# SH-500


MORI SEIKI

# A realistic answer to today's demands for high quality and low cost


● 2-station turn-type APC

# SH-500

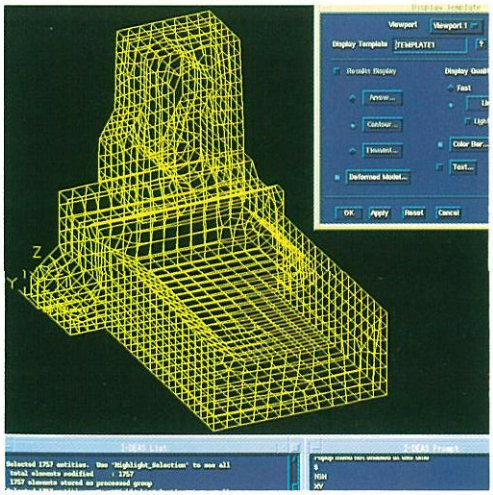
## High-efficiency, super-precise horizontal machining center

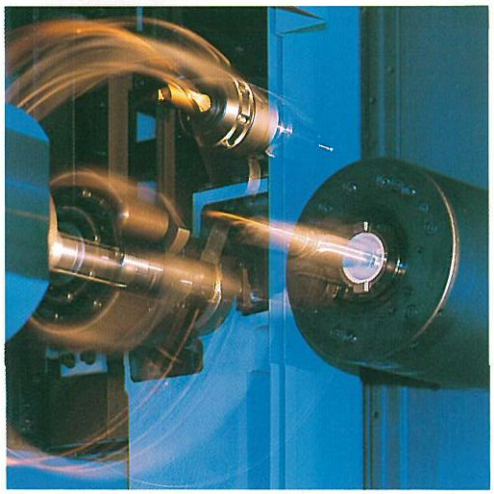
A perennial problem in machine tool design is how to combine high-speed operation, efficiency and precision at a low cost. Today, tough production requirements such as quality, short delivery times and competitive prices are commonly experienced. Consequently, the real value of machining centers in customers' plants must be measured against these severe standards.

Mori Seiki can now offer the SH-500 machining center as a solution to your manufacturing requirements. The SH-500 was conceived and developed by computer aided design (CAD), Finite Element Method (FEM) and the latest technologies to establish machine rigidity that serves as the basis for high-speed operation.

The new SH-500 horizontal machining center provides a large work envelope in a very compact frame. All machine units, axis feed systems, automatic tool changer, automatic pallet changer and spindle speeds were all designed specifically for high speed operation.

Mori Seiki's SH-500 delivers extreme reliability and an excellent cost to performance ratio. This machine should provide customers with an excellent investment for many years in the future.





- Max. spindle speed: 12,000 $min^{-1}$ (SH-500/40)
  : 10,000 $min^{-1}$ (SH-500/50)
- Rapid traverse rate: 32 m/min (1,259.8 ipm)
- Cutting feedrate: 16 m/min (629.9 ipm)
- ATC time (tool-to-tool): 1.3 sec*1 (SH-500/40)
- APC time: 6.0 sec*1
- Machine designed for maximum rigidity via CAD and FEM
- Mori Seiki's unique "MICRONLUB" lubrication
- Basic high-speed machining is standard
- Pneumatic or hydraulic pallet coupler for fixtures*2

*1 At 60 Hz *2 option

# Highly rigid body with stability
# Large machining capacity in compact body

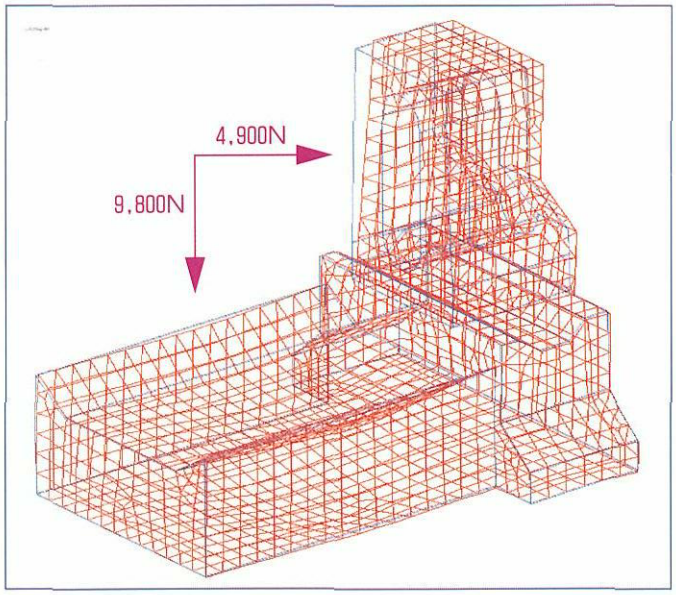
## Design by Advanced Technology

Before designs of the SH-500 were set, Mori Seiki utilized the Finite Element Method (FEM) of analyzing machine components for optimum configuration. This optimum configuration provides maximum stability and support for high speed operation.

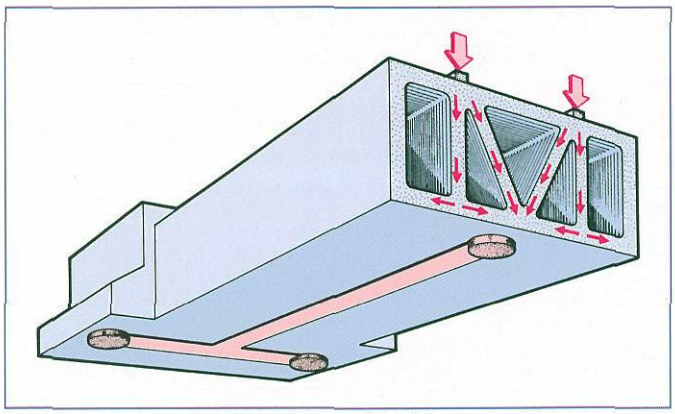
In order to specify the bed design, Mori Seiki design engineers simulated a heavy load at the center of the casting. From this simulation, to give the bed an unprecedented stability, a design which increased the bed thickness to 850 mm (33.5 in.), included innovative ribbing of the bed, and dictated the three point support system was established.

The same design techniques were applied to the column for maximum stability. To enhance the column design even further, because of the fast speeds, the material was changed to a super strong ductile cast iron for reduced weight with improved rigidity.*

*The column uses FCD450 ductile cast iron. This yields a rigidity 1.3 times that of FC250 cast iron.



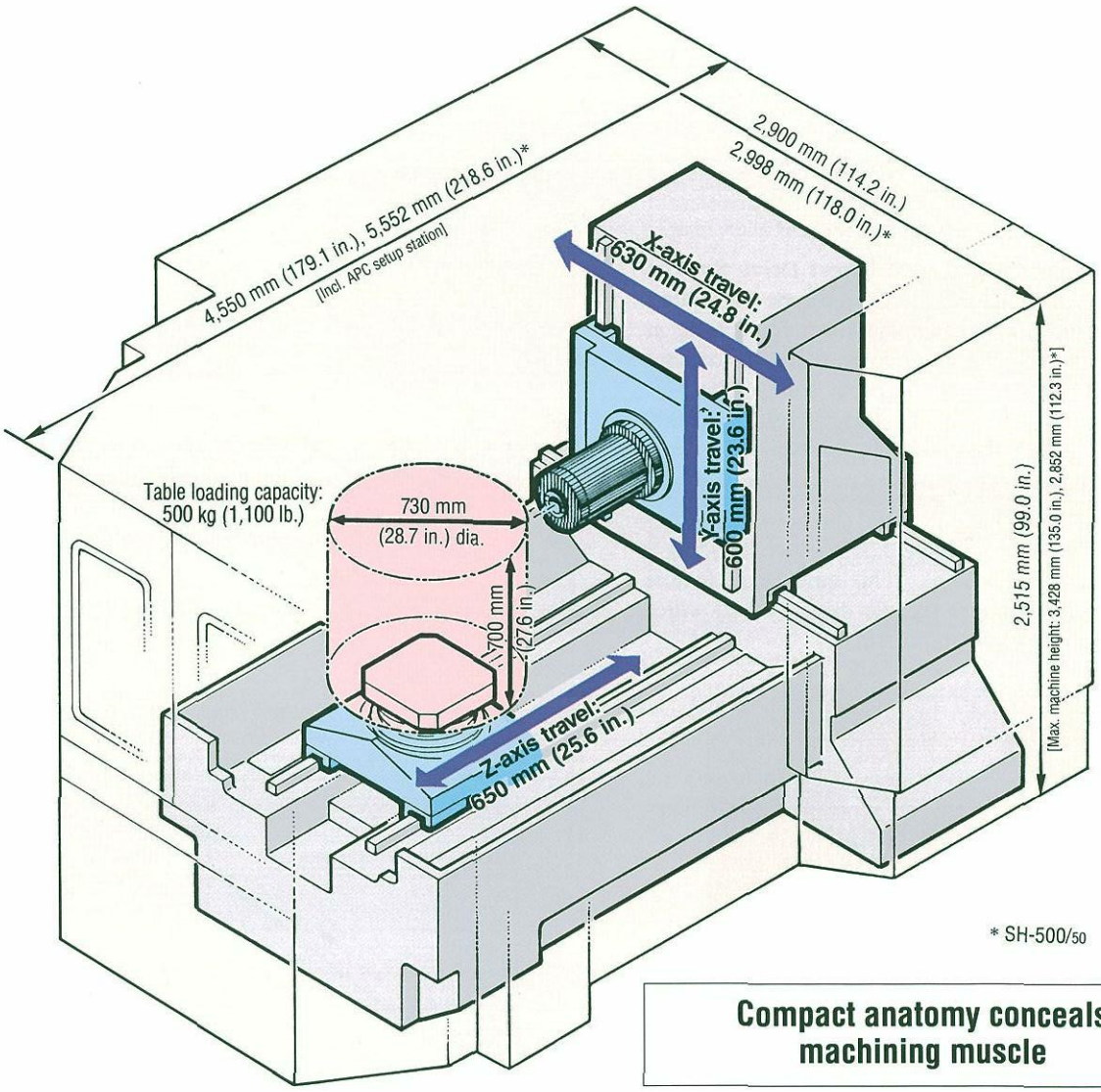

●FEM analyzed bed design provides stability



●Unique ribbed construction affords great rigidity
Three point support system provides stability and easy to install



● Ductile cast iron column.
Deep 850 mm (33.5 in.) bed.



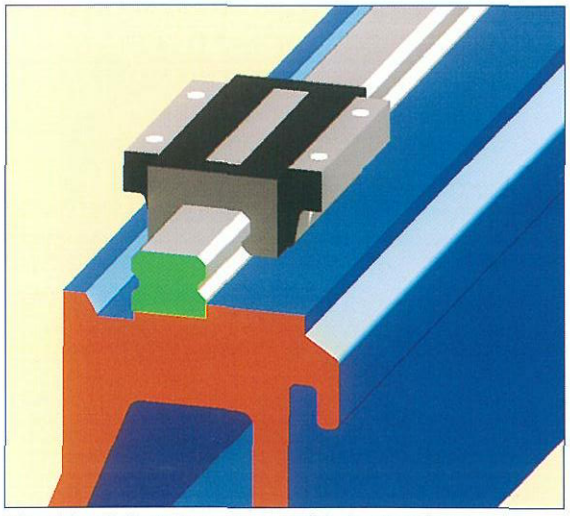

* SH-500/50

## Compact anatomy conceals machining muscle

The SH-500 has the silhouette of a small machine tool, but don't let that fool you! Axis travels are; X = 630 mm (24.8 in.), Y = 600 mm (23.6 in.), Z = 650 mm (25.6 in.). The table is 500 mm (19.7 in.) square and can rotate a workpiece that is 730 mm (28.7 in.) in diameter.*

The SH-500 has enormous specifications for a compact machine that takes up very little floor space, which makes it perfect for today's production where space is at a premium.

*With the optional 3-station turn type APC, the maximum workpiece diameter on the setup station is 610 mm (24.0 in.).



●Precision ball guides enhance slide feed systems

## Tremendous rapid traverse and feed rates

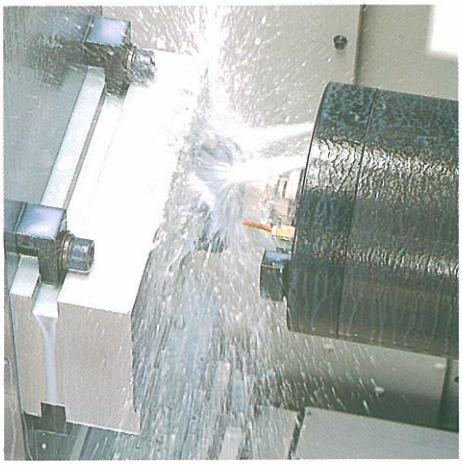
The SH-500 has increased productivity by reducing wasted non-cut times (idle). This is accomplished with rapid traverse rates of 32 m/min (1,259.8 ipm), feed rates of 16 m/min (629.9 ipm) and speedy slide response. An extremely rigid ball guide is an integral part of the SH-500's speed and capability.

# High-power spindle drive
# Effective spindle lubrication for high accuracy

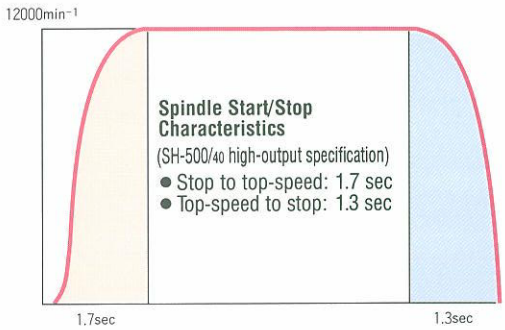
## Super efficient and powerful spindle drive

The spindle is powered by a Direct Drive Spindle (DDS) motor that affords; 1) great torque for cutting at lower speeds, 2) large horsepower for cutting at high speeds and 3) tremendous acceleration and deceleration that reduces non-cut time. The SH-500/40 has 12,000 $min^{-1}$ as standard with 20,000 $min^{-1}$ as an option.

The spindle also has excellent start/stop characteristics –started from the stopped state, the spindle reaches the top speed within a mere 1.7 seconds (SH-500/40 high-output specification). This quick start feature gives a highly efficient spindle drive system which slashes idle time to the minimum.

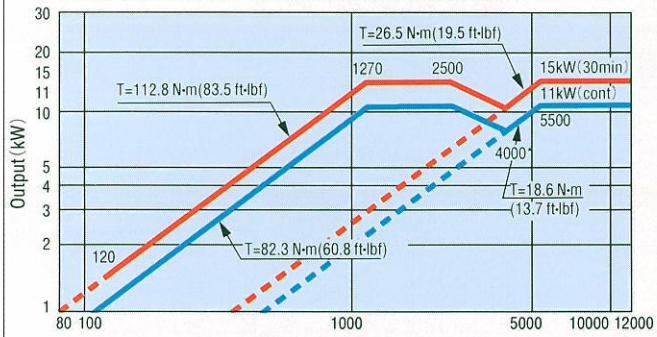


●Remarkable speed and response provide unsurpassed efficiency.



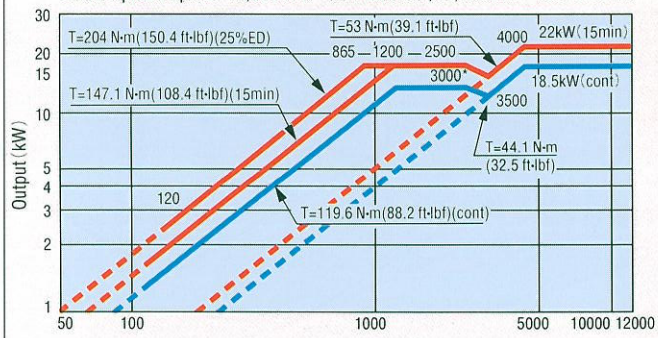

### Spindle speed — output diagram

■**Standard** (SH-500/40)
●15/11 kW (20/15 HP) AC〈30 min/cont〉 ●Max. spindle speed: 12,000 $min^{-1}$



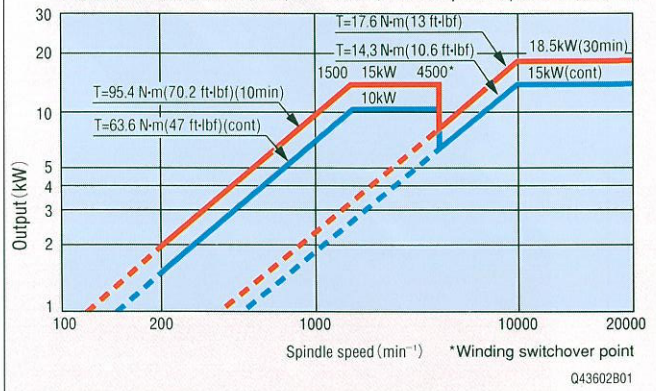

Q43593A03

■**Standard** (SH-500/50) , **High-output** (SH-500/40)
●22/18.5 kW (30/24.8 HP) AC〈15 min/cont〉
●Max. spindle speed: 10,000 $min^{-1}$ (SH-500/50) , 12,000 $min^{-1}$ (SH-500/40)




Q43566A04

■**High-speed** (SH-500/40)
●18.5/15 kW (24.8/20 HP) AC〈30 min/cont〉 ●Max. spindle speed: 20,000 $min^{-1}$

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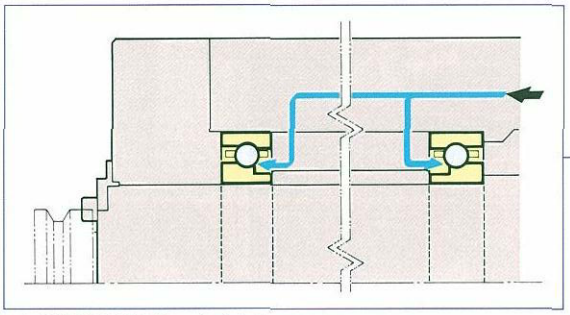
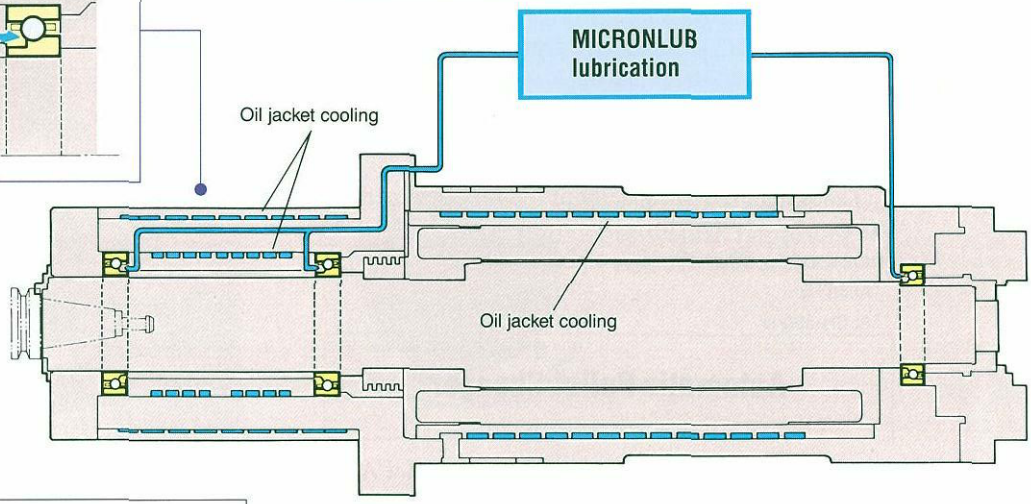
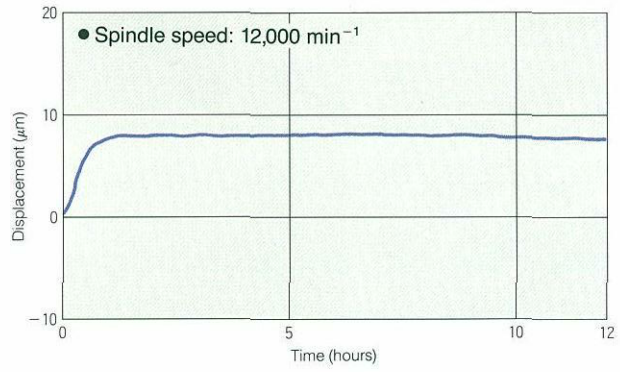


●A "MICRONLUB" of oil is forced through a great number of nozzles directly onto the bearing balls.

●Mori Seiki's unique "MICRONLUB" lubrication system is utilized in both the spindle and slide areas for maximum efficiency.



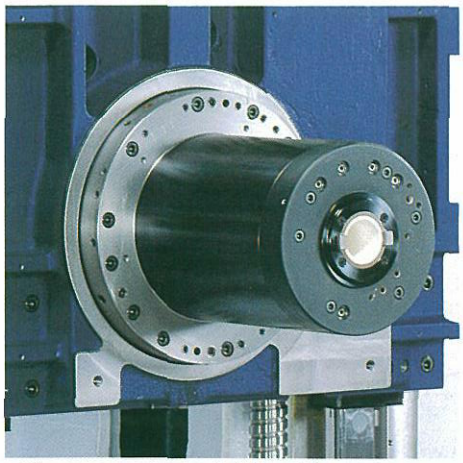

**Thermal displacement data of spindle head (Z-axis) (SH-500/40)**




Note: The results indicated above may not be obtained due to differences in environmental conditions during measurement.

## Super efficient lubrication system supports accuracy in machining

Using Mori Seiki technology the unique "MICRONLUB" lubrication system was developed to direct super small (2 μm diameter) droplets of purified oil directly on to the bearing balls or ball guides. This lubrication system drastically enhances the lubrication performance while increasing reliability where the "air-purge" eliminates dust. This not only reduces costs but increases performance.



● The accuracy and reliability of the parts related to the spindle have also been improved.

## Ceramic Spindle is Standard

Space age Ceramics are used in the spindle taper to prevent fretting, wear, chip damage and corrosion.* Since it is not made of a magnetic material, the taper also has the advantages that it does not attract steel particles and that burrs are not generated easily, which means that taper accuracy can be maintained for long periods.

*Not available for through-spindle coolant specification, 20,000 min⁻¹ specification, and SH-500/50.

# Unrivaled speed and reliability with the ATC and APC

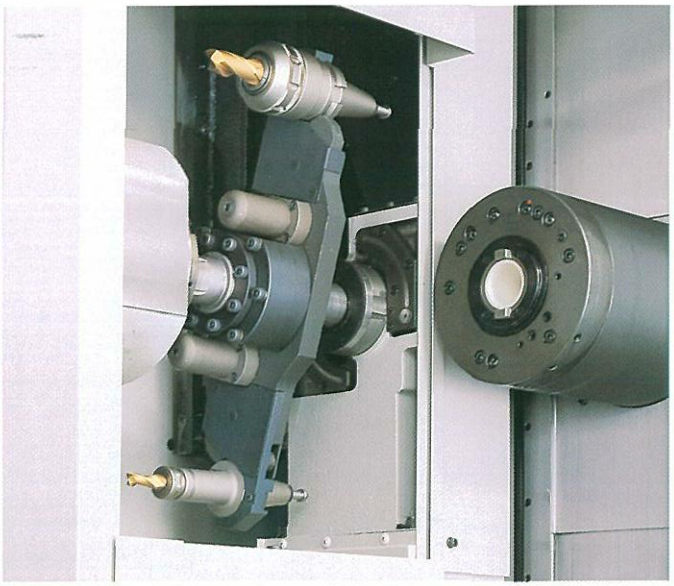
## Automatic Tool Changer

Mori Seiki innovative cam drive mechanism in the SH-500/40 ATC is super fast, featuring a tool-to-tool time of 1.3 seconds* (max. tool length: 360 mm (14.2 in.), max. tool mass: 12 kg (26.4 lb.)). Because of the cam drive mechanism the reliability is superb.

The standard tool capacity of the ATC magazine is 40 Tools.** Optionally, the magazine can be increased to 60, 120, 180, or 240 tools.**

*At 60 Hz

**At SH-500/40



● Super-fast ATC has a tool-to-tool time of only 1.3 seconds. (SH-500/40)

## Automatic Pallet Changer

The SH-500 comes equipped with a two pallet APC as standard and has an optional three pallet system available. Both types of APC handle 500 mm × 500 mm (19.7 in. × 19.7 in.) pallets. In order to minimize idle time, the pallet change time is merely 6 seconds*.

Mori Seiki pallet system utilizes a true curvic coupling for accuracy and tremendous clamping force for rigidity. The standard index increment is 1°, and a rotary table (0.001°) is available as an option.

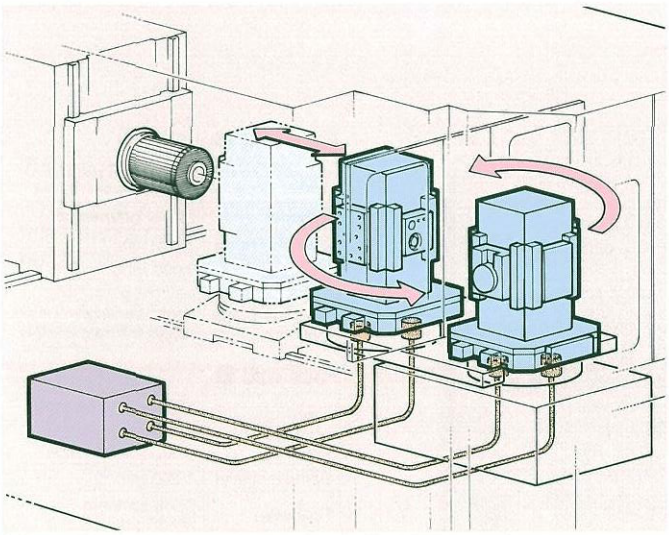
*At 60 Hz

● 2-station turn type APC (standard)

● High-precision curvic couplings for great accuracy and rigidity.

● 3-station turn type APC (option)

■ Table indexing accuracy: 3 seconds (1° indexing)
[5 seconds with full 4th axis rotary table (0.001°)]
■ Indexing repeatability: ±1 second (1° indexing)
[±1 second with full 4th axis rotary table (0.001°)]
■ Pallet change repeatability (on X/Y/Z axes): 0.003 mm.
[ ] option



●The optional auto-coupler supplies hydraulic/pneumatic pressure to fixtures through pallets.

## Automatic Fixture Coupler in Pallet

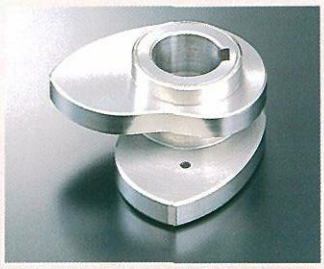
Users can select an optional hydraulic/pneumatic automatic coupling system that is directed to the fixture through the pallets. Clamp force can be adjusted to meet the cutting conditions without returning pallets to the setup station. Machining rigidity and accuracy are enhanced as well as improving the ease of operation.

# SAMPLE WORKPIECES

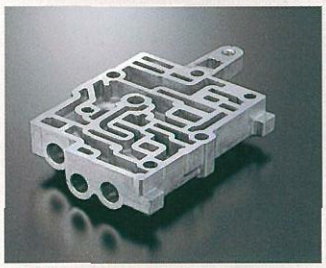
● Testpiece (aluminum)

● Die (aluminum)

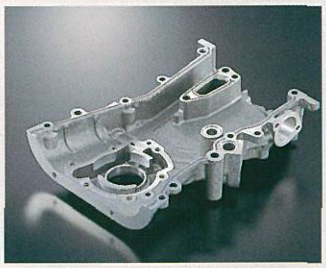
● Die(carbon tool steel)＜HRC60＞



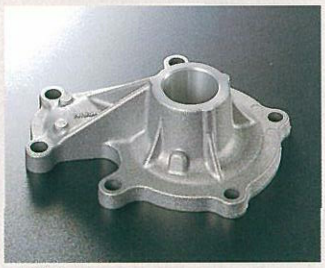
● Cam(chromium-molybdenum steel)



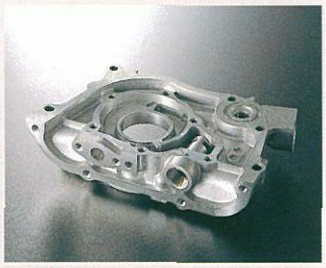
● Control valve



● Front cover

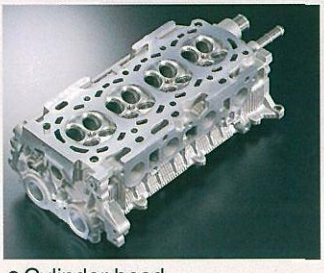


● Water pump cover

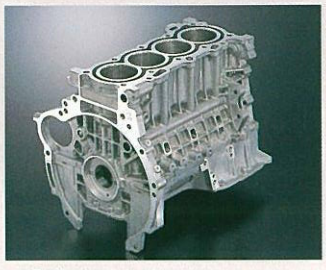


● Side cover

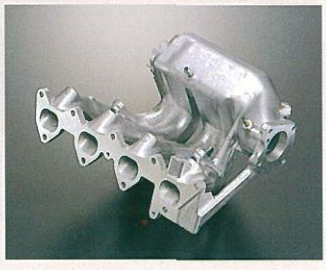
● Casing



● Cylinder head



● Cylinder block

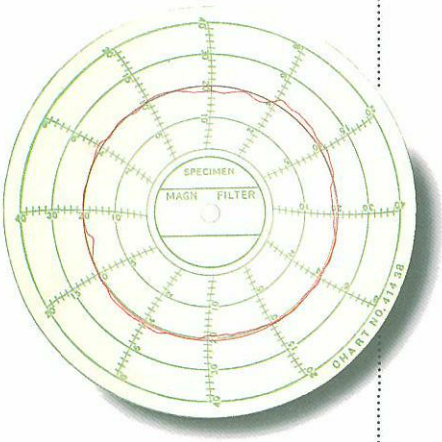


● Manifold

# The SH-500 guarantees power and accuracy in a variety of machining operations

## Reliable Performance

Optimum efficiency and accuracy are always considered in the harmony of design from Mori Seiki. The SH-500 is no exception, offering; high torque cutting at lower speeds, heavy duty cutting at high speeds up to 12,000 $min^{-1}$, and synchronized tapping.

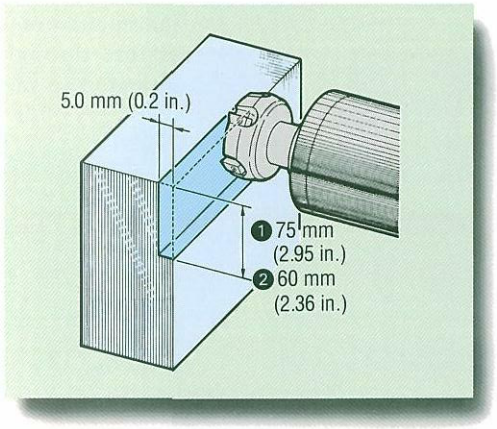



▲Roundness measurement data
<measured roundness: 3 μm (0.00012 in.)>

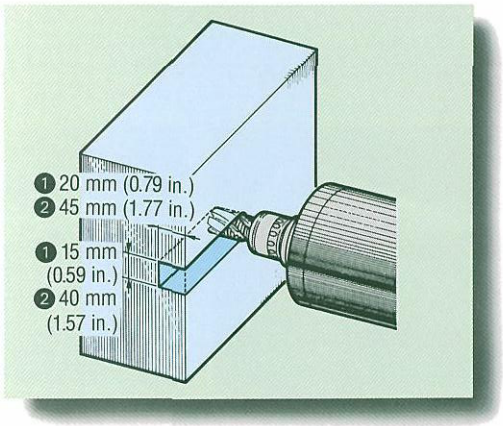
**Roundness** (SH-500/40)

| | |
|---|---|
| Tool | ϕ16 (0.63 in.) end mill |
| Material | A2017 (aluminum) |
| O.D. x depth | ϕ135 x 3 mm (ϕ5.31 x 0.12 in.) |
| Spindle speed | 12,000 $min^{-1}$ |
| Feedrate | 8,000 mm/min (314.96 ipm) |
| Measured roundness | 3μm (0.00012 in.) (Filter: 1-15) |

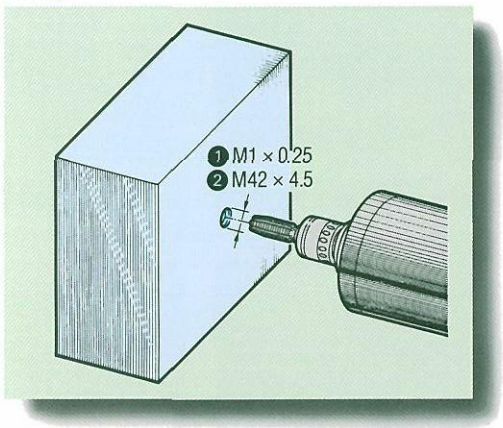
### ■ Face mill




### ■ End mill




### ■ Tap




**Face mill ❶**

| | |
|---|---|
| Tool | ϕ80 (3.15 in.) face mill <6 blades> |
| Material | A2017 (aluminum) |
| Spindle speed | 7,000 $min^{-1}$ |
| Feedrate | 9,000 mm/min (354.33 ipm) |
| Machining rate per minue | 3,375 $cm^3$/min (205.9 $in^3$/min) |

**Face mill ❷**

| | |
|---|---|
| Tool | ϕ80 (3.15 in.) face mill <4 blades> |
| Material | S50C (carbon steel) |
| Spindle speed | 1,200 $min^{-1}$ |
| Feedrate | 2,016 mm/min (79.37 ipm) |
| Machining rate per minute | 605 $cm^3$/min (36.9 $in^3$/min) |

**End mill ❶**

| | |
|---|---|
| Tool | ϕ20 (0.79 in.) end mill <2 blades> |
| Material | A2017 (aluminum) |
| Spindle speed | 12,000 $min^{-1}$ |
| Feedrate | 7,200 mm/min (283.46 ipm) |
| Machining rate per minute | 2,160 $cm^3$/min (131.8 $in^3$/min) |

**End mill ❷**

| | |
|---|---|
| Tool | ϕ40 (1.57 in.) end mill <5 blades> |
| Material | S50C (carbon steel) |
| Spindle speed | 320 $min^{-1}$ |
| Feedrate | 96 mm/min (3.78 ipm) |
| Machining rate per minute | 172.8 $cm^3$/min (10.5 $in^3$/min) |

**Tap ❶**

| | |
|---|---|
| Tool | M1 × 0.25 tap |
| Material | S50C (carbon steel) |
| Spindle speed | 3,000 $min^{-1}$ |
| Feedrate | 750 mm/min (29.53 ipm) |

**Tap ❷**

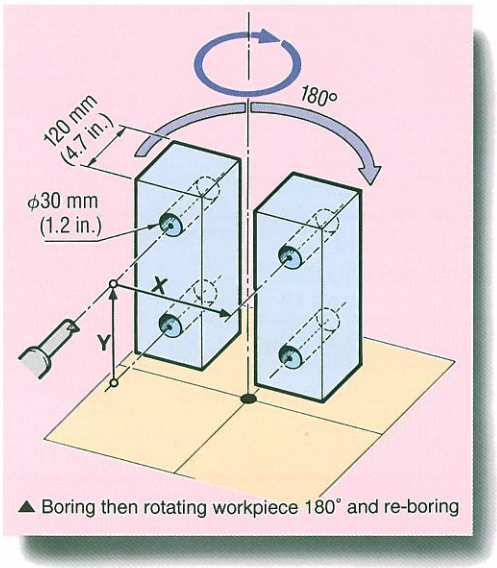
| | |
|---|---|
| Tool | M42 × 4.5 tap |
| Material | S50C (carbon steel) |
| Spindle speed | 80 $min^{-1}$ |
| Feedrate | 360 mm/min (14.17 ipm) |

- The above data is obtained by SH-500/40 High-output specification machine.
- The results indicated in this catalog may not be obtained due to differences in environmental conditions during measurement and cutting conditions.

## Data confirms accuracies

After cutting several typical machining patterns (geometries) on the SH-500, the results were measured using a coordinate measuring machine. Boring test data is shown at the right.

### ■ True Position boring test




▲ Boring then rotating workpiece 180° and re-boring

### Boring test data

The concentricity (true position) of holes bored from both sides is measured. Accuracies include table indexing as well as axis positioning accuracy.

- When axis movement is included in the test cut:

| | Concentricity (X) | Concentricity (Y) |
|---|---|---|
| Permissible error | 5 μm | 5 μm |
| Measured error | 2 μm | 3 μm |

- When axis movement is not included in the test cut:

| | Concentricity (X) | Concentricity (Y) |
|---|---|---|
| Permissible error | 5 μm | 5 μm |
| Measured error | 1 μm | 2 μm |

Note: The results indicated above may not be obtained due to differences in environmental conditions during measurement and cutting conditions.

## Basic High Speed Machining

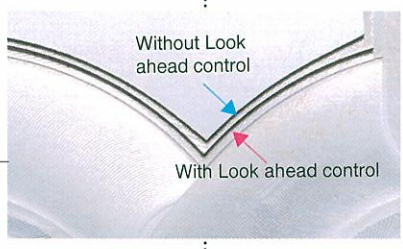
Featured as a standard specification of the SH-500 is "Look ahead control".* This function maintains profile accuracy as speeds and feeds are increased while contouring.

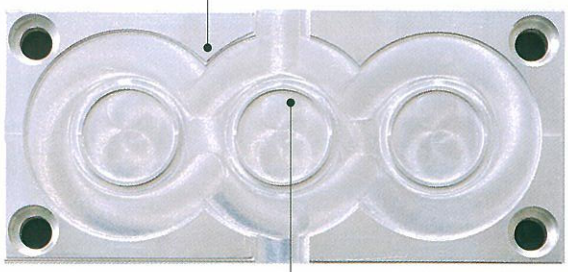
### Look ahead control

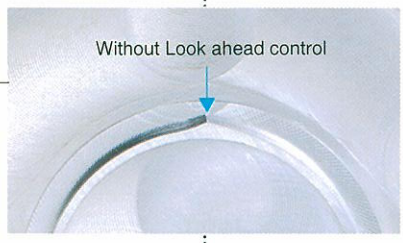
- Look Ahead Feed Forward
- Automatic Corner Deceleration
- Automatic Radial Feedrate Clamp
- Linear Accel/Decel Before Interpolation

*For three dimensional machine requiring ultra small increments you may require the advanced level of high speed machining (High-precision contour control)

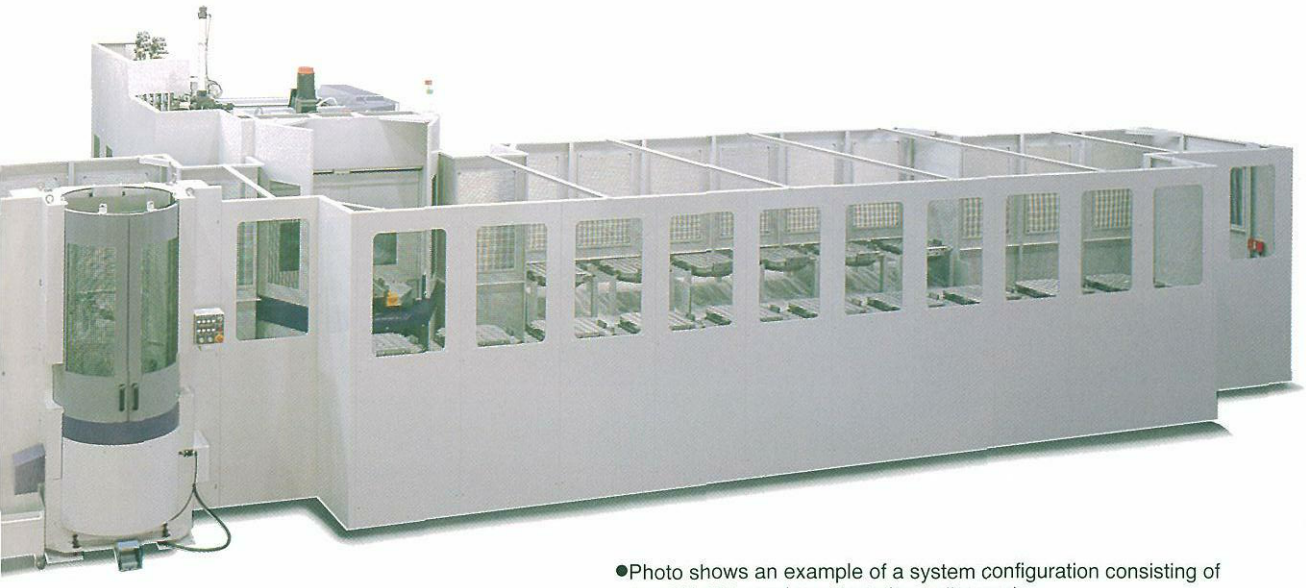
▲With Look ahead control the corner is machined to a sharp edge as programmed
▲Without Look ahead control the corner is machined to a dull (rounded) edge



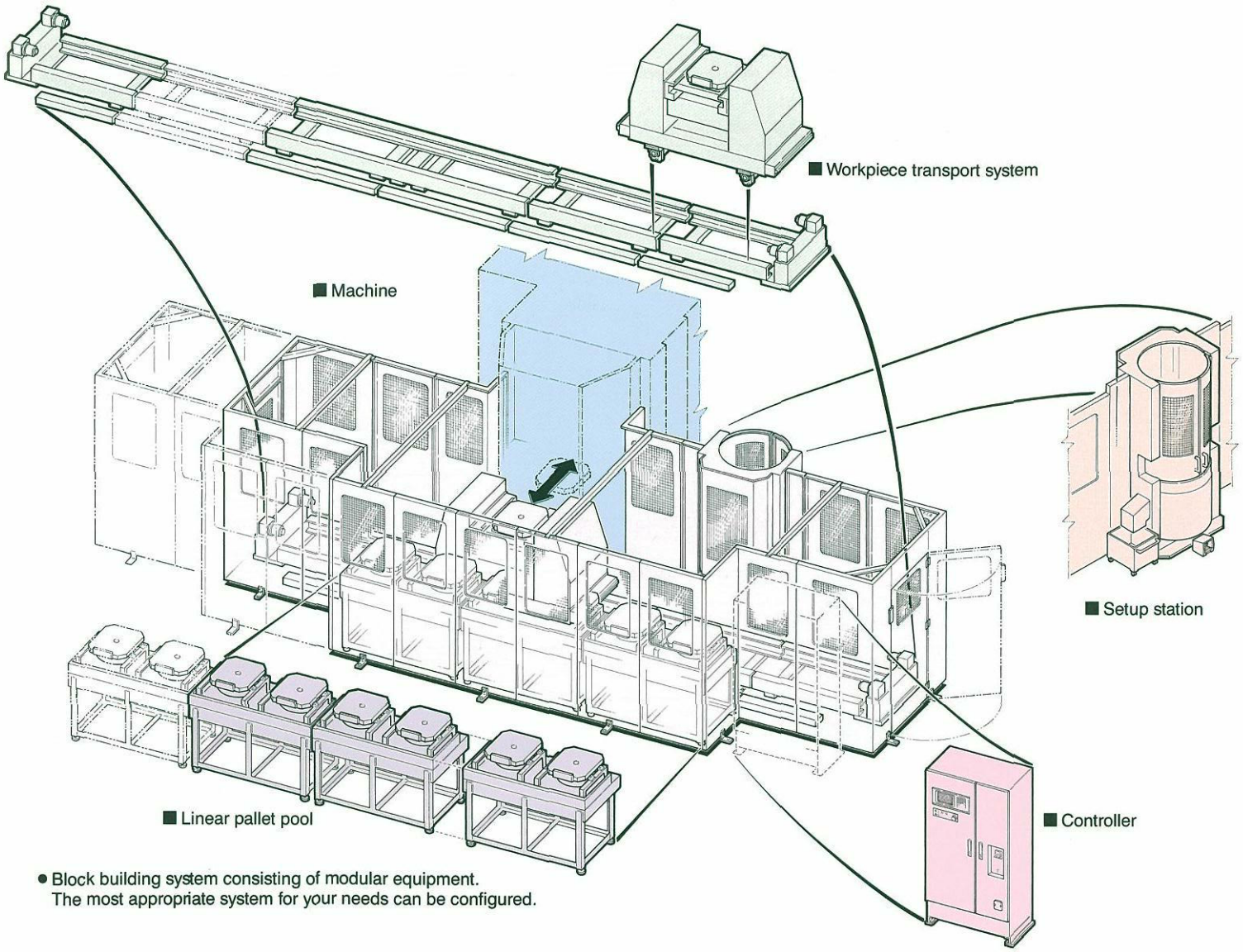






▲With Look ahead control the tool path is compensated (corrected) when using circular interpolation resulting in a more accurate circle.

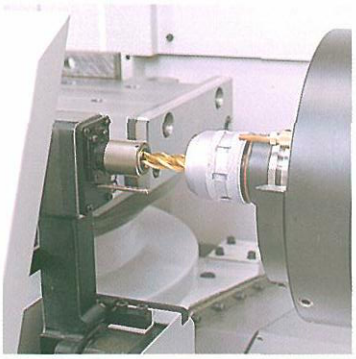


●Photo shows an example of a system configuration consisting of two SH-500s and an 18-station pallet pool.

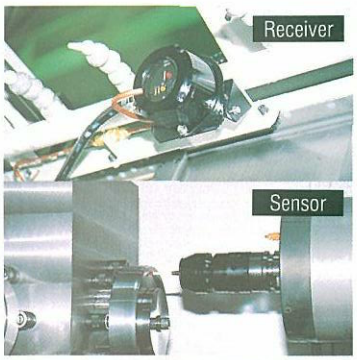



● Block building system consisting of modular equipment.
The most appropriate system for your needs can be configured.

## OPTIONAL FEATURES



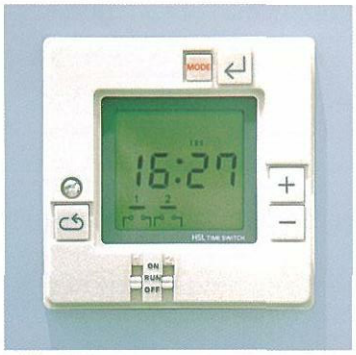
● Tool length measurement




● Automatic measurement (probe sensor)

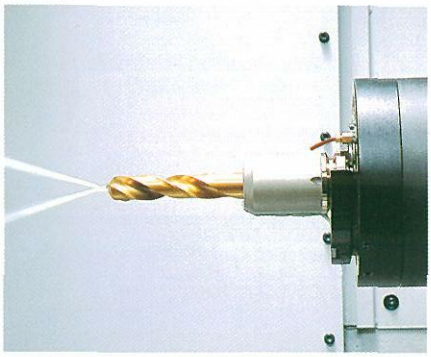
● Auto-coupler

● Full 4th axis rotary table




● Weekly timer

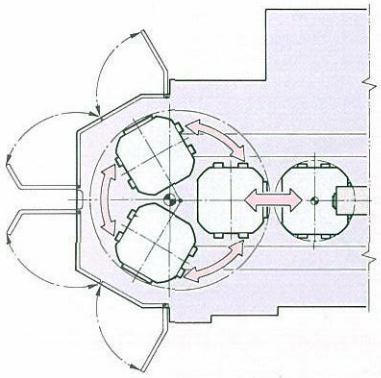
● Coolant gun



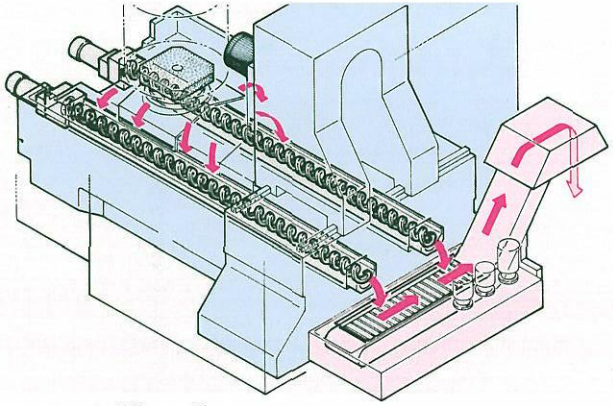
● Through-spindle coolant system

● High-pressure coolant system
(Max. 6.9 MPa)

● 6-station pallet pool



● 3-station APC



● Chip conveyor outside machine
< spiral type in-machine chip conveyor is standard >

## STANDARD/OPTIONAL FEATURES

| Item | Standard features | Optional features |
|---|---|---|
| **Spindle** | ☐ 15/11 kW (20/15 HP) motor<br>☐ 12,000 $min^{-1}$<br>☐ *Oil cooler* | ☐ 22/18.5 kW (30/24.8 HP) motor<br>☐ 20,000 $min^{-1}$<br>☐ *Two-face constrained tools*[*1] |
| **ATC magazine** | ☐ 40-tool | ☐ 60-tool ☐ 240-tool<br>☐ 120-tool<br>☐ 180-tool |
| **APC** | ☐ 2-station turn-type | ☐ 3-station turn-type |
| **Table/Pallet** | ☐ 1° indexing<br>☐ Tap pallet | ☐ Full 4th axis rotary table (0.001°)<br>☐ T-slot pallet<br>☐ Auto-coupler for fixture clamp (hydraulic/pneumatic) |
| **Angle plate** | | ☐ One-sided angle plate<br>☐ Two-sided angle plate<br>☐ 4-sided angle plate<br>☐ Sub-table |
| **High accuracy control** | ☐ Look ahead control | ☐ High-precision contour control<br>☐ Direct scale feedback |
| **Measurement** | | ☐ Contact type sensor (probe sensor)<br>• Automatic measurement<br>• Automatic centering<br>☐ Contact type sensor (table mount)<br>• Automatic tool length measurement<br>• Automatic tool breakage detection<br>☐ Z-axis zero point setting tool<br>☐ Automatic bored diameter *compensation*<br>☐ Alignment indicator arbor<br>☐ Independent tool presetter |
| **Coolant** | ☐ Coolant system<br>☐ Shower coolant<br>☐ Oil-hole drill coolant system | ☐ High-pressure coolant system (6.9 MPa)<br>☐ Through-spindle coolant system[*2] (center[*3]/side)<br>☐ Oil shot system<br>☐ Oil mist system<br>☐ Coolant cooling unit<br>☐ Oil skimmer |
| **Chip disposal** | ☐ Chip conveyor inside machine (spiral type)<br>☐ Tool tip air blow system | ☐ Chip conveyor outside machine (hinge type/scraper type)<br>☐ Chip bucket<br>☐ Coolant gun<br>☐ Air blow system<br>☐ Mist collector<br>☐ Dust collector |
| **Pallet pools** | | ☐ 6-station pallet pool<br>☐ 8-station pallet pool<br>☐ Linear pallet pool<br>☐ 3D pallet pool |
| **Operation support device/function** | ☐ Automatic power-off system<br>☐ Signal indicator | ☐ Conversational programming unit<br>☐ Weekly timer<br>☐ Load monitor<br>☐ Work counter<br>☐ Total counter |
| **Others** | ☐ Built-in worklight ☐ Hand tools<br>☐ Leveling block | ☐ Earth leakage breaker |
| **Safety features** | ☐ Full cover (incl. ceiling cover)<br>☐ Door interlock system (incl. mechanical lock)<br>• Right side door/Magazine door/ Setup station door<br>☐ Door interlock system<br>• Electrical cabinet<br>☐ Low hydraulic pressure detecting switch<br>☐ Low air pressure detecting switch | ☐ Danger sensing device interface[*4] |

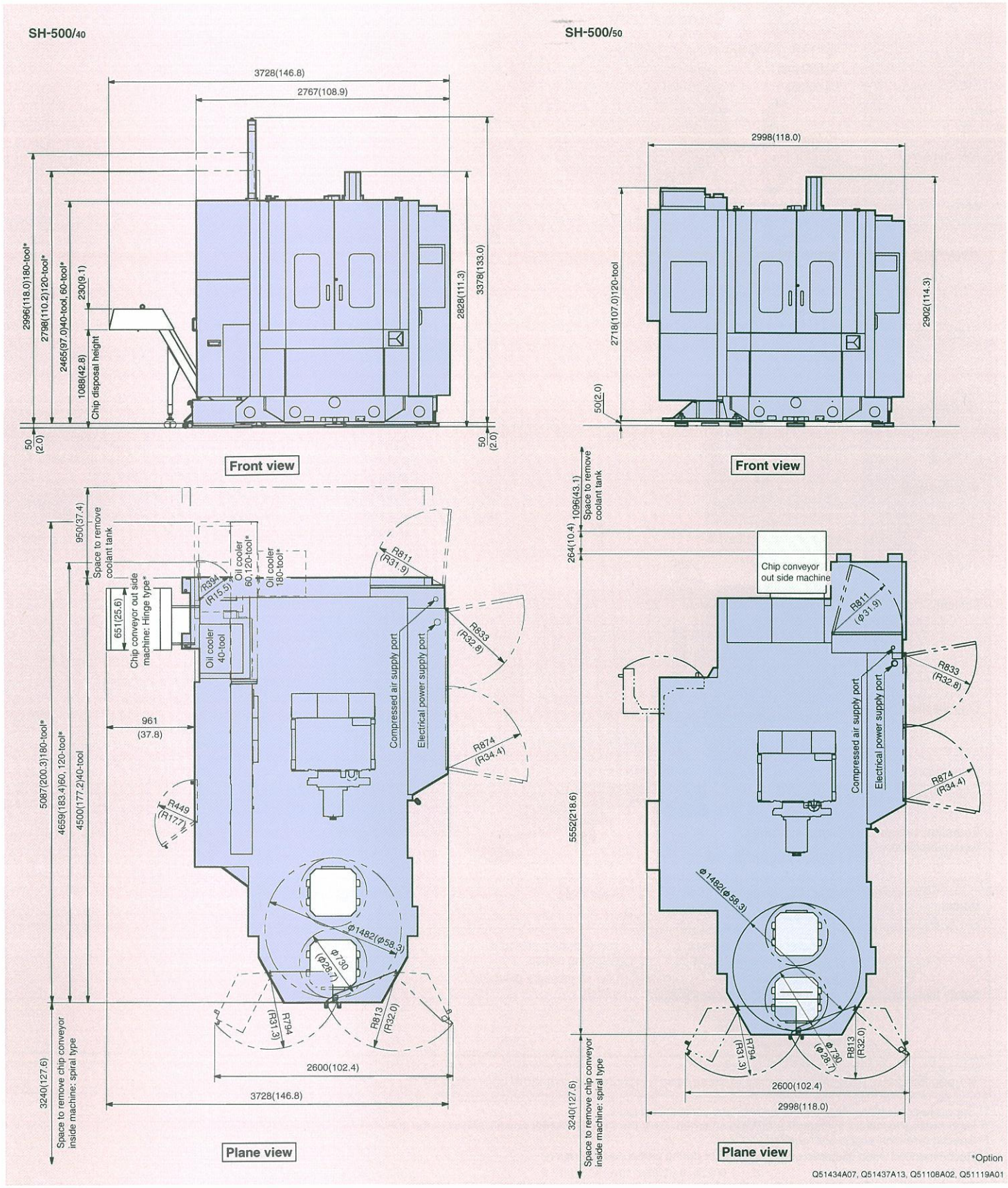
• Specifications, accessories, safety devices, and functions are available upon request.

*1 Separate consultation is required for two-face constrained tools.
*2 High-pressure coolant system (6.9 MPa) is attached. Only the through-center specification can be selected with two-face constrained tools.
*3 Special retention knobs are required.
*4 Recommended when oil-based coolant is used or during unmanned operation.

• ☐ is check box. • The details given above and the specifications are subject to change without notice.
• Some options are not available in particular regions. For details contact Mori Seiki.

# INSTALLATION

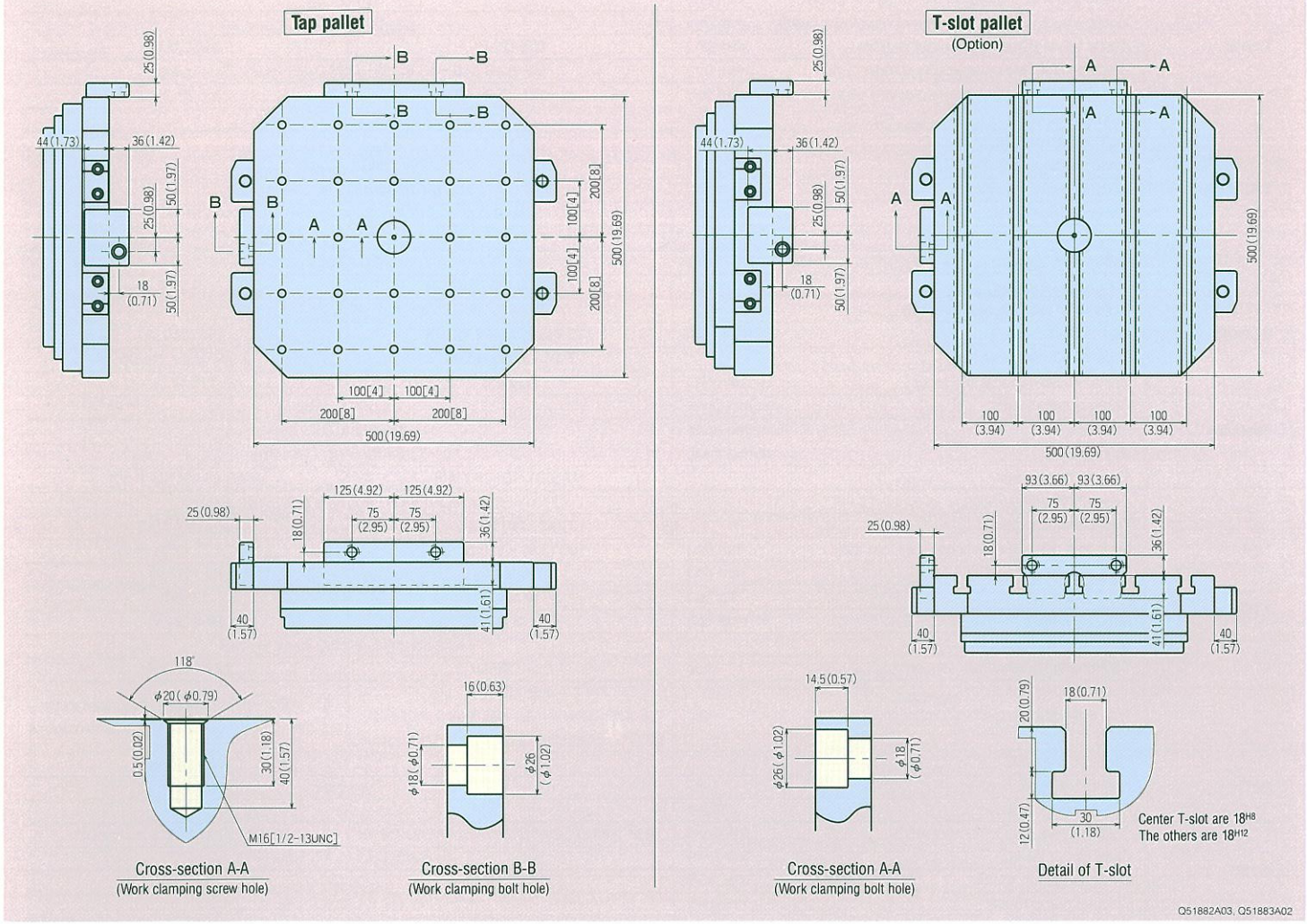
mm (in.)

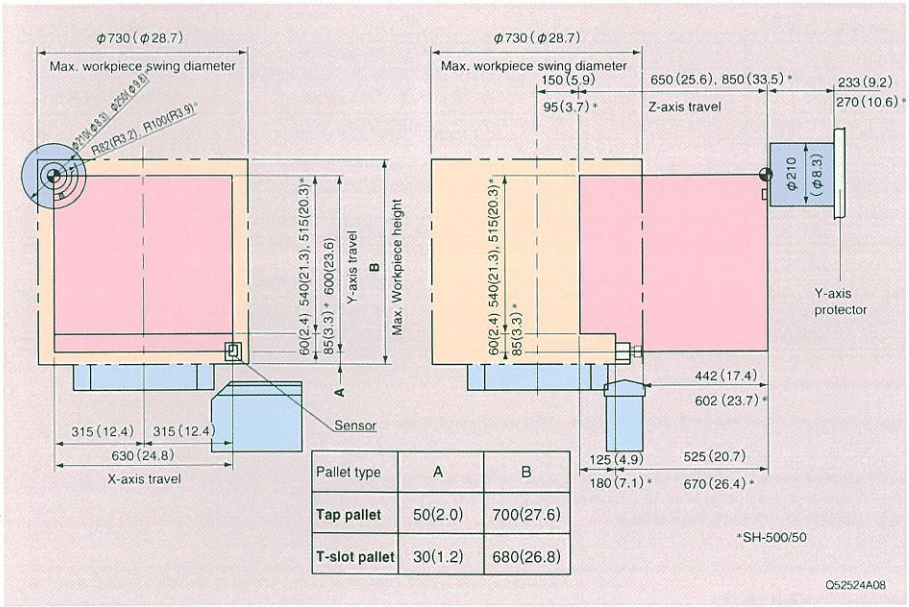


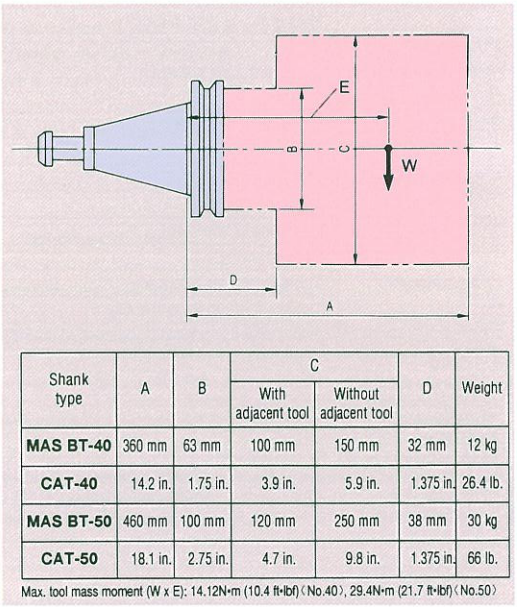

● Figures in inches are converted from metric measurement.

# PALLET DIMENSIONS • TRAVEL • TOOL APPLICATIONS

mm (in.)



| Shank type | A | B | C | | D | Weight |
|---|---|---|---|---|---|---|
| | | | With adjacent tool | Without adjacent tool | | |
| MAS BT-40 | 360 mm | 63 mm | 100 mm | 150 mm | 32 mm | 12 kg |
| CAT-40 | 14.2 in. | 1.75 in. | 3.9 in. | 5.9 in. | 1.375 in. | 26.4 lb. |
| MAS BT-50 | 460 mm | 100 mm | 120 mm | 250 mm | 38 mm | 30 kg |
| CAT-50 | 18.1 in. | 2.75 in. | 4.7 in. | 9.8 in. | 1.375 in. | 66 lb. |

Max. tool mass moment (W x E): 14.12N•m (10.4 ft•lbf)〈No.40〉, 29.4N•m (21.7 ft•lbf)〈No.50〉

- [ ] originally designed in inch specifications.
- Figures in inches are converted from metric measurements.

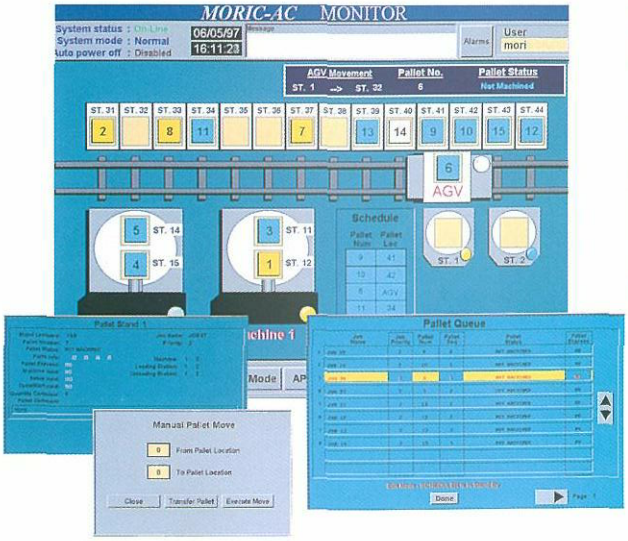
# Expanding the system meeting the needs to boost productivity

## The Linear Pallet Pool System easily expandable and flexible

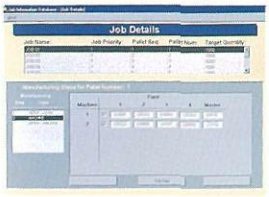
The new linear pallet pool system is based on a modular approach to machines and related equipment, allowing construction of "block-built" systems on the scale required to meet individual needs. Since these systems are customized, they are easy to introduce, and they offer top level cost performance.

Furthermore, these systems will be operated with easy-to-understand software loaded into a personal computer, which should make them very easy to run.* Managers will be able to get a quick and easy understanding of the system's operation status and machining productivity. The ability to respond to interrupts for high-priority orders offers a great deal of another key ingredient for today's manufacturer-flexibility.

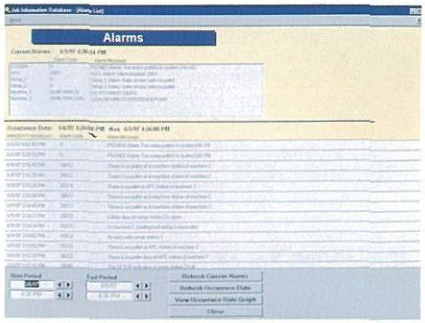
*Personal computers and software required for system operation are options.

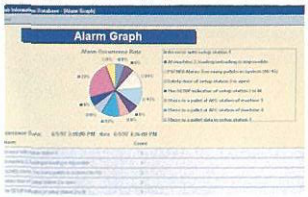



■ MORIC-AC: Monitor screen
Monitors operating status of the system. Also the available functions are used for the entry of pallets and control of the A.G.V.


■ Job information screen
This system allows multiple workpieces to be produced in equal quantities by entering detailed data for each pallet number.




■ Alarm screen
Preserves data relating to alarms that occur at machines, at AGVs, at setup stations, and in the system, and represents their order of occurrence and ratio of occurrence in table and graph forms.

## ■ Specifications of Linear Pallet Pool System

| Control unit | Number of machining centers | Number of setup stations | Number of pallet racks | Number of pallets |
|---|---|---|---|---|
| PMC | 1 | 1 | Max. 28 | • Random method: Max. 29 pallets (number of racks + 1) |
| MORIC-AC (special controller) | Max. 8 | Max. 5 | Max. 60 | • Random method: Max. 68 pallets (number of racks + number of machining centers) |

| Table working surface | Table loading capacity | Workpiece size | Pallet transfer equipment speed | Pallet transfer equipment drive method |
|---|---|---|---|---|
| 500 × 500 mm* (19.7 × 19.7 in.) | Max. 500 kg* (1,100 lb.) | Max. φ730 mm × 700 mm* (φ28.7 in. × 27.6 in.) | 75 m/min (2,953 ipm) | AC servo motor + rack and pinion |

*The same specification as the standalone model of the SH-500.
• Some options are not available particular regions. For details contact Mori Seiki.

# MACHINE SPECIFICATIONS

| Item | | | SH-500/40 | SH-500/50 |
|---|---|---|---|---|
| Travel | X-axis travel (Longitudinal movement of column) | mm (in.) | 630 (24.8) | |
| | Y-axis travel (Vertical movememt of spindle head) | mm (in.) | 600 (23.6) | |
| | Z-axis travel (Cross movement of table) | mm (in.) | 650 (25.6) | 850 (33.5) |
| | Distance from table surface to spindle center | mm (in.) | 50—650 (2.0—25.6) [30—630 (1.2—24.8): T-slot pallet] | |
| | Distance from table center to spindle gage plane | mm (in.) | 150—800 (5.9—31.5) | 95—945 (3.7—37.2) |
| Table | Working surface | mm (in.) | 500×500 (19.7×19.7) | |
| | Max. workpiece swing diameter | mm (in.) | 730 (28.7)*1 | |
| | Table loading capacity | kg (lb.) | 500 (1,100) | |
| | Max. workpiece height | mm (in.) | 700 (27.6) [680 (26.8): T-slot pallet] | |
| | Table surface configuration | mm (in.) | M16 (1/2—13 UNC) Tap: 24 pcs. Pitch: 100 (4*2) | |
| | Minimum table indexing angle | | 1° [Full 4th axis rotary table : 0.001°] | |
| | Table indexing time | sec | 2.0 〈90°〉 | |
| Spindle | Max. spindle speed*3 | $min^{-1}$ | 12,000 [20,000] | 10,000 |
| | Number of spindle speed ranges | | 1 | |
| | Max. spindle torque | N·m (ft·lbf) | 113 (83.2) [204 (150.4)] | 204 (150.4) |
| | Type of spindle taper hole | | 7/24 Taper, No.40 | 7/24 Taper, No.50 |
| | Spindle bearing inner diameter | mm (in.) | 85 (3.3) | 110 (4.3) |
| Feedrate | Rapid traverse rate | mm/min (ipm) | 32,000 (1,260) | |
| | Feedrate | mm/min (ipm) | 1—16,000 (0.01—630) | |
| | Jog feedrate | mm/min (ipm) | 0—1,260 (0—50) 〈15 steps〉 | |
| ATC | Type of tool shank | | MAS BT-40 [CAT-40] | MAS BT-50 [CAT-50] |
| | Type of retention knob | | For MORI SEIKI 90° type [MAS Ⅰ·Ⅱ, ISO] | |
| | Tool storage capacity | | 40 [60, 120, 180, 240] | 60 [120, 180] |
| | Max. tool diameter 〈without adjacent tools〉 | mm (in.) | 100 (3.9) 〈150 (5.9)〉 | 120 (4.7) 〈250 (9.8)〉 |
| | Max. tool length | mm (in.) | 360 (14.2) | 460 (18.1) |
| | Max. tool mass | kg (lb.) | 12 (26.4) | 30 (66) |
| | Max. tool mass moment | N·m (ft·lbf) | 14.12 (10.4) | 29.4 (21.7) |
| | Method of tool selection | | Fixed address, shorter route access | |
| | Tool changing time (tool-to-tool)*4 | sec | 1.3 〈MAS〉 | 2/3*5 〈MAS〉 |
| | Tool changing time (chip-to-chip)*4 | sec | 3.9 〈MAS〉<br>4.3 〈DIN〉: in case of adjacent tool of tool change position.<br>6.2 〈DIN〉: in case of most distant tool in a 40-tool magazine. | 9.1 〈DIN〉: in case of adjacent tool of tool change position.<br>17.5 〈DIN〉: in case of most distant tool in a 120-tool magazine. |
| APC | Number of pallets | | 2 [3] | |
| | Method of pallet change | | Turn-type | |
| | Pallet changing time*4 | sec | 6 | |
| Motor | Spindle drive motor (30 min/cont) | kW (HP) | 15/11 (20/15) [22/18.5 (30/24.8) 〈15 min/cont〉] | 22/18.5 (30/24.8) 〈15 min/cont〉] |
| | Feed motor (X/Y/Z) | kW (HP) | 3.8/3.8/3.8 (5.1/5.1/5.1) | |
| | Hydraulic pump motor | kW (HP) | 2.2 (3) | |
| | Coolant pump motor | kW (HP) | 1.1 + 1.1 (1.5 + 1.5) | |
| Power source | Electrical power supply | kVA | 45.5 [Full 4th axis rotary table: 46.5] | 50 [Full 4th axis rotary table: 51] |
| | Compressed air supply | MPa (psi), L/min (gpm) | 0.5 (71), 765 (202) 〈ANR*6〉 | |
| Tank capacity | Hydraulic oil tank capacity | L (gal.) | 40 (10.6) | |
| | Lubricant tank capacity | L (gal.) | 0.7 (0.2) 〈for spindle〉<br>0.7 (0.2) 〈for guide and ball screw〉<br>74 (19.5) 〈Oil cooler〉 | |
| | Coolant tank capacity | L (gal.) | 500 (132) | |
| Machine size | Machine height | mm (in.) | 3,428 (135.0) | 2,852 (112.3) |
| | Floor space | mm (in.) | 2,900×4,550 (114.2×179.1) | 2,998×5,552 (118.0×218.6) |
| | Mass of machine | kg (lb.) | 14,000 (30,800) | 15,100 (33,220) |
| Accuracy*7 | Positioning accuracy | mm (in.) | 0.005 (0.0002) | |
| | Repeatability | mm (in.) | ±0.001 (±0.00004) | |
| | Table indexing accuracy | | 0°0'3" 〈for 1° indexing〉 [for full 4th axis rotary table: 0°0'5"] | |
| | Table indexing repeatability | | ±0°0'1" 〈for 1° indexing〉 [for full 4th axis rotary table: ±0°0'1"] | |
| | Pallet changing repeatability (X,Y and Z) | mm (in.) | 0.003 (0.0001) | |

[ ] Option
*1 With the optional 3-station turn type APC, the maximum workpiece diameter on the setup station is 610 mm (24.0 in.).
*2 Originally designed in inch specifications.
*3 Depending on restrictions imposed by the workpiece clamping device, jig and tool used, it may not be possible to rotate at the maximum spindle speed.
*4 At 60 Hz.
*5 More than 10 kg (22 lb). tool weight
*6 ANR refers to a standard atmospheric state; i.e., temperature at 20℃ (68°F); absolute pressure at 101.3 kPa {29.9 inHg }; and relative humidity at 65%.
*7 The above precision values were obtained in accordance with JIS B6336, with measurements being taken at a room temperature of 23℃±1℃(73.4°F±1.8°F) and with all units of the machine having been run until reaching stability with regard to temperature, lubrication, etc.

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# NC UNIT SPECIFICATIONS

| Item | | MSC-502 |
|---|---|---|
| Controls | Simultaneous controlled axes | 3 axes: X, Y, Z<br>Simultaneously controllable axes: 3 axes (positioning and linear interpolation)<br>2 axes (circular interpolation) |
| | Least command increment | 0.001 mm (0.0001″) |
| | Least input increment | 0.001 mm (0.0001″) |
| Spindle functions | Spindle speed command | S5 digit direct command |
| | Spindle speed override | 50—120% (in 10% increments) |
| Feed functions | Feedrate override | 0—150% (in 10% increments) |
| | Dwell | Stop time (sec) command: G04 |
| | Zero return | Return to machine zero point: G27—G30 |
| | Pulse handle feed | Manual pulse generator: 0.001/0.01/0.1 mm (0.0001″/0.001″/0.01″) per pulse |
| | Manual jog feed | 0—1,260 mm/min (0—50 ipm) (15 steps) |
| | Dry run | Moves at jog feedrate regardless of feed command |
| | Rapid traverse rate override | F0 (fine feed), 25/100% |
| Tool functions | Tool number command | T4-digit |
| | Tool length measurement | Offset value is entered when soft-key is pressed |
| | Cutter radius offset | G40—G42 commands |
| | Tool length offset | G43·G44·G49 |
| | Tool position offset | G45—G48 |
| | Number of tool offsets | 64 sets (length,radius geometry and wear offset) |
| Programming functions | Absolute/Incremental programming | G90/G91 |
| | Canned cycle | G73·G74·G76·G80—G89 |
| | Decimal point input | Inputs values with decimal point |
| | Inch/Metric conversion | G20/G21 |
| | Circular interpolation by radius programming | Specifying by radius R instead of I, J, and K commands |
| | Sub-program | Up to 4 nestings |
| | Work coordinate system selection | G54—G59 |
| | Local/Machine coordinate system | G52/G53 |
| | Maximum programmable dimension | ±99,999.999 mm (±9,999.9999″) |
| | M function | M3-digits |
| Tape functions | Input code | ISO/EIA automatic discrimination |
| | I/O interface | RS-232-C |
| | Memory card interface | PCMCIA interface |
| | Part program storage | 320m (1,050′) |
| | Number of stored programs | 125 programs |
| | Search function | Sequence No. search, Program No. search, Address search |
| Other functions | MDI/CRTunit | 10.4″ TFT, Keyboard for data input, Soft-keys |
| | Programmable data input | Tool offset amount and work offset are entered by programming G10, G11 |
| | Look ahead control | Configuration precision is maintained even when feedrate is increased |
| | Synchronized tapping | Rigid tap function |
| | Pattern cycle | Hole position on line, circle and square (G300—G305)<br>Finishing shape for circle and square (G306—G309) |
| | Stored stroke check 1 | Overtravel controlled by software |
| | Background editing | Part program storage and editing during automatic operation |
| | Help function | Alarm contents and operation display |
| | Display of PMC alarm message | Displays up to 25NC alarms stored in memory |
| | Load meter display | Spindle and servo motor's loads are displayed on screen |
| | Stored pitch error compensation | Pitch error compensation up to 128 positions for each axis |
| | Mirror image | Reverse of axis movements (X-, Y-, Z-axis: Setting screen X-, Y-axis: M function) |
| | Self-diagnostic function | Self-diagnostic test |
| | Helical interpolation | Simultaneous interpolation of circulation and linear interpolation<br>(max. 2 axes other than circular interpolation axes) |
| Options | Additional part program storage (in total) | 640/1,280/2,560/5,120 m (2,100′/4,200′/8,400′/16,800′) |
| | Additional registered programs (in total) | 200/400/1,000 programs |
| | Additional number of tool offests (in total) | 99/200/400/499/999 |
| | Others | ● Polar coordinate interpolation<br>● Cylindrical interpolation ● Addition of optional block skip<br>● Tool life management ● Playback function<br>● Handle interruption ● Stored stroke check 2<br>● Arbitrary angle, chamfer, corner R designation<br>● F1-digit feed ● Uni-directional approach ● Scaling<br>● Coordinate system rotation ● Program restart |

● Conversational automatic programming system (MSD-502) is also available as an option.

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