

Higher accuracy produces greater profitability

YASDA CNC JIGBORER

YBMvi40



MOLD & DIE MILLER

Hardmilling solution with 5 axis, new technology for total profitability
Yasda built-in B/C axis rotary table, promising reliability

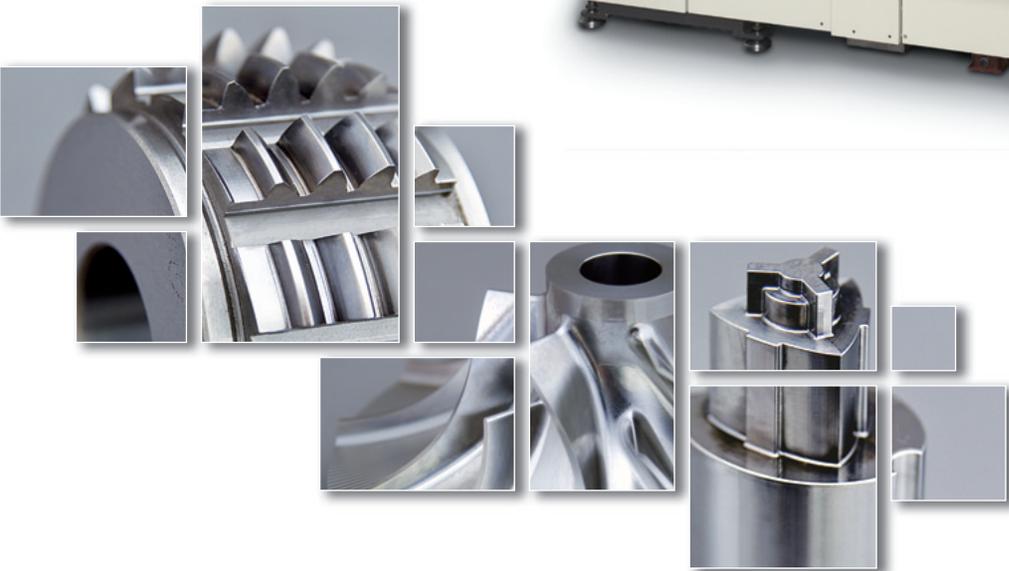
YASDA



YBMvi40

New reliable solution for 5-axis die and mold making

- Structure based on YBM series known for highly accurate and rigid machines.
- Installing highly rigid and accurate rotary B/C-axis on the Y-axis realizes excellent control performance minimizing weight differences in movable bodies on each axis and setting the heavy movable bodies to lower center of gravity.
- Thermal displacement removal by intensive measures.
- Improvement in accessibility between spindle and workpiece, and operator and machining point.



Advantage of 5-axis machining and Applications

Realizing high-precision and high surface quality required for die and mold manufacturing field by use of 5-axis machining technology

• 3+2 axes machining

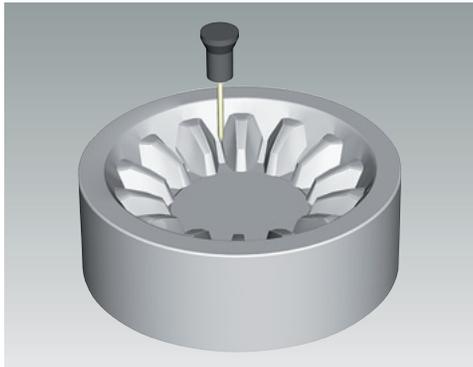
(3 axes simultaneous machining by fixing the index angles of B/C-axes.)

• 4+1 axes machining

(4 axes simultaneous machining by fixing the index angle of B-axis.)

General 3-axis machining

Longer machining time due to longer cutter length to the bottom of workpiece and more delicate in cutting conditions to achieve high surface quality.

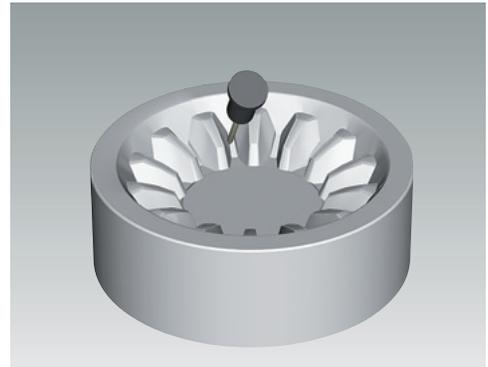


Machining time is reduced to approximately one-fifth



Index 5-axis machining

By tilting workpiece, cutter length is minimized thus surface quality is improved and machining time is reduced.



R1 ball end mill for finishing

- Required under neck length is 25mm.
- Required projection length from holder is 35mm.
- Cutting feed rate: 400mm/min or less
- Surface roughness: Ra 0.90 μ m

R1 Ball end mill for finishing

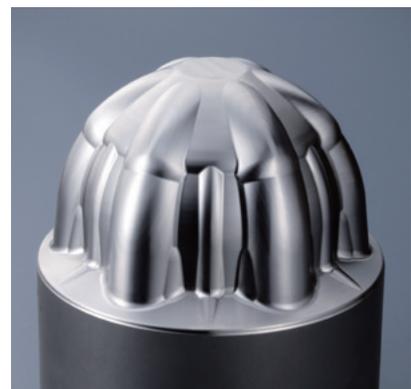
- Required under neck length is 5mm only.
- Required projection length from holder is 19mm only.
- Cutting feed rate: 2000mm/min
- Surface roughness: Ra 0.25 μ m

Application examples

By adopting the basic structure of a 3-axis machine from YBM V series, YBM Vi40 has comparable cutting ability. In combination with 5-axis machining, this machine can exert high performance for high-precision machining of highly hard materials in complicated shapes which are difficult for a three-axis machine.



Bevel gear forging die for trucks

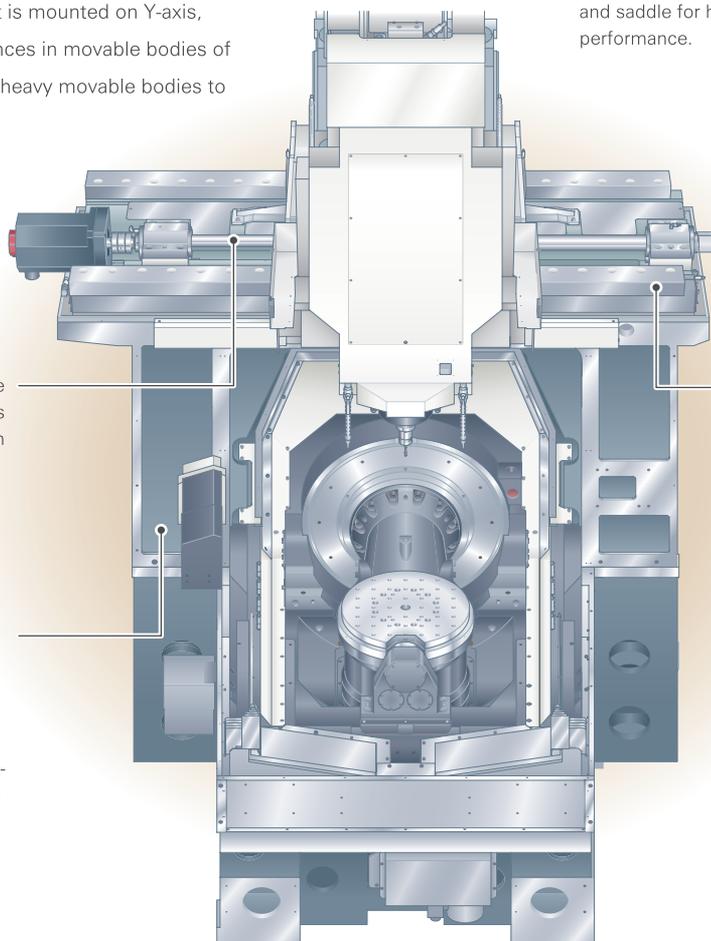


CVJ(Constant-velocity joint) punch for automobiles

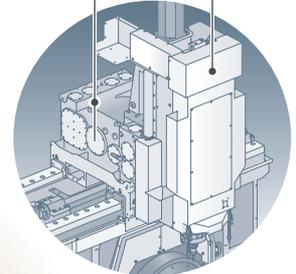
Framework structured in highly rigid symmetric bridge type

The highly rigid integrated bridge structure dominates the field of ultrahigh precision and heavy cutting.

Equipped with a highly rigid and high-precision B / C-axis tilting rotary table unit is mounted on Y-axis, minimizing weight differences in movable bodies of each axis, and setting the heavy movable bodies to lower center of gravity.



Optimized weights of head and saddle for high performance.



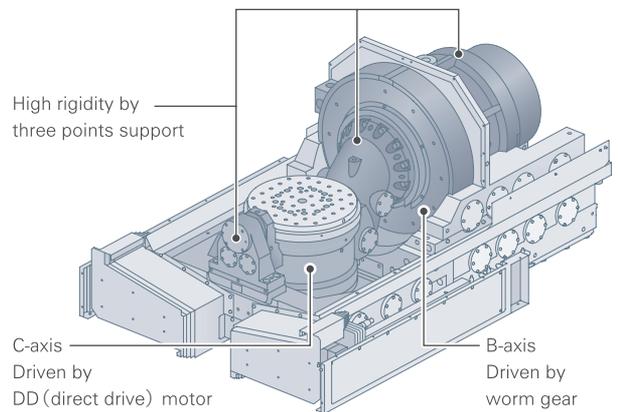
With a highly rigid feed drive system adopting ball screws with large diameter and high speed interpolation control, demand for high-speed and high-precision machining is fulfilled.

Highly precise through-hardened box guide ways are fastened so as to reach a straightness of $2\mu\text{m}$ or less.

The machine body adopts a bridge type thermally symmetrical structure with less thermal displacement. High rigidity performance is further improved by a single-piece structure (column and top beam) made of high grade cast-iron.

The in-house built highly rigid worm gear mechanism with high reduction ratio is used for tilting B-axis, which stabilizes the machine against tremendous changes in tilting moments depending on the position and heavy cutting loads. The B-axis is supported by bearings in 3 points, especially front side of the main support uses dia.400 mm of cross taper roller bearing, and helps improve control performance in reverse motion.

Direct drive motor is used for rotary C-axis, which is less influenced by disturbance and cutting force. By using DD (Direct Drive) motor in C-axis, highly accurate positioning without mechanical backlash is achieved.



High rigidity by three points support

C-axis Driven by DD (direct drive) motor

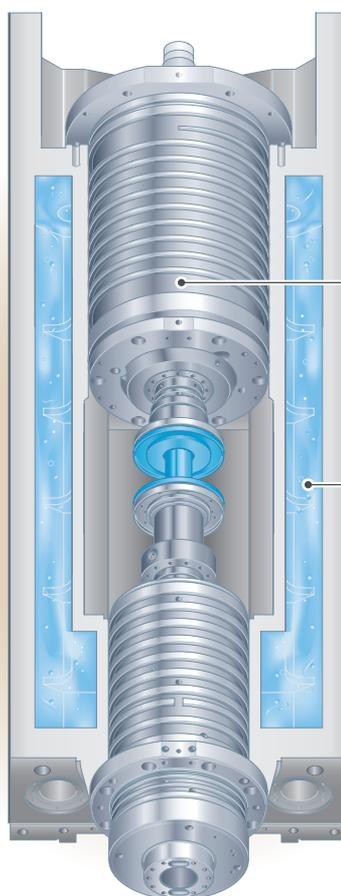
B-axis Driven by worm gear

YASDA's original mechanism enabling stable high quality machining

The preload self-adjusting spindle that machines at high degree of accuracy through whole speed range

(MODEL:SAtype)

In a conventional fixed-position preload type spindle, as preload increases along with heat generation of the bearing by high rotation of a spindle, the initial preload is set very low. This method, however, did not fulfill the requirement. "Preload self-adjusting spindle" developed by YASDA has a mechanism that applies a large preload at low-speed rotation, and the preload decreases in accordance with the amount of heat generation of the spindle bearing at high-speed rotation. Thus both heavy-duty cutting in a low-speed range and low heat generation and high-precision rotation in a high-speed range can be achieved. By this function, heavy-duty cutting, high-speed cutting of highly hardened steel and machining by a helical end mill that generates a thrust-reversing force can be performed in high precision.



Direct Drive System

The preload self-adjusting spindle and the spindle drive motor are connected co-axially by a diaphragm coupling, in order to achieve high precision rotation of the spindle throughout the full speed range of the spindle.

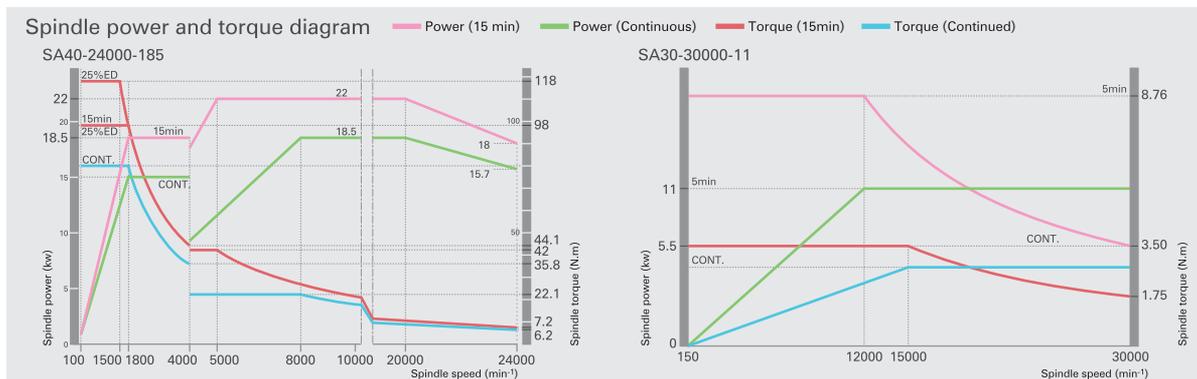
Spindle motor

YASDA spindle motor employs a two coil changeover type winding, and helps high torque drive at both of high and low spindle speeds.

Spindle head Thermal distortion stabilized system

The spindle head and saddle of the machine contain the largest heat generating parts such as spindle, spindle motor and feed motor. This is why machining centers suffer from thermal distortion which can easily result in inconsistent machining accuracy. YASDA's design prevents such distortion by circulating heat exchange fluid throughout the spindle head, controlling the temperature of spindle head following the sensor for reference room temperature.

Spindle power and torque diagram



Advanced measures against thermal displacement

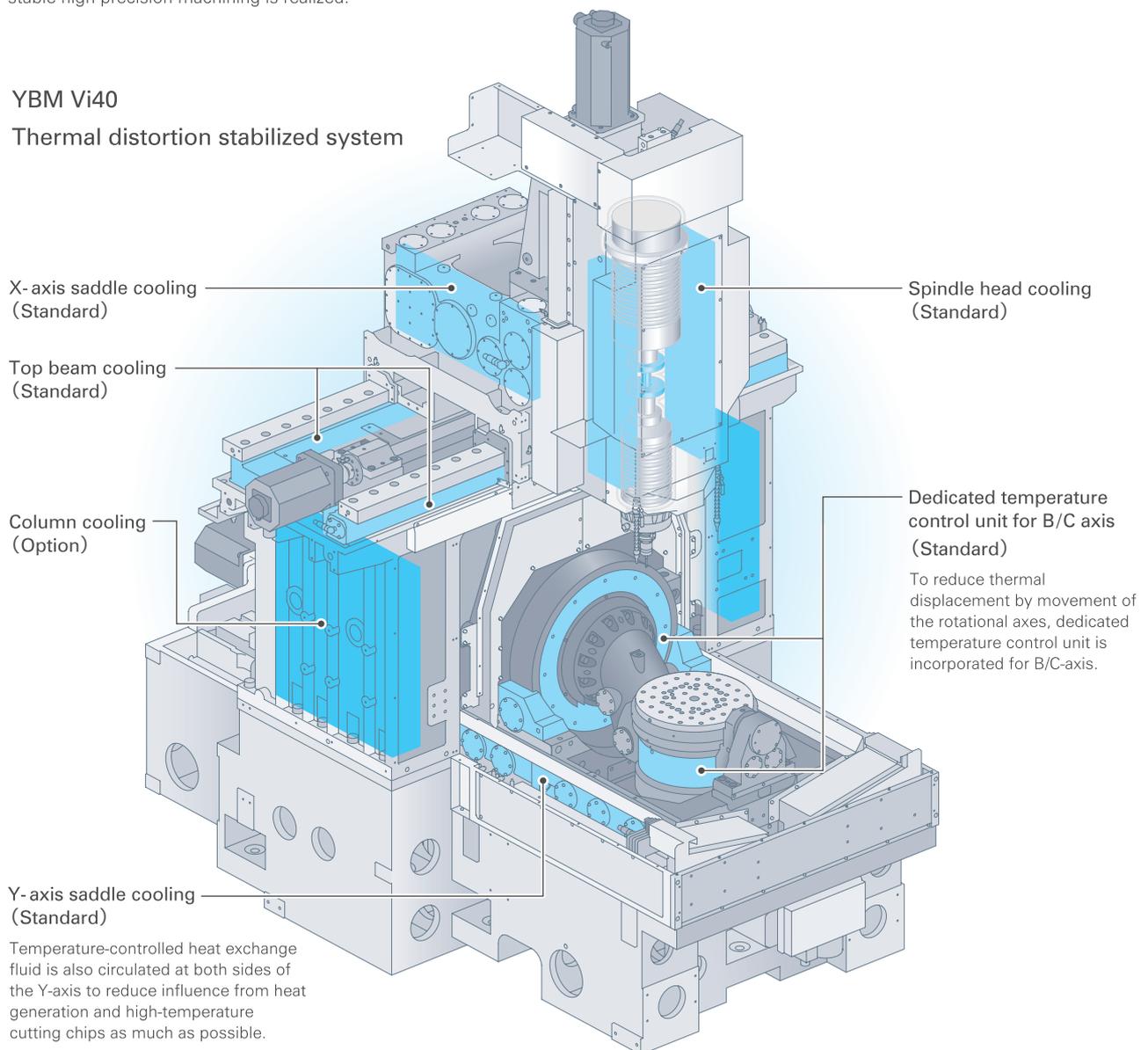
Thermal distortion stabilized system that helps assure highest accuracy during a long time running

To achieve high-precision 5-axis machining, having center positions of two rotational axes constantly at a fixed position in air is very important.

By circulating temperature-controlled oil through machine body, thermal displacement of each axis is minimized thus stable high-precision machining is realized.

YBM Vi40

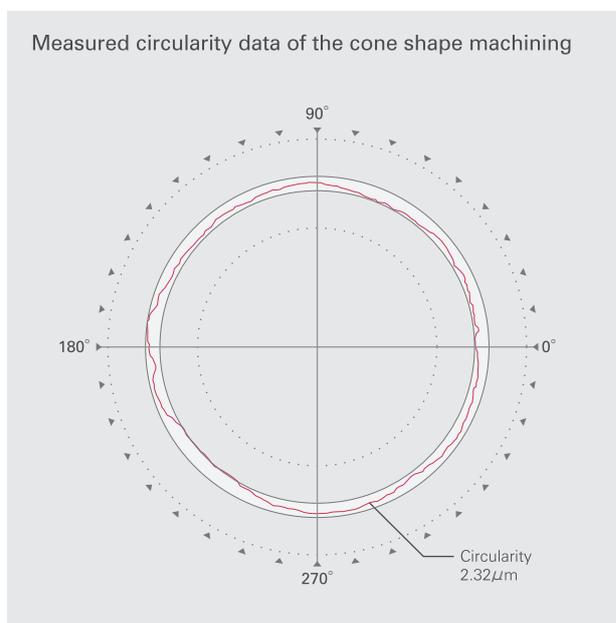
Thermal distortion stabilized system



Outstanding Accuracy

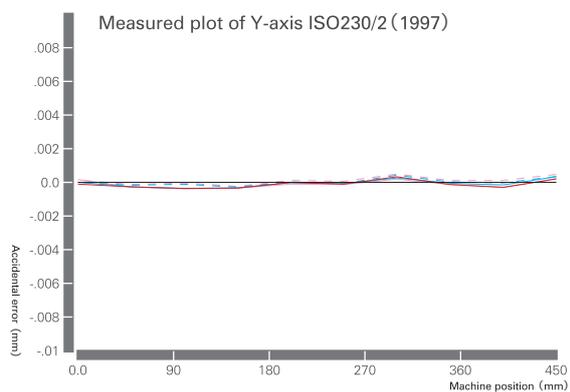
Simultaneous 5-axis cone machining circularity $2.32\mu\text{m}$ (Measured value)

This machine achieved $2.32\mu\text{m}$ of circularity (measured value) in a tilted cone machining test according to NAS979 standard.

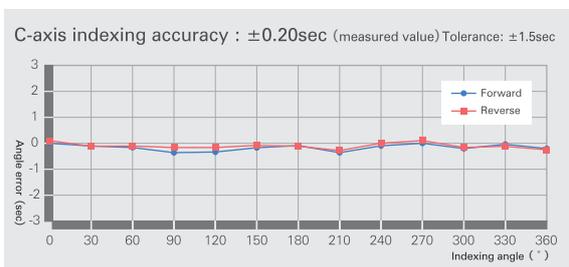
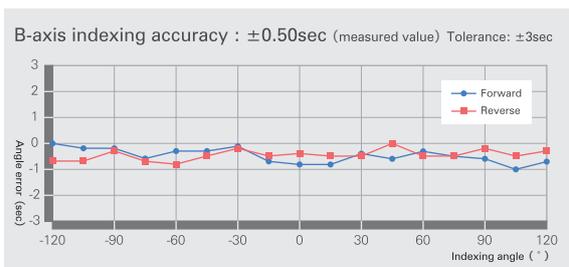


Positioning accuracy of Y-axis (measured value)
ISO 230/2 (1997)

A [Positioning Uncertainty]	0.00089 mm
R [Positional Scatter]	0.00030 mm
B [Reversal Error]	0.00008 mm



Indexing accuracy of B/C-axis



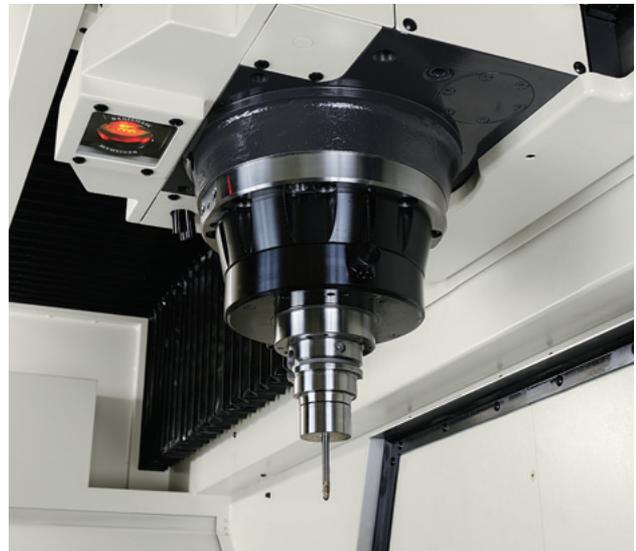
Designed for high precision 5-axis operation

The distances between spindle and workpiece and between operator and machining point have been made closer to improve operability and workability



Operator-friendly design

Operators can approach the machining point not only from the front side but also from the right side, allowing a greater degree of accessibility and improved workability.



Extended spindle nose

The spindle nose is extended by 50mm longer than a conventional machine (YBM950V) to reduce the interference zone.

Incorporated Standard 5-axis functions

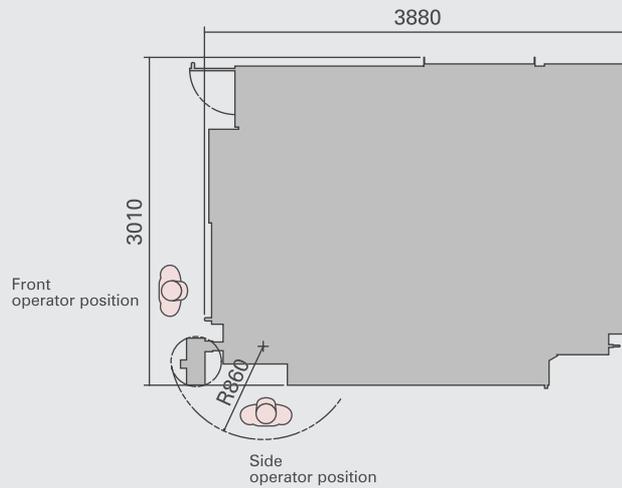
Variety of supporting functions for 5-axis machining are equipped as standard so that simultaneous 5-axis machining and indexing 5-axis machining are performed easier thus operator's burden is reduced.

- Smooth TCP (Tool center point) control
- Tilted working plane command with guidance
- Work setting error compensation
- Work coordinate setting macro program (YASDA)

OUTLINE

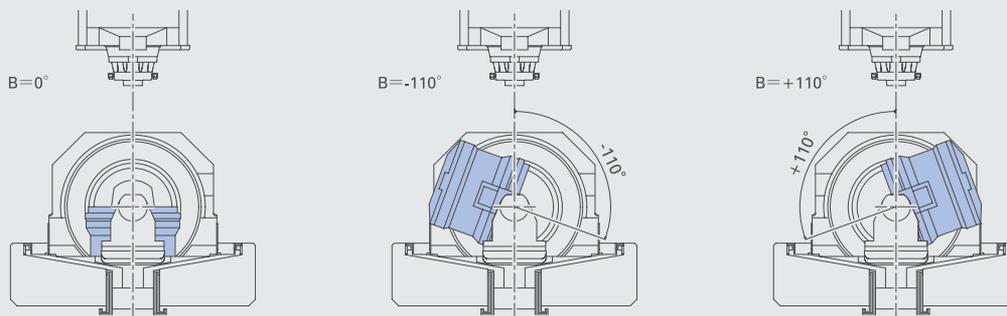
unit:mm

M/C Height : 3515mm (~F.L.)

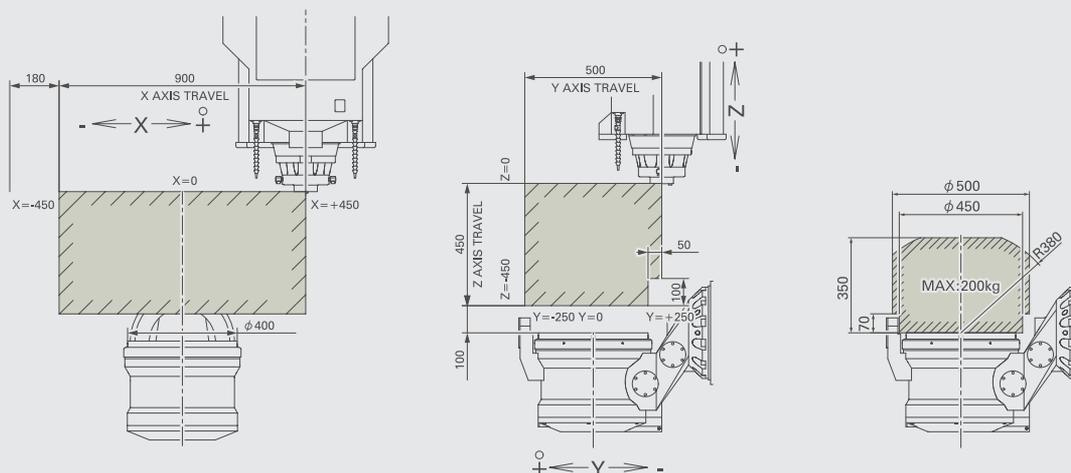


DIMENSION

B-axis tilting range



Maximum workpiece dimensions



1. Specifications of base machine

1) Travel	X-axis travel (Cross movement of spindle head)	900mm
	Y-axis travel (Longitudinal movement of table)	500mm (With limitation)
	Z-axis travel (Vertical movement of spindle head)	450mm
	Distance from table surface to spindle nose face (B=0°)	100~550mm
2) Rotary table (B / C axis)	Table working surface	φ400mm
	Table loading capacity	200kg
	Table surface configuration	44-M12 Tap
	Table rotational axis (C-axis)	360deg.
	Table tilting axis (B-axis)	±110deg.
	Distance from tilting axis center to table surface	0mm
3) Spindle	Spindle type	SA40-24000-18.5 (Preload self-adjusting spindle)
	Spindle speed range	100~24,000min ⁻¹
	Spindle drive motor	AC18.5 / 22kW (Continuous / 15min)
	Spindle taper hole	7 / 24 Taper No.40 Big Plus System
4) Feed rate	Rapid traverse rate	(X-Y-Z-axis) 20,000mm/min (C-axis) Max100min ⁻¹ (B-axis) Max20min ⁻¹
	Cutting feed rate	(X-Y-Z-axis) 5,000mm/min (Standard) (C-axis) Max100min ⁻¹ (B-axis) Max20min ⁻¹
	Least input increment	0.0001mm (deg)
5) Automatic tool changer	Tool shank type	MAS BT40
	Pull-stud type	JIS B6339-40P
	Tool storage capacity	60
	Maximum tool diameter / length / mass	φ70mm / 250mm / 7kg
6) Mass of machine		Approx. 15,000kg
7) Electric power capacity		39kVA
8) NC unit		FANUC 31i-A5

2. Standard equipment

1) Optical scale feed back	X-Y-Z-B-and C-axes 0.0001mm (deg) command compliant
2) Cutting oil unit (AA type)	2 Flood nozzles, standard tank capacity 170L
3) Splash guard	Manual door with top cover, with fluorescent lamp
4) Chip conveyor	Screw conveyor in the machine
5) Thermal distortion stabilized system	Spindle head, saddle, Y-axis and B/C-axis
6) Thermal displacement compensation for spindle	Standard data

3. CNC standard options

1) Least input / travel increment	0.0001mm
2) Display	10.4" color LCD
3) Program storage length	320m (128KB)
4) Custom macro	Common variable : 100
5) Number of registerable programs	250
6) Automatic corner override	
7) Tool offset pairs	64 pairs
8) Tool offset memory	C memory
9) Run hour and parts count display	
10) Extended part program editing	
11) Smooth TCP	
12) Tilted working plane command with guidance	
13) Work coordinate system setting macro for rotational axis equipped machine (YASDA)	

SPECIFICATIONS (Optional)

1. Optional equipment	
1) Spindle nose face configuration	HSK-A63
2) High-speed spindle (BT30)	AC5.5/11kW (Continuous / 5min) 、 150~30,000min ⁻¹
3) Maximum tool storage capacity	Total : 90
4) Signal tower (Multilayer signal lamp)	Red, yellow, green (Flashing)
5) Spindle center through air coolant	Micro fog coolant unit
6) Spindle center through flood coolant	3.5/6MPa (With cutting fluid temperature control unit)
7) Scraper chip conveyor with external separator	Drum filter equipped
8) Cutting fluid temperature control unit	
9) External mist coolant	Manufactured by Bluebe / 2 nozzles
10) Oil skimmer	Oil Pure or belt type
11) Washing gun	One position (Operator position)
12) Mist collector	1 unit
13) Automatic tool length compensation and tool breakage sensor	Manufactured by Metrol / Touch probe
14) Tool length / radius compensation and tool breakage sensor	Manufactured by BLUM / NT-H type (Touch and laser)
15) Automatic measuring system	Manufactured by Renishaw / Touch probe
16) High-speed machining function (YASDA HAS-3 system)	Maximum feed rate 12,000mm / min
17) Thermal distortion stabilized system	With weekly timer
18) Weekly timer	
19) Thermal displacement compensation for spindle	Individual data
20) AWC door	
21) Robot interface	Compatible with System 3R and EROWA
2. CNC Options	
1) Part program storage	Total : 256KB · 512KB · 1MB · 2MB · 4MB · 8MB
2) Extensional number of registerable programs	Total : 250 · 500 · 1,000 · 2,000 · 4,000
3) Background editing	
4) Helical interpolation	G02 · G03
5) Conical / spiral interpolation	G02 · G03 (Helical interpolation is required)
6) Inch / Metric conversion	G20 · G21
7) Scaling	G50 · G51
8) Coordinate system rotation	G68 · G69
9) Programmable mirror image	G50.1 · G51.1
10) Rigid tap	M29 (G84 · G74)
11) Optional block skip	Total : 9
12) Tool offset pairs	Total : 99sets · 200sets · 400sets · 499sets · 999sets
13) Custom macro common variable	Total : 600
14) Addition of workpiece coordinate	48sets · 300sets
15) Tool management	
16) Normal direction control	G40.1 · G41.1 · G42.1
17) Cs contouring control	
18) Three-dimensional coordinate conversion	G68 · G69
19) Inverse time feed	G93
20) Ethernet function	FOCAS2 / Ethernet function
21) Data server function	Fast data server, Capacity 1GB
22) Manual guide	

YASDA

YASDA PRECISION TOOLS K.K.

www.yasda.co.jp

Main Office&Factory:

1160Hamanaka,Satosho-cho,Okayama,719-0303,Japan
PHONE: +81/865-64-2511 FAX: +81/865-64-4535

Representative Office:

Firtz-Vomfelde Strasse 34,D-40547 Düsseldorf,Germany
PHONE: +49/211-53-883214 FAX: +49/211-53-883174

YASDA PRECISION AMERICA CORPORATION

62 North Lively Boulevard Elk Grove Village,IL60007 U.S.A.
PHONE: +1/847-439-0201 FAX: +1/847-439-0260

YASDA PRECISION TOOLS(SHANGHAI) K.K.

Rm.1001 Orient International Plaza Part(C),
No.85 Lou Shan Guan Rd,Shanghai,China
PHONE:86-21-62700955 FAX:86-21-62700970

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