Higher accuracy produces greater profitability

YASDA PRECISION CENTER

Model TT & TH

YBM 10T-100TT
YBM 10T-TH

Saxis

Thermal Distortion Stabilizing System
High-performance Spindle with Preload Self-adjusting System

YASDA
Integration of traditional technology and smart advanced technology

*YBM10T-100TT* and *YBM10T-TH* were developed by fully putting YASDA’s advanced concepts and the technology to manufacture traditional high-precision machining centers into them. The subject is “high-precision and high-quality profiling of difficult-to-cut materials.” This large five-axis machine realizes the above subject with excellent efficiency. It is a superior machine which achieves a higher degree of confidence and unlimited possibility serving as an engine of the times and industry.

**Main features**

- **Preload self-adjusting spindle mounted.** Both heavy duty cutting at low spindle speed and highly accurate rotation with low-heat generation at high spindle speed are achieved.
  - A two-motor torque tandem control spindle (option) mounted for YBM10T-100TT.
- **Thermal distortion stabilized system equipped.** This enables stable high-precision processing for an extended period of time by minimizing the machine-body thermal distortion caused by the factory environment.
- **YASDA’s unique advanced function “HAS-3” equipped.** This enables extremely high-precision processing at high speed by accurately reflecting NC data.
- **High-precision five-axis processing support function “i-CAL” equipped.** This enables high-precision and high-grade five-axis processing by accurately searching for the central coordinates of the important “rotation axis” and “spindle” which exert influence on processing accuracy and automatically sets them.

**PRECISION CENTER**

"YBM10T-100TT" is a newly developed simultaneous 5-axis machining center, which is equipped with a 1,000-square-mm tilting table for YBM10T. It is new to the lineup of YBM10T and a high-end model machining center developed for performing stable high-precision processing with a high degree of efficiency as a theme. This processing ranges from difficult-to-cut materials to complicated profiling, in addition to aircraft parts which have recently been in high demand.
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Main components and their mechanisms

I Table

Trunnion table of complete symmetrical structure mounted - High-grade processing capability has been improved

A large 1,000-square-mm table is driven with trunnions of complete symmetrical structure supported coaxially. The driving force of the A-axis (tilt axis) transfers the rotation of the servo motor through the speed reducer to pinion gears to drive the segment gear mounted on the base (cradle) of the B-axis (rotation axis). The rotary encoder mounted on both sides of the twin-drive cradle drive shaft also performs position tandem control to achieve non-backlash positioning with high accuracy. For the angle of the tilt axis, the processing point dividing accuracy is secured by measuring each angle at both ends of the cradle. Heat generation can also be controlled by enhancing the efficiency of a conventional drive mechanism.

High rigidity, high precision drive and guide system

The guide mechanism of the B-axis (rotation axis) employs a “three-roller bearing” which achieves both high rigidity and rotational accuracy. It also has a “high-resolution rotary encoder” as standard for the detection of a dividing angle. This allows a wide range of high-precision processing of heavy weight work from difficult-to-cut materials to profiling.

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Option</th>
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</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>1,500mm</td>
<td>——</td>
</tr>
<tr>
<td>Y-axis</td>
<td>1,200mm</td>
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<tr>
<td>Z-axis</td>
<td>1,100mm</td>
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</tr>
<tr>
<td>B-axis</td>
<td>360°</td>
<td>——</td>
</tr>
<tr>
<td>A-axis</td>
<td>——5°</td>
<td>——</td>
</tr>
</tbody>
</table>

II Spindle

Self-adjusting spindle equipped with innovative functions

The preload self-adjusting spindle (Model SA type) developed by YASDA is equipped with functions completely different from conventional concepts. This spindle, which has appealed to many users since the beginning of development, differs from the conventional fixed type preload system. It has a mechanism of providing a large preload at low spindle speed and reducing the preload according to the bearing heat generated at high spindle speed. This mechanism helps to achieve both heavy duty cutting at low spindle speed and highly accurate rotation at low-heat generation at high spindle speed.

The spindle and the spindle motor are connected coaxially by a diaphragm coupling. This enables highly accurate rotation of the spindle at the full range of its rotation speed, in a variety of processing, such as heavy duty processing, high speed cutting on hardened steel, and thrust-reversing helical end milling.

Torque tandem control spindle

In this system, two low-speed and high-speed motors operate the spindle. The system has a mechanism for compensating to obtain a larger torque by the output of the high-speed motor where a required torque cannot be obtained only by the low-speed motor in heavy duty processing, etc. This allows the spindle to deliver high performance and provide stable work with high reliability for heavy weight work processing.

Spindle speed
Max. 8,000/min
Main components and their mechanisms

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Spindle speed
Max. 8,000min⁻¹

Spindle power & torque diagram
III Pallet and chucking mechanism to support high-precision, high-grade processing

High-precision pallet with high rigidity

A highly rigid pallet with a thickness of 175 mm provides high precision with the top surface accurately scraped and maintains its precision for an extended period of time.

With the flat bottom surface, these pallets are compatible with various transfer systems, automatic warehouses, and flexible manufacturing systems (FMS).

Powerful clamping force, high positioning accuracy - Unique pallet chucking mechanism

To realize high efficiency and high-grade processing by loading heavyweight work, the pallet chucking mechanism is an extremely important mechanism that must have high rigidity and stable repeatability of positioning accuracy.

YBM10T-100TT, a newly developed pallet chucking mechanism, performs positioning with V-shaped and flat-shaped blocks. In this mechanism, pull rods placed at four points powerfully draws a pallet.

With the above, this pallet chucking mechanism can sufficiently withstand the moment load associated with the rotation of the tilt axis and maintains stable, high-precision repeatability of high positioning accuracy.

YBM10T is a heavy-duty machine which provides high-speed and high-precision processing for the world’s heaviest work (5 tons).

To adapt to industrial trends and changes in requests for parts processing and enable a wider variety of processing with a higher degree of efficiency, this YBM10T includes a newly-developed, compact, and powerful built-in spindle.

It is configured with a large simultaneous five-axis controller of the tilting head type, as YASDA’s new product lineup.
Pallet and chucking mechanism to support high-precision, high-grade processing

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Key components and their mechanisms

I Spindle

Dedicated spindle equipped with a preload self-adjusting spindle

As a newly-developed built-in spindle dedicated to a tilting head, the “preload self-adjusting spindle” in which many users have full confidence is configured. The greatest strengths of highly accurate rotation of the spindle and high-precision processing at the full range of rotation speed are exerted by achieving both heavy duty cutting at low spindle speed and highly accurate rotation with low-heat generation at high spindle speed. Its superior capability is compatible with all types of processing including difficult-to-cut materials of castings and heat-resistant alloys. This spindle provides two types: high-speed rotation type and high-torque type.

WORK DIMENSION

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II Pallet and pallet chucking mechanism

Pallet chucking mechanism

The pallet chucking mechanism consists of highly rigid pallets with a thickness of 150mm and YASDA’s traditional large-diameter curvic couplings. It maintains high precision for an extended period of time:
1) Pallets of high-grade cast iron, with the top surface accurately scraped, maintains high precision.
2) The pallet bottom surface is flat, which is compatible with various transfer systems, automatic warehouses, and flexible manufacturing systems.
In the pallet chucking mechanism, 72 teeth with an engagement angle of 30° placed on the circumference are engaged with no backlash using large-diameter curvic couplings. With automatic aligning, this mechanism delivers high repeatability of positioning accuracy and chucking rigidity.

Curvic coupling cleaning nozzle

Air cleaning nozzles are provided on each tooth bottom side face of the curvic coupling. Air jetted from these nozzles constantly removes minute deposits from curvic coupling tooth surfaces to maintain high chucking precision.
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**Highly rigid basic structure comprising YBM10T-100TT/10T-TH**

To operate large machinery with high precision and stability for an extended period of time, the basic structure of the rigid, highly-durable machine body is indispensable. Key components of YBM10T-100TT/10T-TH have high-precision and high-rigidity construction which is a characteristic of YASDA.

**Bed**

The bed consists of vertical frames with a thickness of 90mm and top horizontal frames with a thickness of 40mm. The most simple ‘H-shaped’ bed is provided with high rigidity. Frames employ solid steel plates. With uniform heat capacity throughout the frames, they maintain stable high precision with no distortion created due to changes in room temperature.

**Column**

A large column of double housing structure has the double-walled box shape. It is provided with superior heat stability. This is due to the highly rigid and bilaterally symmetrical structure with ribs placed inside the both side walls. With the above, stable and high-precision processing is made possible.

**Column (Y-axis) guideway (for 100TT only)**

Column (Y-axis) guideways, with both sides not completely parallel, are slightly bourglass-shaped mounted. This is to make the preload of roller way bearings on both sides of the spindle constant regardless of the spindle head position. This realizes extremely high positioning accuracy with fewer positional changes of the spindle head.

**YASDA’s unique accuracy retention system**

YASDA constructs its unique machine-body accuracy retention system to prevent processing precision from deteriorating due to machine-body heat deformation as a result of heat propagation and transmission of various heat such as heat generated from the working part of the machine body or heat caused by the factory environment.

**Thermal distortion stabilized system (Special specification)**

The factory environment for establishing a machining center has a profound effect on the machine body accuracy. For example, abrupt changes in room temperature, a temperature difference between the upper and lower parts in a room, and radiant heat from the ceiling or wall always distorts machinery due to heat, having an effect on the accuracy of the machine body. YASDA's thermal distortion stabilized system minimizes the effect the factory environment has on the machine body. It realizes always-stable high-precision processing by circulating the liquid coolant controlled at room temperature ±0.2℃ in the main component to prevent abrupt thermal distortion of the machine body.

**Structure to prevent heat transfer to the bed**

If the liquid coolant or chips taking on heat drop onto the bed, the bed will be thermally distorted. YASDA maintains high accuracy of the machine body by placing covers over the slide way and bed to prevent this thermal distortion.

**Cooling of ball screw bracket**

The machine body distortion caused by heat transfer becomes a major impediment to positioning accuracy. YASDA prevents the thermal distortion of the machine body caused by bearing heat generated by providing an oil jacket for a ball screw bracket and circulating cooling oil.
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**Improvement in chip discharge capacity/Doubling the capacity of sliding surface oiling device**

To enable productivity improvement in and unattended processing for an extended period of time, new functions and mechanisms are provided in many places as follows:

1. The improvement in chip discharge capacity is realized by additionally establishing a screw conveyor in the Z-axis direction of the machine to adapt to a large quantity of chips.
2. The capacity of the sliding surface oiling device doubles the conventional one to enable unattended operation for an extended period of time.
3. Sliding surface oil recovery devices are located at one point to improve the ease of maintenance.
4. Water-oil separation and recovery is performed for a water-soluble coolant to reduce the quantity of waste oil.

**Consideration of workability and safety**

To ensure excellent workability and safety is an indispensable factor to stably perform high-efficiency production. YASDA is committed not only to high precision but also to the development of user-friendly safe machining centers, making innovations and improvements in each machine body location. The following is one example of the above:

**Manual tool changer**

In the case where tools are manually removed from the stocker of a large machine where a wide variety of tools are stored, especially handling of heavy tools not only imposes a substantial burden upon personnel but also involves danger. YASDA, considering workability and safety in such conditions, provides a "manual tool changer" to be selected as a special specification.

**Ensuring high visibility**

High visibility, which further surpasses that of conventional machines, is realized to ensure safer work for personnel working inside and outside of the machine. Workability inside the machine is also significantly improved. The "slide steps inside the machine" which can safely expand the work area are provided as an option.
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Extended version

In addition, “YASDA OpeNe” is equipped with various functions that assist automation, such as the tool life management function, production control function, and stored tooling content confirmation function, to achieve high productivity and automation. In addition, wide-ranging needs such as machined product accuracy management can be met.

Tool management function
Well-developed management functions such as tool life management and spare tool management

Production control function
The operating conditions of the machine are summarized and displayed. Data of the processing program, and operating rate and operating hours on a daily basis are tabulated and displayed as graphs.

Stored tooling content confirmation system
This is a new function created by enhancing the “tool check function before processing” of MIPSL, which is highly valued by YASDA’s unique control system. Conditions of all the tools used are set before processing to judge the approval or prohibition of the use and support high precision and high-grade processing. In the case of multifaceted pallets, the order of priority is assigned to the pallet with the work that can be processed with the target tool. This realizes flexible processing with high productivity.

Specifications

<table>
<thead>
<tr>
<th>Machine body specifications</th>
<th>YBM 10T-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of travel</td>
<td>X-axis travel (Longitudinal movement of table) 1,500mm</td>
</tr>
<tr>
<td></td>
<td>Y-axis travel (Vertical movement of spindle) 1,500mm</td>
</tr>
<tr>
<td></td>
<td>Z-axis travel (Cross movement of column) 1,800mm</td>
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<tr>
<td></td>
<td>Distance from table top surface to spindle center (X-axis horizontal) 400~800mm</td>
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<tr>
<td></td>
<td>Distance from table centerline to spindle nose (X-axis vertical) 200~2,300mm</td>
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<td>Min. distance from table top surface to spindle nose (X-axis vertical) 200mm</td>
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<tr>
<td>Rotary table A- and B-axes</td>
<td>Size of table working surface 1,000x1,000mm</td>
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<tr>
<td></td>
<td>Table maximum loading capacity/moment (Horizontal:200kg/Vertical:600kg)</td>
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<td>Table top surface configuration 109x1M15cap</td>
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<td></td>
<td>Max. turning diameter of work ø1,350mm</td>
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<tr>
<td></td>
<td>Max. work height 900mm (Conditional: 900 mm)</td>
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<td>Spindle</td>
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<td>Spindle speed Standard 50<del>10,000rpm Option 50</del>8,000rpm (High-torque spec.)</td>
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<td></td>
<td>Spindle motor ACT15.5/20kW (torque:30Nm-rated)</td>
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<td>Tapered bore of spindle 7.24 INT No.50</td>
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<td>Feed rate</td>
<td>Rapid feed rate X-axis, Y-axis, Z-axis:1600mm/min</td>
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<td>Cutting feed rate X-axis, Y-axis, Z-axis: 5000mm/min (Standard)</td>
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<tr>
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<td>Min. setting unit 0.005mm/deg</td>
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<td>Automatic tool changer 60 pcs.</td>
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<td>Max. tool diameter/length/mass ø300mm , 400mm /20kg</td>
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<td></td>
<td>Automatic pallet changer High-stuff spin, handle of pallet 2 pallets</td>
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<td></td>
<td>Pallet chucking system w/pallet setting check function</td>
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<td>Mass of machine body Approx. 36,000kg</td>
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<tr>
<td>Spindle</td>
<td>Spindle type S45–600/30/real 3-stage oil-spindle</td>
</tr>
<tr>
<td></td>
<td>Spindle speed Standard 50<del>6,000rpm/Option 50</del>10,000rpm</td>
</tr>
<tr>
<td></td>
<td>Spindle motor ACB15.5/20kW (torque:30Nm-rated)</td>
</tr>
<tr>
<td></td>
<td>Tapered bore of spindle 7.24 INT No.50</td>
</tr>
<tr>
<td>Feed rate</td>
<td>Rapid feed rate X-axis, Y-axis, Z-axis:1600mm/min</td>
</tr>
<tr>
<td></td>
<td>Cutting feed rate X-axis, Y-axis, Z-axis: 5000mm/min (Standard)</td>
</tr>
<tr>
<td></td>
<td>Min. setting unit 0.005mm/deg</td>
</tr>
<tr>
<td></td>
<td>Automatic tool changer 60 pcs.</td>
</tr>
<tr>
<td></td>
<td>Max. tool diameter/length/mass ø300mm , 400mm /20kg</td>
</tr>
<tr>
<td></td>
<td>Automatic pallet changer High-stuff spin, handle of pallet 2 pallets</td>
</tr>
<tr>
<td></td>
<td>Pallet chucking system w/pallet setting check function</td>
</tr>
<tr>
<td></td>
<td>Mass of machine body Approx. 47,500kg</td>
</tr>
</tbody>
</table>
In addition, “YASDA OpeNe” is equipped with various functions that assist automation, such as the tool life management function, production control function, and stored tooling content confirmation function, to achieve high productivity and automation. In addition, wide-ranging needs such as machined product accuracy management can be met.

### Tool management function
Well-developed management functions such as tool life management and spare tool management

### Production control function
The operating conditions of the machine are summarized and displayed. Data of the processing program, and operating rate and operating hours on a daily bases are tabulated and displayed as graphs.

### Stored tooling content confirmation system
This is a new function created by enhancing the "tool check function before processing" of MIPs, which is highly valued as YASDA’s unique control system. Conditions of all the tools used are set before processing to judge the approval or prohibition of the use and support high precision and high-grade processing. In the case of multifaceted pallets, the order of priority is assigned to the pallet with the work that can be processed with the target tool. This realizes flexible processing with high productivity.
Higher accuracy produces greater profitability.

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Export of the products and associated software is subject to prior approval of the Japanese government according to "Foreign Exchange and Foreign Trade Law".