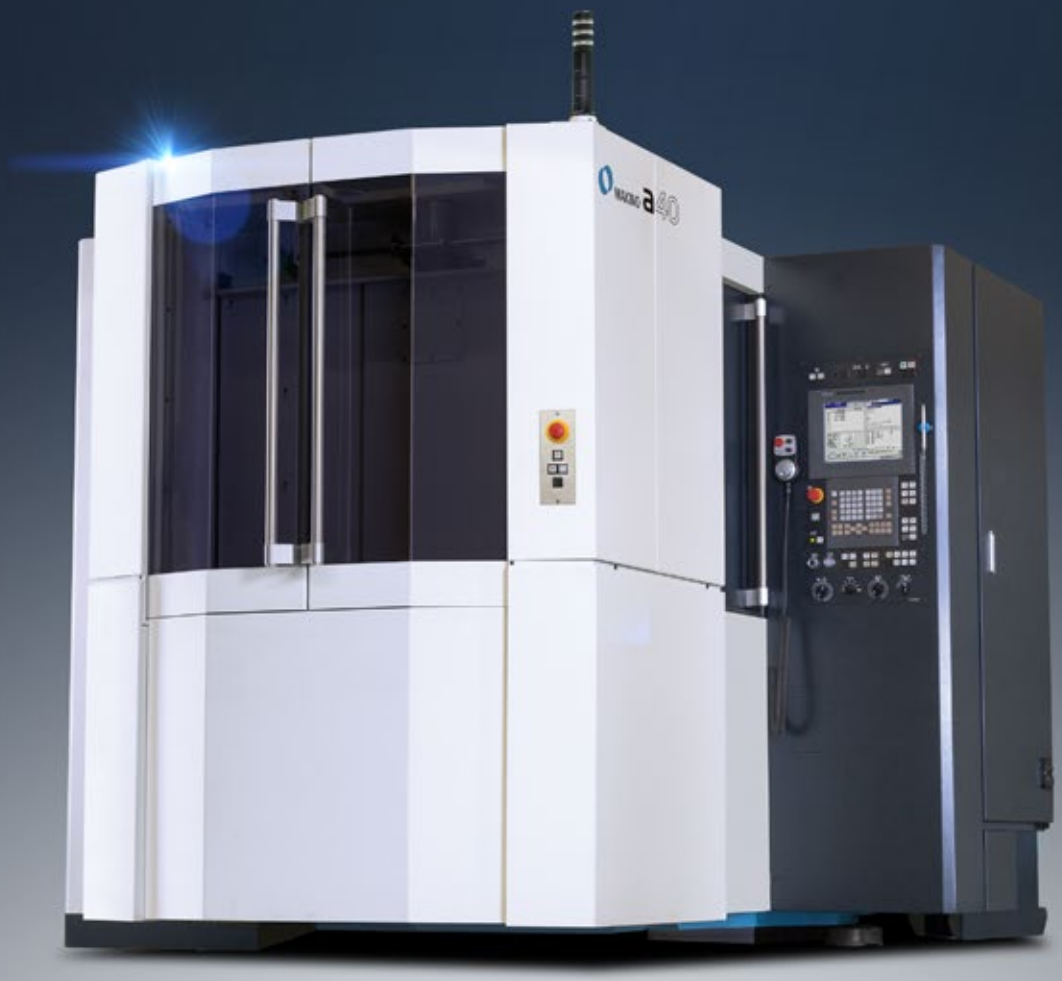
a40

Horizontal Machining Center



MAKINO

Superior Reliability

Aiming for Zero Downtime

Designed for Die Cast Parts Production

Introducing the Makino a40, a first of its kind Horizontal Machining Center designed and built to address the challenges of die cast parts production.

Reliability of your machining system is a paramount consideration. The a40 leverages on robust, proven systems like single piece X & Z axis covers, center trough chip / coolant management and dual supported ATC mechanisms from Makino's 1-Series horizontal machining centers. New and improved systems ensures reliable operation.

- Vision B.T.S.
  - -Tool breakage detection function by camera
  - - Quickly checks the status of the tool before and after tool change
- Taper cleaning coolant feature
  - - Cleaning achieved by coolant with 20μm filtration accuracy at the time of tool exchange
  - - Ensures no chip on tool clamping
- Coolant filtration system
  - - 20μm filtration accuracy achieved by three stages of the cyclone filter
  - - Sludge associated with the aluminum machining is removed
  - - Reduce the frequency of preventive maintenance and cleaning of the coolant tank

Makino understands that one of the largest drivers of cost per piece is the cycle time. Cycle time drives the number of machines required but also has far reaching cost implications affecting labor, floor space, utilities and durable tooling. The a40 features Makino's Intelligent R.O.I. design, a collection of innovative technologies designed to slash unproductive non cut times from your part process.

- Responsive #40 spindle accelerates to 12,000 in 0.45 seconds.
- Quickly complete common tapping operations with the 6,000 rpm rigid tapping synchronization speed.
- Minimize feature-to-feature positioning time with linear axis that reach full rapid traverse rates, thereby achieving an average up to 30% faster than similar machines in the market.
- Inertia Active Control (IAC) evaluates fixture and tool weights to optimize acceleration performance of multiple machine systems.

Don't settle for a machine designed for general purpose use. Contact Makino to see how a machine built for specific application delivers a competitive advantage in cost per piece.

The new a40 is YOUR machine for YOUR industry.

PRODUCTIVITY

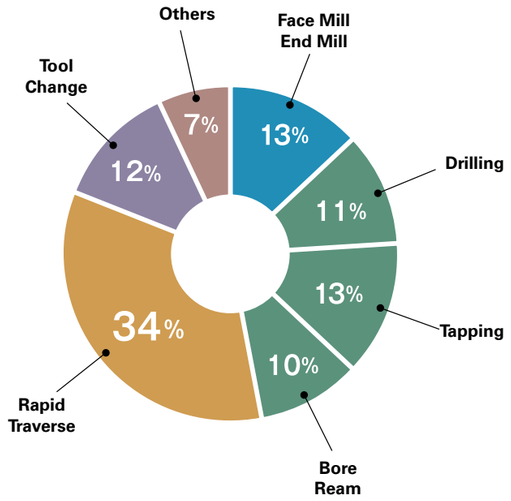
- Productivity improvements are a common focus in die cast machining applications
- For a given volume, cycle time reduction of few seconds can mean reduction from four to three machines in a production cell
- Incremental reduction of capital equipment costs brings savings on additional labor, fixture, tooling and floor space
- The Makino a40 is packed with productivity boosting technologies designed to reduce wasteful non-cutting time

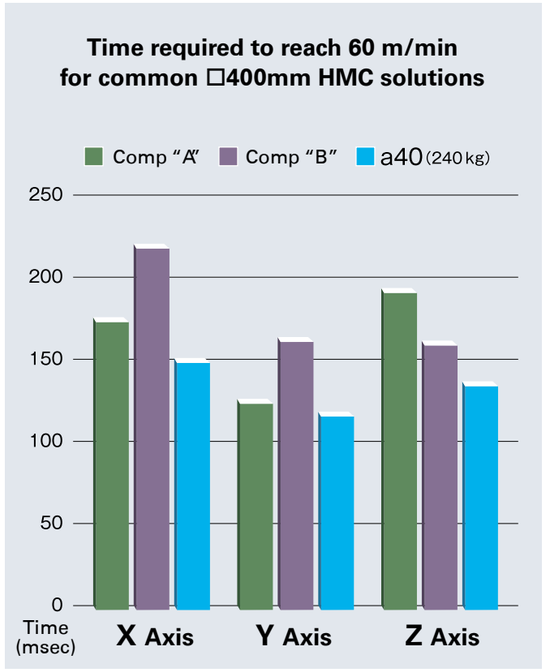
Intelligent ROI Reduction of Inertia

The a40 is designed to eliminate non-productive positioning time. Each major casting and machine system has been engineered using an Intelligent ROI (Reduction Of Inertia) Design philosophy. Net results are superior linear and radial positioning times that lead to an overall reduction of non-cut times in die cast part production.

Intelligent ROI Design

Because of their high feature count and minimal stock removal, rapid traverse positioning from feature to feature can account for up to 1/3 of the total cycle time on die cast components.





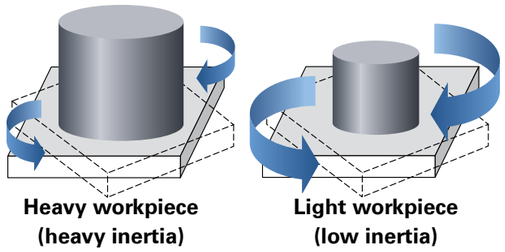
Common specs like rapid traverse rates and axis "G" ratings don't tell the whole story and can be misleading, with little impact to the overall machine quickness or influence in cycle time reductions. A better evaluation is to look at the time elapsed and the distance travelled for the machine to reach full rapid traverse. This measurement takes into account the entire machine system including rigidity, G-rating, ball screw pitch and axis jerk.

The a40's Intelligent ROI Design allows acceleration to full rapid traverse an average of 30% faster than the common □400mm HMC solutions.

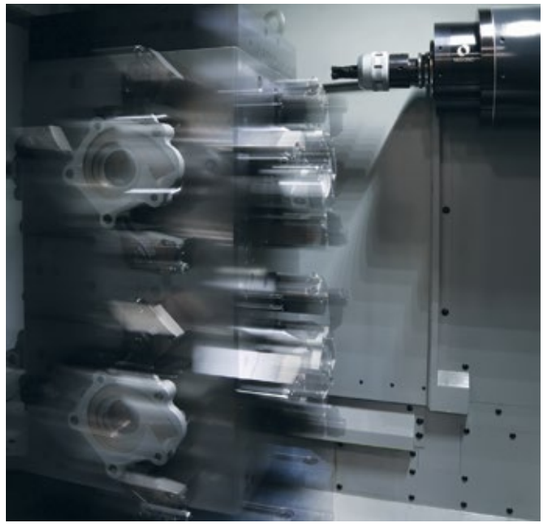
Inertia Active Control

The a40's Inertia Active Control (IAC) system can quickly access inertia and mass of the machine systems through servo motor feedback. This information is used to optimize the acceleration performance of each system.

- **B-Axis:** IAC evaluates inertia of each pallet then sets rotary acceleration values to optimal rotary positioning time.



- **Z-Axis:** IAC evaluates inertia and payload of each pallet then optimizes linear acceleration to minimize Z axis positioning time.
- **ATC Magazine:** IAC automatically evaluates inertia of ATC ring magazine each time the ATC operator door is opened. Ring speed is optimized to reduce tool seek time.

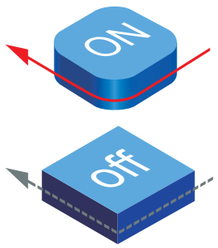


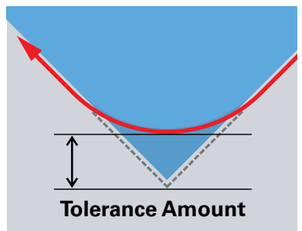
Advanced Motion Control

Advanced motion control technologies provide the user with easily implemented tools to reduce non-cut times during common die cast machining operations. Cutting corners can actually get you to your destination quicker!

- **Geometric Intelligence Milling:**

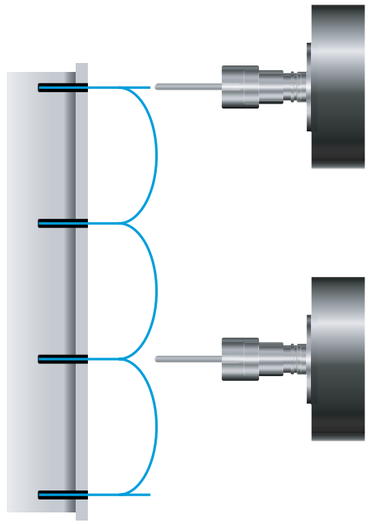
Allows the user to define a corner rounding tolerance for milling paths. GI Milling allows the a40 control to smooth out abrupt direction changing motion with contoured curves that produce fluid 2D milling motion, while maintaining programed feedrates.





- **Geometric Intelligence Drilling:**

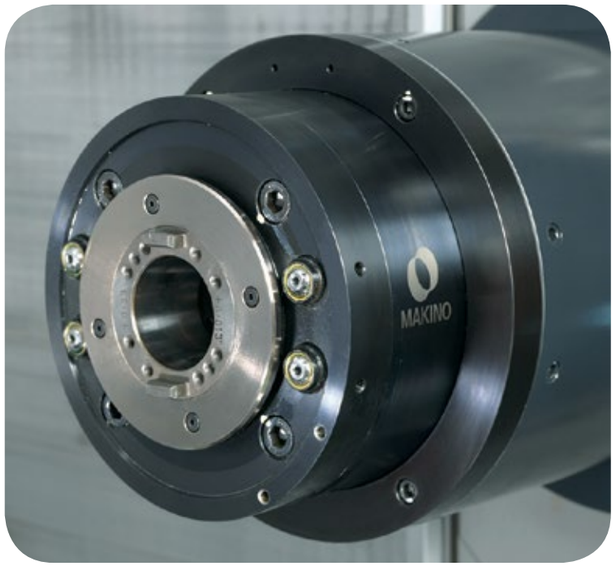
A dedicated canned drilling cycle that allows the a40 to arc between holes in a programmed pattern. It keeps the high-speed feedrate at positioning in the identical pattern canned drilling cycle.



PRODUCTIVITY

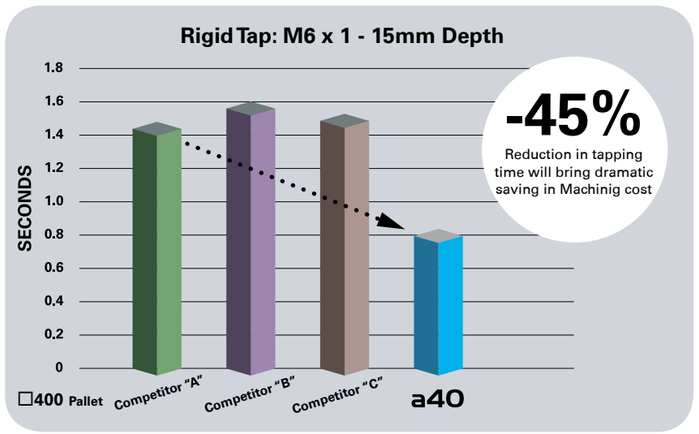
Spindle

The a40's spindle is designed to address the specific challenges of die cast parts production. Its responsive direct drive design accelerates to 12,000 rpm in just 0.45 seconds providing the reliability of a 40 taper with the performance advantages typical associated with 30 taper drill tap solutions.



Rigid Tapping Synchronization Up to 6,000 rpm

Fast spindle acc/dec reduces tapping times per hour by 0.5 to 0.7 seconds compared to typical □400mm HMC solutions.



What could a 45% reduction in total tapping time do to your per piece cost?

Steering Housing

Details: Aluminum die cast
(2) operations
(25) tools
(22) B-axis indexes

Makino a40	6 minutes, 16 seconds
Competitor "A"	7 minutes, 54 seconds

20.7% Faster
on the Makino a40

RELIABILITY

- Unplanned down time is a big loss in high volume die cast production machining
- Reliability of your machining system is a paramount consideration.
- The a40 leverages several of the robust, proven systems from Makino's 1-Series horizontal machining centers which is a industry leader in reliability, but then enhances reliability with new systems

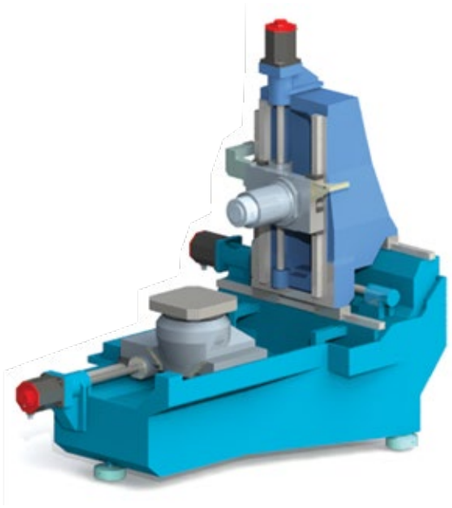
Proven Design to sustain Reliability

Advanced axis cooling system

Heat generation in the axis during high speed machining can affect accuracy and performance of the machine. The a40 machine has the core cooling technology of ball screws and ball screw support bearing. Cooling oil temperature maintained as per the bed casting temperature and circulated through to the ball screws and end support bearings.

Stepped column

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



3 points support

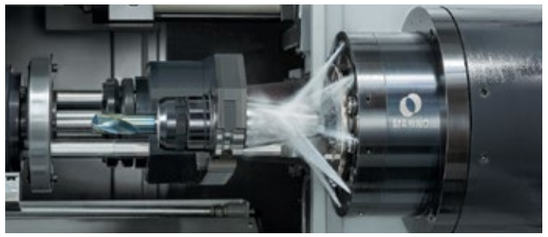
Superior design allows the entire machine structure to sit on the shop floor by only three points support. The three points support reduces the installation time and allows easy deployment of the machine at production site.

Single Piece Way Covers

Single piece X and Y axis way covers eliminate way cover failures common with many machine tools. Spring steel scrapers shed chips and coolant from the covers during normal axis motion. This system was first implemented on Makino a-series machines in 2002. With over 10,000 units installed globally, this system has a proven reliability record and has virtually eliminated way cover replacements.

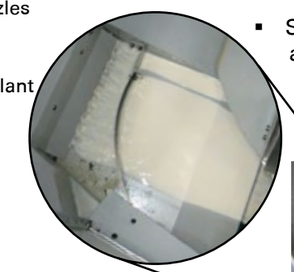
Standard Taper Cleaning Nozzles

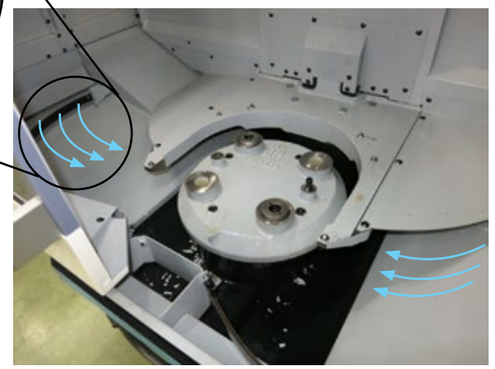
Chip contamination of the tool / spindle taper can cause a variety of part quality defects, most notably out of tolerance bore dimensions. Eight dedicated tool taper cleaning jets wash the tool taper with 20µm clean coolant during each tool change. This system coupled with the spindle washing nozzles ensures that the critical tool/spindle taper interface area is free of chip contamination.



Superior Chip and Coolant Management

- The splash guard interior is constructed entirely of vertical and sloped panels. Dedicated interior wall wash nozzles for vertical panels and terrace washing jets on sloped surfaces ensure efficient removal of chips and self-cleaning operation. Center trough design directs all chip and coolant to into the center trough where high volume base coolant moves the chips to the lift up chip conveyor. To reduce potential for leaks, interior panels are single piece construction utilizing sheet metal bends rather than multi-piece construction joined by welds & caulking.
- Comprehensive Standard Coolant System
  - Overhead shower coolant (fixture / work piece)
  - Overhead splash guard nozzles (wall cleaning coolant)
  - 4-Nozzle flood coolant
  - 1.5MPa through spindle coolant
  - Terrace washing nozzles
  - Spindle wash nozzles
  - Center trough base coolant
- Standard Lift Up chip conveyor features three stage chip & coolant filtration. Scrapper type conveyor removes majority of chips. As the coolant exits the conveyor, twin permanent media filter discs filter the main tank coolant to 35µm cleanliness. Designed specifically for die cast operations, this chip & coolant system includes hydro-cyclonic filtration for ultra-clean coolant. The hydro-cyclone fills an ultra-clean tank with coolant filtered to 20µm. This tank supplies coolant to the through spindle and taper washing coolant pumps. Hydro-cyclonic filtration of the coolant system dramatically reduces the sludge common in aluminum applications and extends preventative maintenance tank cleaning intervals.
- Systems to keep Pallet Stocker (PLS) area clean and free of chips
  - Terrace type wash at PLS
  - Coolant flushing in PLS pan

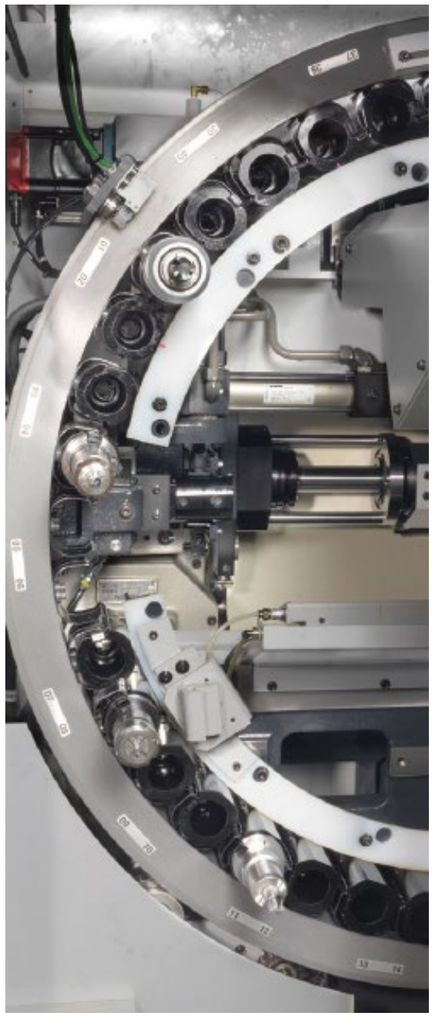


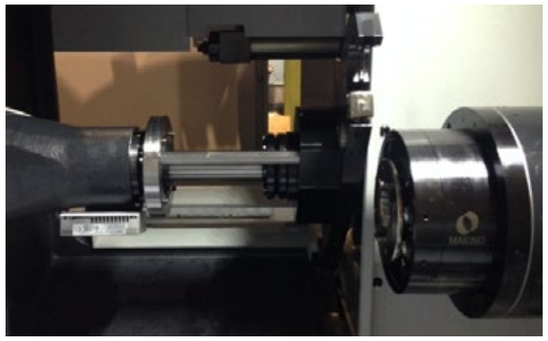


RELIABILITY

ATC Magazine

- a40 ATC magazine utilizes a compact steel ring design to store up to 40 tools. This is a robust, proven design that has been utilized with Makino's a-series family of machining centers. Responsive indexing ensures that the next tool is quickly moved to the ready station - tool preparation time: 2.9 / 4.8 sec (minimum/maximum). Inertia Active Control automatically accesses total tool weight and further optimizes ring acceleration to minimize tool seek times.
- Fixed pocket logic always returns tools to their original location, simplifying tool management for the operators.





- Dual support ATC arm
- Superior reliability using Roller Type cam

Easy maintenance and inspection

- Units that require daily checking of oil levels or air pressures are housed in one location for easy confirmation.

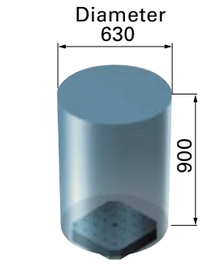
Vision B.T.S.

- a40 has a standard vision type broken tool detection. The Vision B.T.S. (Broken Tool Sensor) is located in the ATC magazine where it can quickly access the condition of the cutting tool with no impact to cycle time. The system improves reliability by eliminating the moving mechanical systems typically used in touch type tool breakage systems. There is no risk of chipping or damaging expensive PCD cutting tools because it is non-contact.

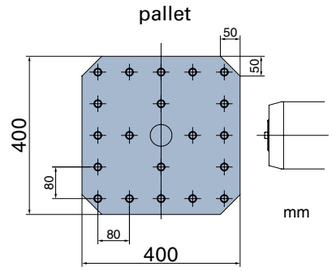
- With each tool check, Vision B.T.S. system captures a silhouette of the cutting tool & holder. The data is utilized to provide additional productivity advantages that help to reduce cycle time.
  - Tool shape is used to approximate tool weight and automatically set automatic tool change speed.
  - Opening of the servo actuated ATC shutter can be matched to the Vision B.T.S. reported tool length. Minimizing the shutter door opening reduces chip to chip tool changing time.
  - Vision B.T.S. reported tool length can be used in conjunction with the work piece fixture radius (user set parameter value) to optimize Z-axis retract during tool change and B-axis rotations. Using safe Z-axis retract distances instead of reference point returns, minimizes non cutting Z-axis rapid traverse time.

Basic Specification

Axis travels X ×Y × Z mm	: 560 x 640 x 640
B-axis degrees	: 360 (0.001 deg. indexing)
Pallet size mm	: 400 x 400
Maximum work load weight kg	: 400
Spindle taper hole	: 7/24 No. 40 or HSK-A63*
Machine weight kg	: 6,000



Maximum workpiece size when pallet is changed.



Machine Specifications

Travels	X, Y, Z-axes	560 x 640 x 640 mm
	Distance from pallet top to spindle center	80 ~ 720 mm
	Distance from pallet center to spindle end	70 ~ 710 mm
Pallet	Pallet working area	400 x 400 mm
	Maximum work piece size	Ø630 x 900 mm
	Maximum pallet load	400 kg
	Pallet surface configuration	20 - M16 tapped
Spindle	Spindle speed range	50 ~ 12,000 rpm
	Spindle taper	7/24 No. 40 Taper [HSK-A63 optional]
	Spindle bearing ID / OD	Ø70 / 110 mm
	Spindle power characteristics	22 / 15 / 11 kW (10%ED / 25%ED / cont.)
	Spindle torque characteristics	91.3 / 37.7 / 27.6 N·m (10%ED / 25%ED / cont.)
Feedrates	Rapid traverse	60,000 mm/min
	Cutting feed	1 ~ 60,000 mm/min
Automatic Tool Changer	Type of tool shank	JIS B6339 40T
	Type of retention knob	JIS B6339 40P
	Tool storage capacity	40
	Max. tool diameter (without / with limitation)	70 / 170 mm
	Max. tool length	360 mm
	Max. tool weight	8 kg
Power Sources	Electrical power supply	50 Hz ± 2%,AC400V ± 10% 60 Hz ± 2%,AC460V ± 10% 52 kVA
	Compressed air supply	0.5 - 0.8 MPa, 410 L/min
Machine Size	Machine height	2,493 mm
	Machine footprint (width x depth)	2,680 x 4,249 mm
	Maintenance floorspace (width x length)	3,745 x 4,662 mm
	Machine weight	6,000 kg

Standard Specifications (•)

- 12,000rpm spindle
- 40 tool ATC
- Pallet changer
- Pallet changer safety guard
- Index table
- Pallet seat confirmation function
- Pallet random call function
- Tool magazine door lock
- APC door lock
- Operator door lock
- Vision B.T.S. (tool breakage detection device)
- Tap hole pallet
- Ball screw core cooling
- Nozzle coolant
- Ceiling shower coolant
- Rear Lift Up Chip Conveyor
- Signal light 3-layer
- Splash guard lighting
- Portable manual pulse generator (with handle Enable button)
- Air Dryer
- Rigid tapping
- GI control
- Data center
- Automatic power-off
- Energy saving function

MAKINO

http://www.makino.com.sg

Printed in Singapore AM007Eb 1607/3 (H/O)