	13.40	-1.9	-1.6
7th	16.05	-0.9	-1.6
8th	18.70	-0.6	-1.2
9th	21.35	-1.0	-0.4
10th	24.00	-0.8	-0.7

(Measuring machine Carl ZEISS UPMC-85)

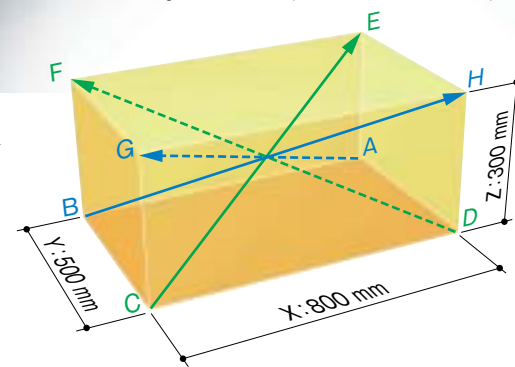
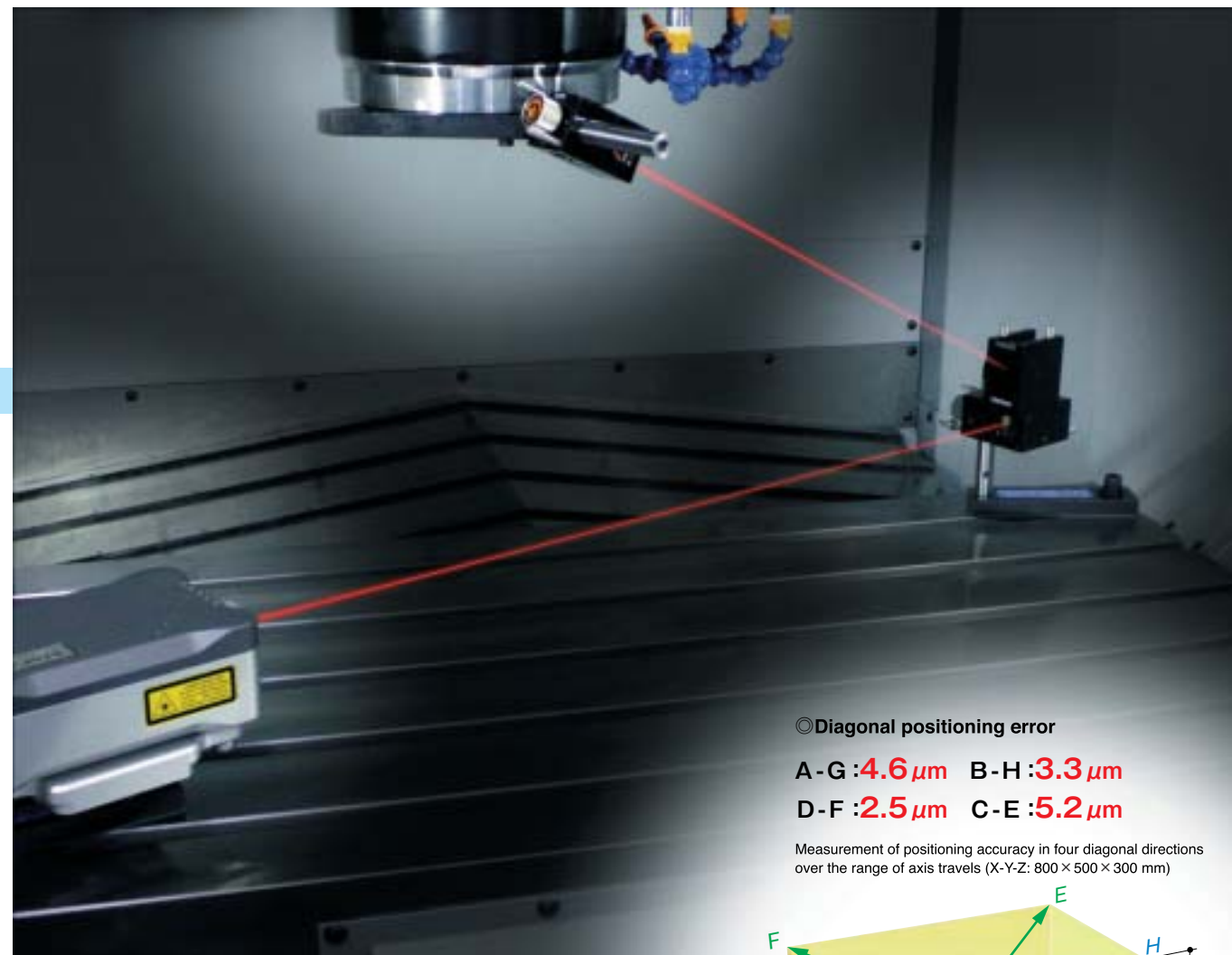


Materials : S55C
Workpiece size : 150 × 150 × 100 mm
Machine temperature during machining: Start: 20.7°C → Finish: 21.7°C

● Machining condition
Tool used : 10 mm diameter endmill (4 teeth)
Spindle speed range : 3500 min^{-1}
Cutting feed : 700 mm/min

● Dry running condition
2.5 hours of continuous operation / Simultaneous 3-axis travel (X-Y-Z : 900 × 550 × 200 mm)
Spindle speed range : 3500 min^{-1}
Feed rate : 4000 mm/min

Volumetric performance (diagonal positioning) maximum error: 5.2 μm



Positioning accuracy was measured in four diagonal directions by reciprocal machine motions over the range of axis travels according to the ISO 230-6 standard.

This measurement reflects the error in positioning accuracy, straightness and squareness in all the axes. Diagonal positioning accuracy showed maximum error of 5.2 μm . The results confirmed that the V56i delivers stable high accuracy over the entire machining range.

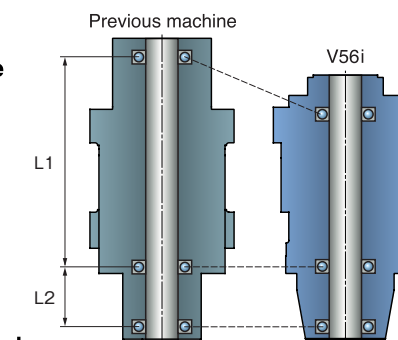
Pursuit of polishing-free machining of dies/molds



Quiet operation indicative of an ideal bearing layout

The new 30000 min⁻¹ spindle is substantially shortened to reduce the L1 distance by 25% compared with previous spindles. This markedly reduces spindle vibration for enhanced machined surface quality and longer tool life.

The overall spindle weight is also lightened by 30% to reduce lost motion in the X/Z axes of spindle travel.



GI.4 control

GI.4 control moves the tool smoothly and accurately along the commanded path. This control feature works in concert with high-responsive servos and high machine rigidity to provide high-accuracy machining with any variation in accuracy even at high speeds.

Super GI.4 control

Super GI.4 control increases the capacity for processing tiny blocks of NC data in 3-D machining. This control delivers exacting, error-free shape accuracy and uniform machined surface quality even at high cutting feeds. This shortens machining times in high-definition milling by 15% on average*.

*compared with Super GI.3 control.

Trust in machine accuracy
"Operating ease" leads the reliability of machine



"An easy-to-use machining center", brings out the operator's maximum ability

The V56i enables the operator to set up accurately, including alignment setting, centering and measuring tool. This facilitates precise machining within several microns. It eliminates the need for enough running-in operation, re-centering of the workpiece and program considered machine displacement, prior to the finish machining process. Furthermore, deterioration of machining accuracy due to tool wear or tool deformation can also be avoided by automatic measuring.



Hybrid automatic tool length measuring device

In continuous finish machining jobs using an ATC, tiny level differences can occur at the seams of machined surfaces due to tool changes. Polishing workpieces to correct such tiny differences is time-consuming. The hybrid automatic tool length measuring device measures the position of the tool tip with a low-pressure contact probe, and a non-contact sensor measures the position of the spindle nose that is revolving at the speed of the machining operation. This measuring device automatically detects and positions the tool tip with high accuracy for improved surface finishes.





◎Main machine specifications

Travels (X × Y × Z-axis).....900 × 550 × 450 mm

Table working area (W × D).....1050 × 550 mm

Maximum workpiecesize (W × D × H)....1050 × 720 × 450 mm (with limitation)

Maximum table load.....800 kg

Spindle speed range.....50 ~ 20000 min⁻¹

Rapid traverse.....20000 mm/min

◎Static accuracy (guaranteed value)

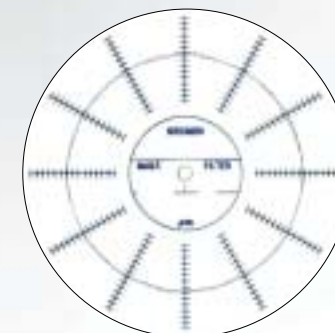
Positioning accuracy **±1.5 μm** (full travel)

Repeatability **±1.0 μm** (full travel)

Squareness **4.0 μm / 500 mm**

Straightness **4.0 μm / 500 mm**

Tolerance at Makino's assembly plant (daily temperature change of ±1℃)



Roundness (actual value) : **1.8 μm**
F2000 mm/min



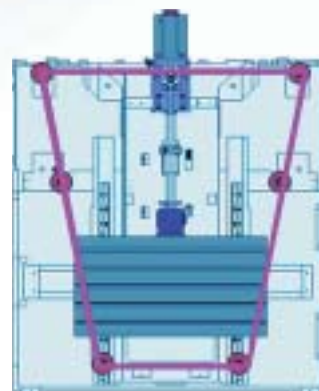
Machine rigidity and guideway system supporting stable accuracy

Y-axis

The range of table movement is kept within the leveling system that supports the machine. This ensures that machining accuracy is not affected by machine attitude changes induced by movement of the table when loaded with the maximum workpiece weight.

Large loads are imposed on the table guideway during horizontal movement of the loaded table. The bed and table that support such loads have high rigidity, to prevent influence on machined surface that caused by the amplification of cutting vibrations.

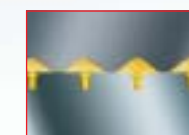
This high rigidity made it possible to adopt rolling guideways with a low friction coefficient that is little affected by changes in the workpiece weight. The V56i provides precise axis feed motion even when the table is fully loaded with the maximum workpiece weight.



X / Z-axes

The X-axis guideway that provides the spindle's horizontal motion supports unbalanced loads. In the Z-axis that provides the spindle's vertical movement, the ball screws support the vertical load, and the guideway resists load shifts due to the weight distribution. Both guideways must have sufficient rigidity. Moreover, cutting vibrations induced by the spindle must be damped swiftly to ensure high-quality machined surfaces. The X / Y-axes on the V56i feature sliding guideways that have the characteristics needed to meet these requirements.

The guideways are amply long and wide to ensure excellent straightness over the full range of axis travel. The X-axis adopts Makino's "nano-sliding system" to reduce the friction force produced by the sliding guideway under the heavy loads put on this axis. This system supplies lubricant at the optimal pressure to reduce the friction coefficient, enabling the V56i to provide high feedrates and swift acceleration.



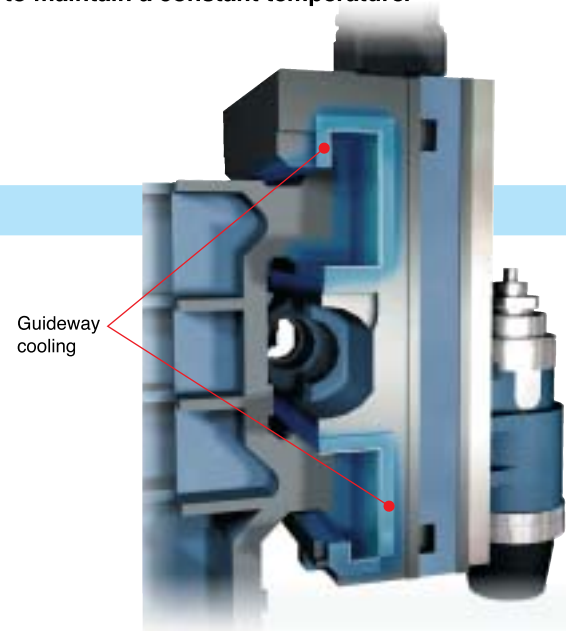


: Intelligent machine construction

The V56i controls its own heat generation.

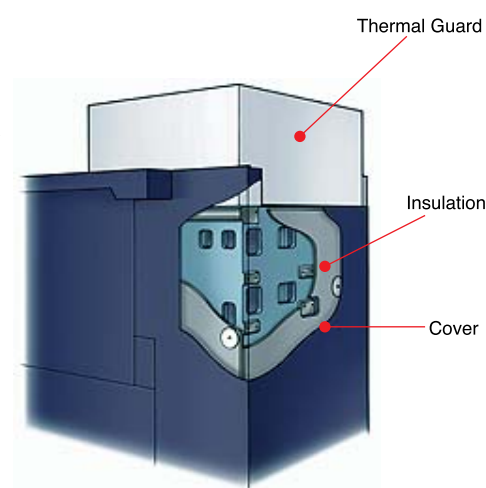
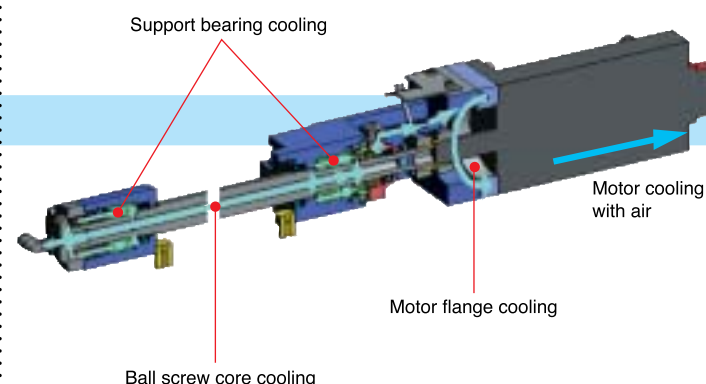
Cooling of sliding surfaces of X / Z-axes

The areas around the sliding guideways are cooled to remove heat quickly even during long hours of high-speed operation. Cooling oil controlled to the machine temperature is circulated through the saddle to maintain a constant temperature.



Thermal stability measures for feed axis ball screws

The feed motors, ball screws and support bearings are all cooled to prevent heat generation even during high-speed movement. Cooling oil controlled to the machine temperature is circulated through each part to remove heat quickly. This maintains the rigidity of the drive system to ensure high machining accuracy and fast feed performance.



Measures against effect of ambient temperature

V56i shuts out ambient air that constantly change temperature by covers and insulation.

Moreover, Thermal Guard (standard) covers the entire machine to suppresses machine attitude changes.

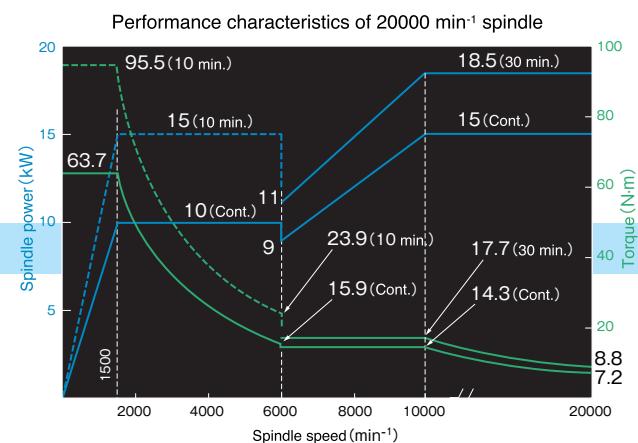
Also available for obtaining more stable machining accuracy is Makino's Column Stabilizer (optional specification). This feature fills the column with a special fluid that is circulated internally to dull the reaction to ambient temperature changes.



Delivers stable high accuracy during long hours of machining at top speed

Standard spindle for wide range of machining 20000min⁻¹ Spindle

Taper hole	7/24 taper No.40 HSK-A63 (optional specification)
Spindle speed range	50 ~ 20000 min ⁻¹
Spindle bearing inner diameter	80 mm
Output characteristics	15 kW (Cont.)
Torque characteristics	63.7 N·m (Cont.)



Machining examples Die-casting mold (exhaust manifolds)

High-efficiency machining of workpieces with deep cavities

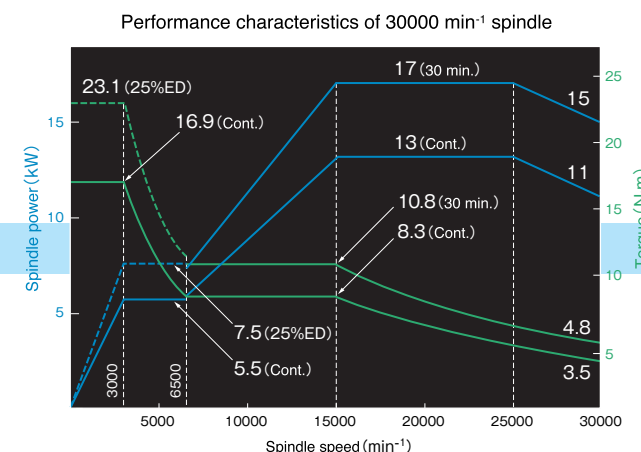


Materials : SKD61 (48HRC)
Workpiece size : 200 × 200 × 150 mm
Tool mainly used : 32 mm diameter radius endmill
R3 ~ R6 ball endmill

Total machining time : 10hrs. 47min.

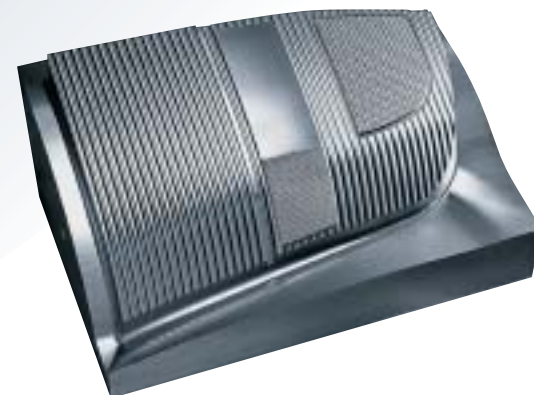
For machining that use many small-diameter tools 30000min⁻¹ Spindle (optional specification)

Taper hole	HSK-F63 HSK-E50 (Please select either one.)
Spindle speed range	300 ~ 30000 min ⁻¹
Spindle bearing inner diameter	55 mm
Output characteristics	13 kW (Cont.)
Torque characteristics	16.9 N·m (Cont.)



Machining examples Plastic mold (taillights)

Reduction of hand polishing work with blending less high-quality machining

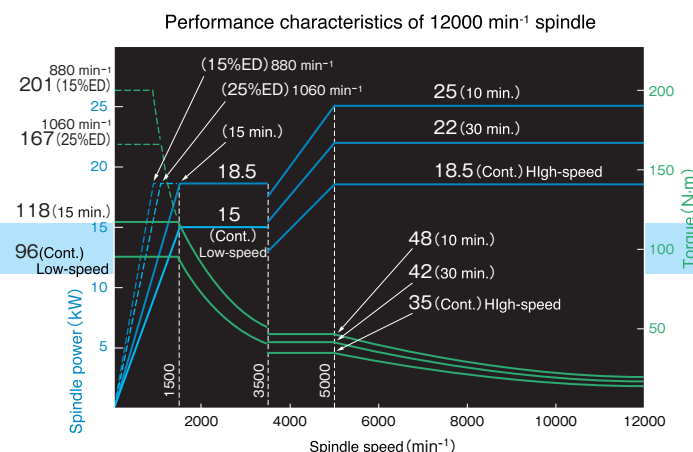


Materials : NAK80 (40HRC)
Workpiece size : 360 × 230 × 180 mm
Tool mainly used : R0.3 ~ R5 ball endmill

Total machining time : 44hrs. 12min.

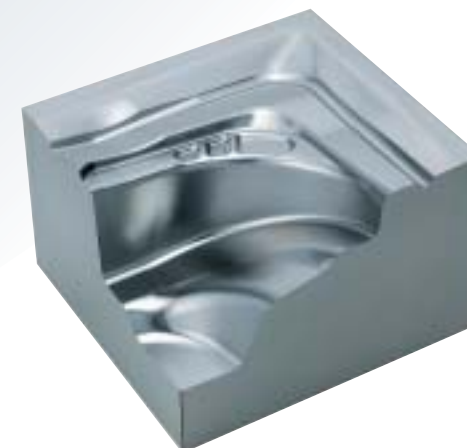
For machining that use large-diameter tools 12000min⁻¹ Spindle (optional specification)

Taper hole	7/24 taper No.40 (optional specification) HSK-A63 / BIG PLUS (BBT40) (optional specification)
Spindle speed range	50 ~ 12000 min ⁻¹
Spindle bearing inner diameter	85 mm
Output characteristics	18.5 kW (Cont.)
Torque characteristics	96 N·m (Cont.)



Machining examples Stamping die

High-efficiency machining using radius endmill

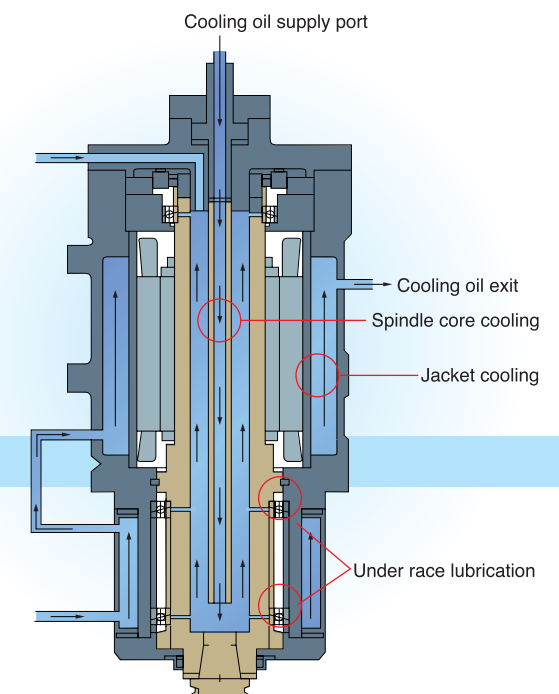


Materials : SKD11 (60HRC)
Workpiece size : 230 × 215 × 160 mm
Tool mainly used : 32 mm diameter radius endmill, R2 ~ R6 ball endmill

Total machining time : 11hrs. 25min.

Continually evolving spindle Spindle core cooling / Under race lubrication

This unique Makino technology maintains high support rigidity by minimizing thermal distortion during long hours of continuous machining at top speed. Additionally, heat generation by the spindle when changing operating speeds is predicted and a highly responsive control is applied to suppress spindle thermal growth.



Substantially improved reliability in continuous machining



Automatic tool changer

Tool storage capacity	15	25*	40*	60*
Maximum tool diameter (mm) / without limitation	80	←	63	←
/ with limitation	-	-	80	←
/ when HSK-E50*	50	←	←	←
Maximum tool length (mm)	300	←	←	←
when HSK-E50*	260	←	←	←
Maximum tool weight (kg)	8	←	←	←

* optional specification



15 tools magazine specifications



25 tools magazine specifications



Coolant and air systems

The V56i is fitted with a 3-nozzle coolant supply device and a double-nozzle air blower. A through-spindle air (standard) is also a standard feature and a through-spindle coolant with a discharge pressure of 1.5 MPa is available as an optional specification. Both systems are effective in removing chips reliably from the machining point in hole drilling and high-speed machining.



Through-spindle coolant

Designed for space and energy savings

Units requiring maintenance, such as the hydraulic and compressed air supply units and slideways lubrication supply unit, are all concentrated on the right side of the machine to minimize the area needed for maintenance work. The V56i has also been designed for energy savings. Power supply to the hydraulic unit, coolant pump, lubricant supply device and other units is turned off when the equipment is not in use.

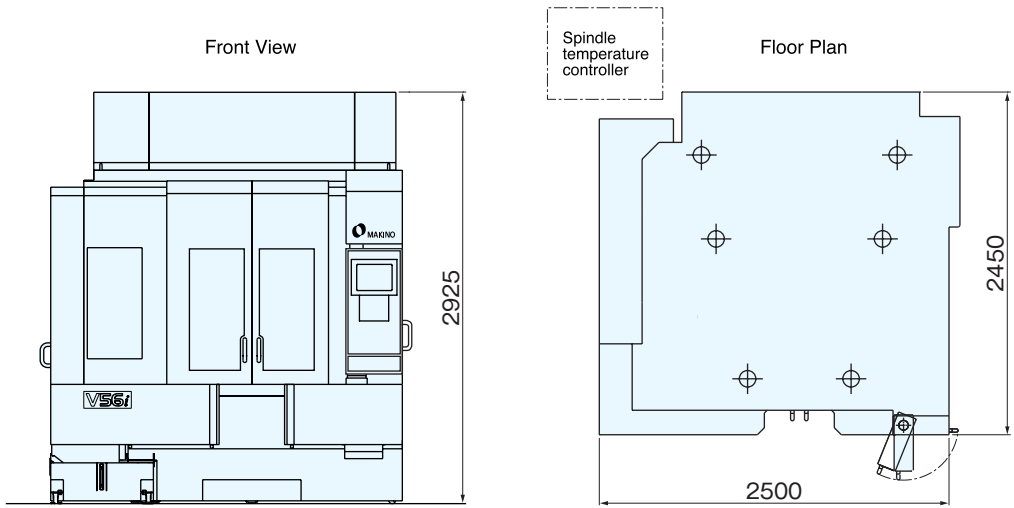


Chip removal

Chips are flushed together with the coolant through six outlets provided below the table and are evacuated from the left side of the machine by two built-in, high-speed, hinged conveyors.

Machine specifications

Travels	X × Y × Z-axis	900 × 550 × 450 mm
	Distance from table top to spindle end	150 ~ 600 mm
Table	Working area	1050 × 550 mm
	Maximum workpiecesize (W × D × H)	1050 × 720 × 450 mm (with limitation)
	Maximum table load (evenly distributed)	800 kg
	Surface configuration	18H8 × 5, T-slot
	Speed range	50 ~ 20000 min ⁻¹
Spindle	Drive motor (30 min / cont.)	18.5 / 15 kW
	Torque (10 min / cont.)	95.5 / 63.7 N·m
	Taper hole	7/24 taper No.40
	Cooling / lubrication	Core, Jacket / Under race
	Surface configuration	18H8 × 5, T-slot
Feedrates	Rapid traverse	20000 mm/min
	Cutting feed	1 ~ 20000 mm/min
Automatic tool changer	Tool storage capacity	15 tools
	Maximum tool diameter	80 mm
	Maximum tool length	300 mm
	Maximum tool weight	8 kg
Machine size	Height	2925 mm
	Width × Depth (excluding Spindle temperature controller)	2500 × 2450 mm
	Mass (including NC unit)	10400 kg



Standard specifications

- 20,000 min⁻¹ spindle (Core cooling) (BT40)
- 15 tools magazine
- Spindle temperature controller
- Scale feedback (0.05 μm)
- Fully enclosed splash guard
- Splash guard lightning device
- Operator door lock (Operation Mode)
- ATC door interlock
- 2 scraper conveyors in splash guard
- Nozzle coolant supply device (21L/min, 3-coolant nozzle)
- Automatic air blower
- Automatic grease supply unit
- Through-spindle air
- Thermal Guard
- Portable manual pulse generator with the handle enable button
- Rigid tap
- G1.4 control
- Linear interpolation type positioning
- Data center
- NC Professional 5
- Spindle-table crash avoidance function
- Standard tool length function
- ECO mode functions
- Automatic fire extinguisher interface

Optional Specifications (●) / Equipment (★)

- 12,000 min⁻¹ spindle (Core cooling) (available for BT40, BIG•PLUS, HSK-A63)
- 30,000 min⁻¹ spindle (Core cooling) (available for HSK-F63, HSK-E50)
- ★ Built-in hale function (including Additional one(1) axis and Helical interpolation)
- HSK-A63 (available for 12,000 and 20,000 min⁻¹ spindle)
- HSK-F63 (only for 30,000 min⁻¹ spindle)
- HSK-E50 (only for 30,000 min⁻¹ spindle)
- BIG•PLUS (BBT40) (only for 12,000 min⁻¹ spindle)
- High column 350mm
- 25 / 40 / 60 tools magazine
- ★ T code eight digits
- ★ ATC door lock
- Pallet changer (including High column specification)
- Pallet random calling function
- Robot shutter
- Through spindle coolant (1.5MPa) (available for 20,000 min⁻¹ + HSK spindle, 12,000 min⁻¹ + HSK spindle, 12,000 min⁻¹ + JIS retention knob spindle) (including L/F filter)
- ★ Nozzle coolant supply device (50L/min, 6-coolant nozzle)
- ★ Workpiece washing gun (operator side)
- ★ Telescopic washing coolant
- ★ Washing coolant (including telescopic washing coolant)
- ★ Coolant temperature controller (with heater) (required for oil type coolant and high precision machining)
- ★ Oil skimmer
- ★ MQL (Mist blow) (KURODA SEIKO, Model: KEP3)
- ★ MQL (through spindle type) (KURODA SEIKO, Model: KEP3)
- ★ Tiltable chip bucket (143L, for Lift-up chip conveyor)
- ★ Chip bucket (Tilt Truck, for Lift-up chip conveyor)
- ★ Front unloading lift-up chip conveyor with coolant filtration (Scraper type, with coolant filter unit)
- ★ Rear unloading lift-up chip conveyor with coolant filtration (Scraper type, with coolant filter unit)
- ★ Operator door lock & ATC door lock (with power shut off)
- ★ Additional Lighting device inside of Splashguard (1 fluorescent lights)
- ★ Mist collector (including Joint mount)
- ★ Joint mount for Mist collector (125 mm diameter)
- ★ Air dryer
- ★ Automatic tool length measuring device (including Broken tool sensor)
- ★ Automatic tool length measuring device (low pressure contact) (including Broken tool sensor)
- ★ Automatic Non-contact tool measuring device (including Broken tool sensor)
- ★ Hybrid automatic tool length measuring device (for HSK-E50)
- ★ Automatic workpiece measuring device (MARPOSS)
- ★ Measuring data print-out function
- ★ Rak rak touch P
- Rak rak touch P & Handy checker 40
- ★ Rak rak touch L
- ★ Portable manual pulse generator with tool position display and the handle enable button
- ★ Run hour meter (power ON, NC automatic ON, spindle ON, with reset function)
- ★ Warm-up timer (with automatic running function)
- ★ Lighting device inside of electric enclosure and 100V outlet
- ★ Signal light 3-layer
- ★ Leakage breaker
- ★ Column Stabilizer
- Customer specified machine color
- ★ Super G1.4 Control

*The machine's specification can comply with CE regulation. Please contact your Makino sales representative for details.