

a5Inx | a6Inx

Horizontal Machining Center



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

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*The all products in this catalogue include the optional specifications and equipment.
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M471Eg 2304 (V-T)



Multi-purpose machining center for parts, and dies and molds

(Mass production, small and medium batch production, prototypes, automobile, aerospace, etc.)



Machining time : 10.4 min

Material : Aluminum (A6061)
Size : 200 × 130 × 135 mm
Machine : a51nx
Spindle : 14000 min⁻¹ (303 N·m)



Machining time : 87.5 min

Material : Titanium alloy (Ti-6Al-4V)
Size : 207 × 152 × 90 mm
Machine : a61nx
Spindle : 14000 min⁻¹ (303 N·m)



14000 min⁻¹, 303 N·m

High torque spindle is provided as standard equipment



80 mm diameter drill

Material : Grey cast iron (FC250)
Spindle speed : 585 min⁻¹
Feedrate : 150 mm/min
Spindle : 14000 min⁻¹ (303 N·m)

14000 min⁻¹ spindle (303 N·m)

Speed : 50 - 14000 min⁻¹
Torque : 303 / 119 N·m (10%ED / Cont.)
Acceleration time : 1.4 sec (14000 min⁻¹)

20000 min⁻¹ spindle (optional specification) (HSK-A63)

Speed : 50 - 20000 min⁻¹



Metal removal rate : 5049 cm³/min

Material : Aluminum (A5052)

80 mm diameter face mill (7 inserts with carbide chips)

Axial depth of cutting : 9.2 mm
Radial depth of cutting : 56 mm

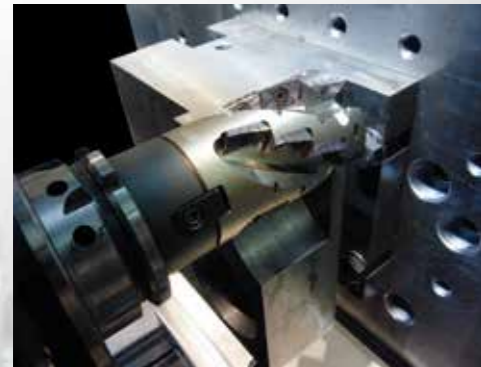
Spindle speed : 4000 min⁻¹

Feed rate : 9800 mm/min
Spindle : 14000 min⁻¹ (303 N·m)



125 mm diameter face mill (7 inserts with carbide chips)

Material : Gray Cast iron (FC250)
 Cutter material : cBN Carbide
 Metal removal rate : 1400 cm³/min : 632 cm³/min
 Axial depth of cutting : 2 mm : 10 mm
 Radial depth of cutting : 87.5 mm : 90 mm
 Spindle speed : 4000 min⁻¹ : 585 min⁻¹
 Feed rate : 8000 mm/mi : 702 mm/min
 (14000 min⁻¹ spindle)



50 mm diameter end mill

Material : Gray Cast iron (FC250)
 Metal removal rate : 550 cm³/min
 Axial depth of cutting : 50 mm
 Radial depth of cutting : 30 mm
 Spindle speed : 764 min⁻¹
 Feed rate : 367 mm/min
 (14000 min⁻¹ spindle)



25 mm diameter end mill

Material : Aluminum (A5052)
 Metal removal rate : 3600 cm³/min
 Axial depth of cutting : 20 mm
 Radial depth of cutting : 20 mm
 Spindle speed : 10000 min⁻¹
 Feed rate : 9000 mm/min
 (14000 min⁻¹ spindle)

Professional 6

Control unit that maximizes machine performance

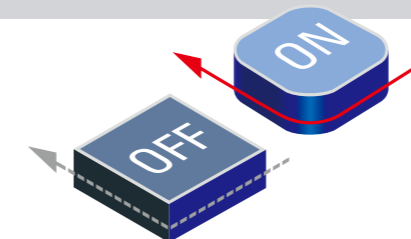
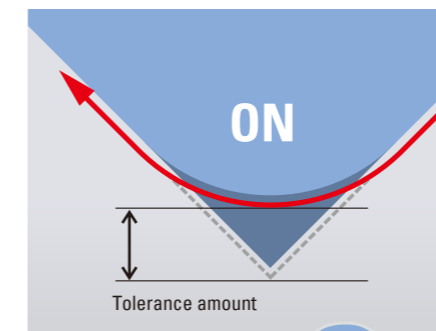
Professional 6 optimizes machine motion, according to machining conditions. Even in machining with high-speed and high-acceleration, machining surface quality and shape accuracy can be kept. Machining efficiency is totally enhanced. A variety of machining modes are preset. Operator can easily choose suitable one for its purpose.



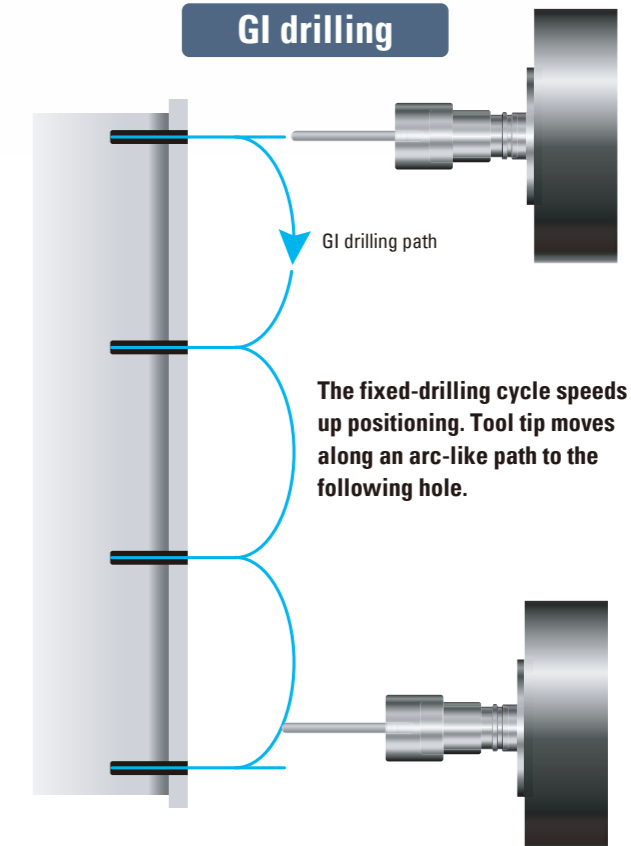
Advanced control technology (for reducing non-cutting time)

GI milling

Tolerance amount at the corner section of the tool path can be defined. Accordingly, the corner section movement can be made smoothly by reducing deceleration range of federate.



GI drilling



Non-cutting time reduced, productivity enhanced

High-acceleration feed mechanism and fast-indexing rotary table

Rapid traverse — **60 m/min**
Cutting feed — **1- 50 m/min**

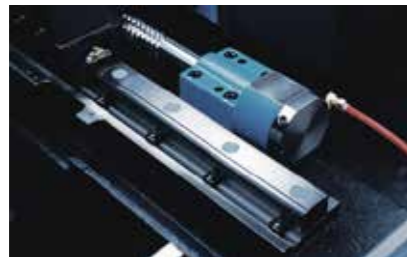


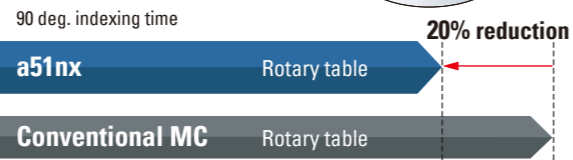
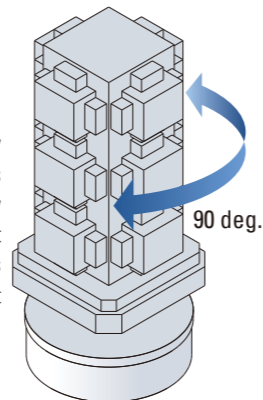
Photo: Rotary table (DD motor)

Rotary table (DD motor) (Standard specification)

Indexing speed is optimized according to detected Workpiece weight.
(Patent pending)

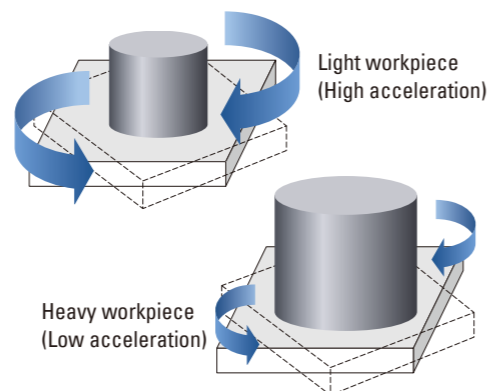
Minimum index angle — **0.0001 deg.**
Index time (90 deg.) — **1.00 sec** (a51nx)
0.98 sec (a61nx)
Maximum speed — **125 min⁻¹**

With the adoption of a NC rotary table in a DD motor drive, 90 degrees indexing time is reduced by 20%. By cooling the bearing and the jacket part of motor, heat generation is suppressed, and its posture is kept stable.



Inertia Active Control (patented)

Pallet inertia is automatically measured. Then B-axis acceleration/ deceleration are optimized.



Rotary table with additional C-axis 5XR spec. (optional specification)



High rigidity machine construction

◎Pallet clamping system

Pallet can be precisely located on the pallet table with four taper-cones. Each taper cone supports and clamps pallet in a balanced manner. High cutting performance is realized even at the upper point on Y-axis.

◎Roller linear guides

Cylindrical roller guides are used in the X-, Y- and Z-axis. Rollers provide line contact area, which enhances rigidity and load capacities of the machines.

◎Stepped column

The two X-axis guides under the column are at different heights. This stepped design supports the machine to move at high speed and high acceleration mode by reducing the weight of column without compromising rigidity of the machine in Z-axis direction.

◎Advanced axis cooling system

Heat generation in the axes during high speed machining can affect accuracy and performance of the machine. The nx machine has the cooling technology of ball screw core and ball screw support bearing. Cooling oil is maintained as per the bed casting temperature and circulated through to the ball screws and end support bearings.

◎Three-point support

The machine body is designed to sit on the shop floor with only three-point support. This structure reduces installation time and makes relocation work easy.

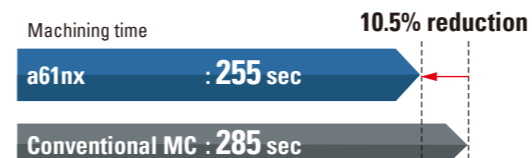
Improved productivity

Comparison of machining times with currently used programs

Gear Box Housing

< Machining description >

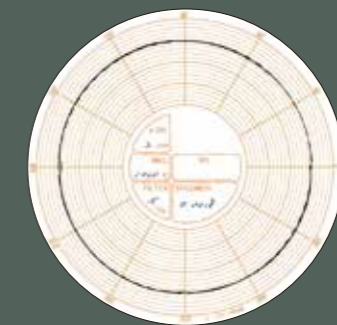
- Tool change: 27 times
- Burnishing reamer
- Drill
- Step bore & chamfer
- Boring bar
- Face mill



Tolerances at Makino's assembly plant

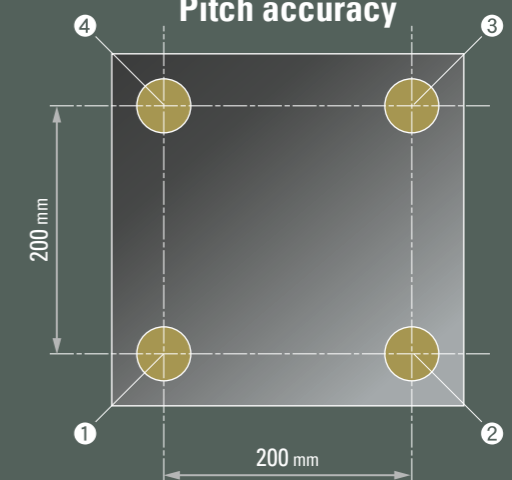
Positioning accuracy — **±2.0 μm** (with scale feedback)
±2.5 μm (without scale feedback)
Repeatability — **±1.0 μm** (with scale feedback)
±1.5 μm (without scale feedback)

* Scale feedback: optional specification
* Measured according to JIS standard / ISO standard.



Roundness 1.8 μm
(Outside machining of 50 mm diameter)
* Actual value measured in Makino facility

Pitch accuracy



Measured positions	Target values	Measured values	Error
① — ②	200.0000	200.0021	0.0021
③ — ④	200.0000	200.0011	0.0011
① — ④	200.0000	199.9999	-0.0001
② — ③	200.0000	199.9998	-0.0002
① — ③	282.8427	282.8417	-0.0010
② — ④	282.8427	282.8452	0.0025

* Actual value measured in Makino facility (mm)

Chip evacuation system

Large volumes of chips of various sizes are evacuated quickly and effectively

Highly productive machining centers generate large volumes of chips. To ensure efficient and reliable chip removal, chamber of machine is composed almost entirely of slanted panels. Coolant from the spindle head and ceiling of the chamber flush chips directly into the center trough under the table. Large volume base coolant in the center trough washes chips towards the lift up chip conveyor.

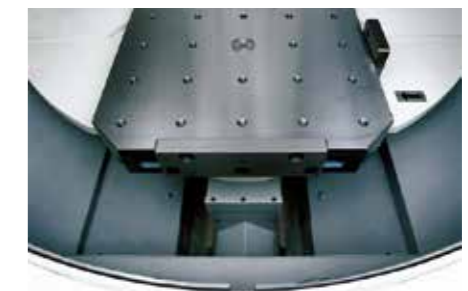
- 8-nozzle coolant
- Through spindle coolant (1.5/2.2MPa)
- Shower coolant
- Spindle head washing nozzle coolant

Two fixed nozzles are equipped to wash away chips from the top of spindle. Chips don't enter the spindle taper in tool changing operation.



◎ Z-axis cover

Z-axis cover of single plate is adopted to avoid chip intrusion and protect guideways.



◎ Center trough structure

The center trough for chip evacuation extends through the machine from the pallet loading station (PLS) to the coolant tank. This structure keeps PLS area clean by allowing chips to fall into the center trough, where they are flushed away by the base coolant.



◎ Lift up chip conveyor

Main filter
Durable stainless steel wire mesh filter prevents clogging of hoses and pipes.

Cyclone type secondary filter
Fine sludge, which cannot be filtrated by the main filter, is completely separated from coolant.

◎ GI breaker (optional equipment)

This function breaking up long cutting chips produced during hole machining. Suppresses the occurrence of wrapping on the tool and abrasion marks on the workpiece. Continuous cutting is possible without interruption such as by inverting the feed axis. Productivity improves by eliminating trouble-shooting operations and reducing machining time rather than the pecking cycles.

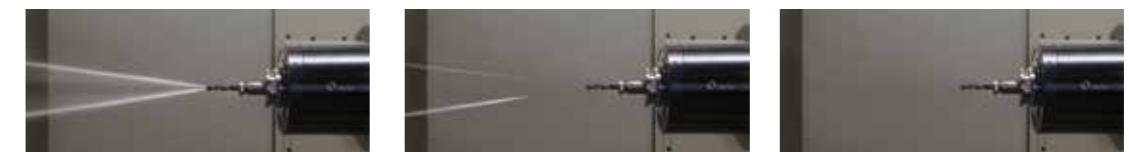


GI breaker OFF

GI breaker ON

◎ Coolant draw-back

The through spindle coolant mechanism includes a unique coolant draw-back circuit. The coolant stop command activates a draw-back system that sucks excess coolant from the tool and spindle.



0.5 sec

Shortening tool change time

Tool preparation time : 2.1 seconds at minimum

ATC shutter synchronizes its opening width with tool length.
(patented)

Tool-to-tool ——— **0.9 sec**

High speed ring type tool magazine
Storage capacity ——— **60 tools** (standard specification)

Inertia active control technology is adapted to the tool magazine. By automatically grasping total weight of tools in the magazine, acceleration /deceleration are optimized.




Photo: 60 tools magazine

Large capacity matrix type tool magazine (optional specification)
Tool storage capacity ——— **133, 218, 313** tools



Large tools can be easily set and taken out at the tool loading station (TLS).

Broken Tool Sensor **Vision B.T.S.** (patented)

The broken tool sensor (BTS) is a device detecting tool breakage. A camera is in the tool magazine. By taking photos of tools at the standby position before and after machining, the BTS detects breakage. Compared with the conventional method of touch-type probe, detecting time is drastically shortened.



- Tool change speed optimized
Weight of each tool is automatically estimated, based on its silhouette. Tool change speed is optimized according to the information.
- ATC shutter opening width adjusted
Length of each tool is automatically measured. ATC shutter opening width is adjusted to the length.
- Z-axis retract minimized
Parameter of workpiece size is input by operator. Together with the information of tool length, necessary distance of Z-axis retract is calculated.

(Available only on a71nx)

Ease of operation

Operator friendly machine design



Excellent spindle accessibility

Operator can easily access to spindle and table to check workpiece, fixture and tool.



Pallet loading station (PLS)

The doors, which open widely, provide easy access of crane for loading workpiece and fixture.



Control panel

The control panel is mounted on the left side of the operator door and can be rotated 180 degrees.



Easy maintenance

Units that require daily check are placed together on the rear panels of the machine.

Automation

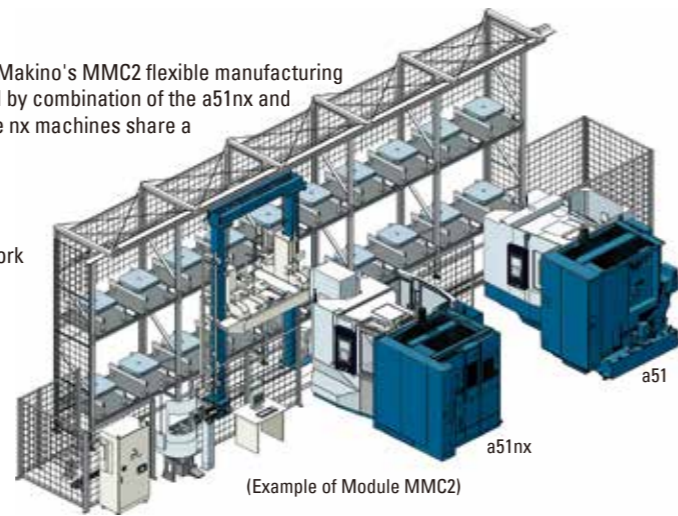
Automation boosts productivity

Module MMC2

The nx family of machines can be integrated into Makino's MMC2 flexible manufacturing system. Existing MMC2 systems can be expanded by combination of the a51nx and a51 machines or the a61nx and a61 machines. The nx machines share a common pallet, design with the previous model (with conditions for a61nx and its pallet).

μMMC

This system combines an articulated robot and work holding pallet to facilitate continuous unattended operation.



(Example of Module MMC2)

- ◎ Robot automation specification
(Please contact Makino representative to discuss automation of your specific application)
- ◎ Pallet magazine specification (7 pallets + 1 WSS)

◎ CPH upper on-line type hydraulic and pressure pipe (12+12 ports)

Up to 12 ports per pallet can be used to supply hydraulic pressure. Another port is also available for supplying jig wash coolant.

◎ Hydraulic jig control package II

This consists of the hydraulic unit for supplying hydraulic pressure to the jigs, the CPH control panel, and the control unit.

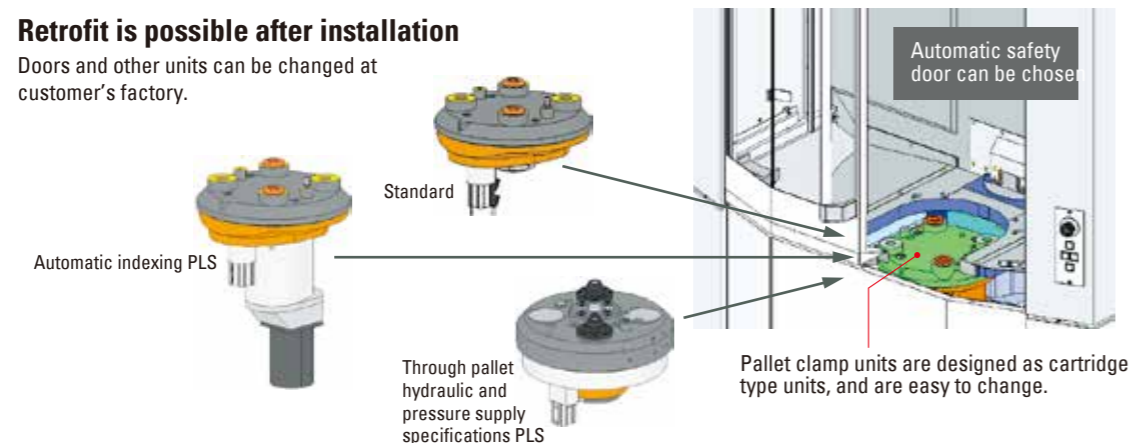
◎ Compatible with through pallet hydraulic and pressure supply specifications PLS

Trough pallet hydraulic pressure can be supplied through the bottom of the pallet at pallet loading station.



Retrofit is possible after installation

Doors and other units can be changed at customer's factory.



(The all items shown on page 13 are optional specifications.)

Specifications

		a51nx	a61nx
Travels	X, Y, Z axes	560 × 640 × 640 mm	730 × 650 (730 ¹) × 800 mm
	Distance from pallet top to spindle center	80 - 720 mm	80 - 730 mm (80 - 810 mm ¹)
	Distance from pallet center to spindle end	100 - 740 mm	100 - 900 mm
Pallet	Size	400 × 400 mm	500 × 500 mm
	Maximum workpiece size (diameter × height)	630 × 900 mm	800 × 1000 mm
	Maximum payload (evenly distributed)	400 kg	500 kg / 700 kg (selectable)
Spindle	Pallet surface configuration	24 × M16 tapped hole	24 × M16 tapped hole
	Speed	50 - 14000 min ⁻¹	50 - 14000 min ⁻¹
	Interface	BT40 (7/24 taper #40)	BT40 (7/24 taper #40)
Feedrates	Bearing diameter (inner/outer)	85 / 130 mm	85 / 130 mm
	Motor power (15%ED / Cont.)	37 / 22 kW	37 / 22 kW
	Torque (10%ED / Cont.)	303 / 119 N.m	303 / 119 N.m
Automatic tool changer	Rapid traverse	60000 mm/min	60000 mm/min
	Cutting feedrate	1 - 50000 mm/min	1 - 50000 mm/min
	Tool shank	JIS B6339 40T	JIS B6339 40T
Machine size (standard specification)	Retention knob	JIS B6339 40P	JIS B6339 40P
	Tool storage capacity	60 tools (133, 218, 313 tools ¹)	60 tools (133, 218, 313 tools ¹)
	Maximum tool diameter (without limitation / with limitation)	70 / 170 mm	70 / 205 mm
	Maximum tool length	430 mm	510 mm
	Maximum tool weight	12 kg	12 kg
Floor space	Height	2796 mm	2923 mm
	Width × Depth	2659 × 4193 mm	2910 × 4879 mm
	Weight	10000 kg	12000 kg
Floor space	Width × Depth	4400 × 6000 mm	4540 × 7030 mm

*1: optional specification

Standard specifications

- 14000 min⁻¹ spindle (303 N-m)
- Spindle temperature controller
- 60 tools magazine
- Broken tool sensor Vision B.T.S
- Pallet changer
- Rotary table (DD motor specification)
- Pallet seating confirmation function
- Random program calling function
- Feed axis acceleration X/Y=1G specification
- APC safety guard door (with door lock)
- Operator door lock (operation mode)
- 2 pallets with tapped holes
- Cooling ball screw core and support bearing
- Through spindle coolant (1.5 / 2.2 MPa) and air
- 8-nozzle coolant
- Automatic grease supply unit
- Base coolant
- Overhead shower coolant system
- Lift-up chip conveyor (left discharge)
- Signal light 3- layer
- Lighting unit (machining chamber internal)
- Portable manual pulse generator with handle enable button
- Air dryer
- Interface for automatic extinguisher
- Rigid tap
- GI control
- Tool life monitoring function
- User memory storage capacity 3GB
- Spindle-table interference preventive function
- ECO mode functions
- UL specification
- Automatic power-off
- MRDF (Machine Retransfer Detect Function)

Optional specifications (◎) / Optional equipment (★)

- ◎ 20000 min⁻¹ spindle²
- ◎ HSK-A63
- ◎ BIG-PLUS (BBT40)³
- ◎ 133, 218, 313⁴ tools magazine
- ★ Tool cleaning air (tool change waiting position)
- ★ Spindle end cleaning air⁵
- ◎ Y axis stroke 730 mm high column specification⁶
- ◎ Scale feedback (X, Y, Z 0.05 μm)
- ◎ T slots pallet specification (2 pallets)
- ★ 2 or 4-face angle plate (T-slots)
- ★ High rigid 2-face angle plates (tapped holes)
- ★ APC safety guard automatic open/close door
- ★ Workpiece washing gun (PLS side)
- ★ Workpiece washing gun (side of operator's door)
- ★ Workpiece washing gun (pallet magazine WSS side)
- ★ Workpiece washing gun (pallet magazine WSS side & side of operator's door)
- ★ Operator side step (side of operator's door)⁵
- ★ Table washing coolant (Mist blow type)
- ◎ Through spindle coolant (3 / 7 MPa) and air
- ★ Coolant temperature controller (with heater)
- ★ GI breaker
- ◎ Conveyor in splash guard
- ◎ Lift-up chip conveyor (left discharge, double layer)
- ◎ Lift-up chip conveyor (rear discharge)
- ◎ Lift-up chip conveyor (for cast iron, left discharge)
- ★ Magnet for cast iron
- ★ Magnetic barrier in clean tank
- ★ Drum filter mist blow washing coolant⁷
- ★ Chip bucket (tiltable)
- ★ Mist collector
- ★ Retractable automatic tool length measuring device
- ★ Automatic workpiece measuring device
- ◎ Portable manual plus generator with tool position display (with coordinate origin function)
- ★ Air conditioner inside enclosure
- ★ Super GI.5 control
- ★ MHmax
- ★ MTConnect interface
- ★ OPC UA interface
- ★ Rotary wiper for splash guard window
- ◎ Customer specified machine color

*2: HSK-A63 only

*3: Only available with 14000 min⁻¹ spindle

*4: Lift-up chip conveyor of 313-tools magazine (rear discharge) must be selected

*5: HSK-A63 must be selected, not available with air blower

*6: Only available with a61nx

*7: Selectable with lift-up chip conveyor (left discharge/rear discharge)