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— GLOBAL NETWORK —
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FH SERIES FH1250SX-5Axis

5-Axis Horizontal Spindle Machining Centers

http://www.jtekt.co.jp

JTEKT
JTEKT CORPORATION

Energy-related industry, aerospace industry, construction machine and transport machine

Top-level performance in machining large-size parts of every industry

Top-level performance in three features of "Large", "Fast", and "Strong". Moreover, this machine enables the 5 axis simultaneous machining of complex-shaped workpieces and multi-face machining in one set-up. This equates to reduced set-up time and shorter workpiece machining lead time. FH1250SX-5Axis is Ultra large-type 5 axis control horizontal machining center which can realize high-quality, increased production efficiency and high cost-performance.

Workpiece range, the largest in the class

Maximum workpiece swing, maximum workpiece height and maximum stroke are realized to be the largest in the class.

Rapid feed rate, the fastest in the class

More than double speed performance is realized compared with large-size machine tools such as horizontal boring and milling machine and 5-face machining center.

Cutting ability, the strongest in the class

From aluminum to titanium - featuring a highly versatile, 5 axis special-purpose spindle not fussy about the material it machines.
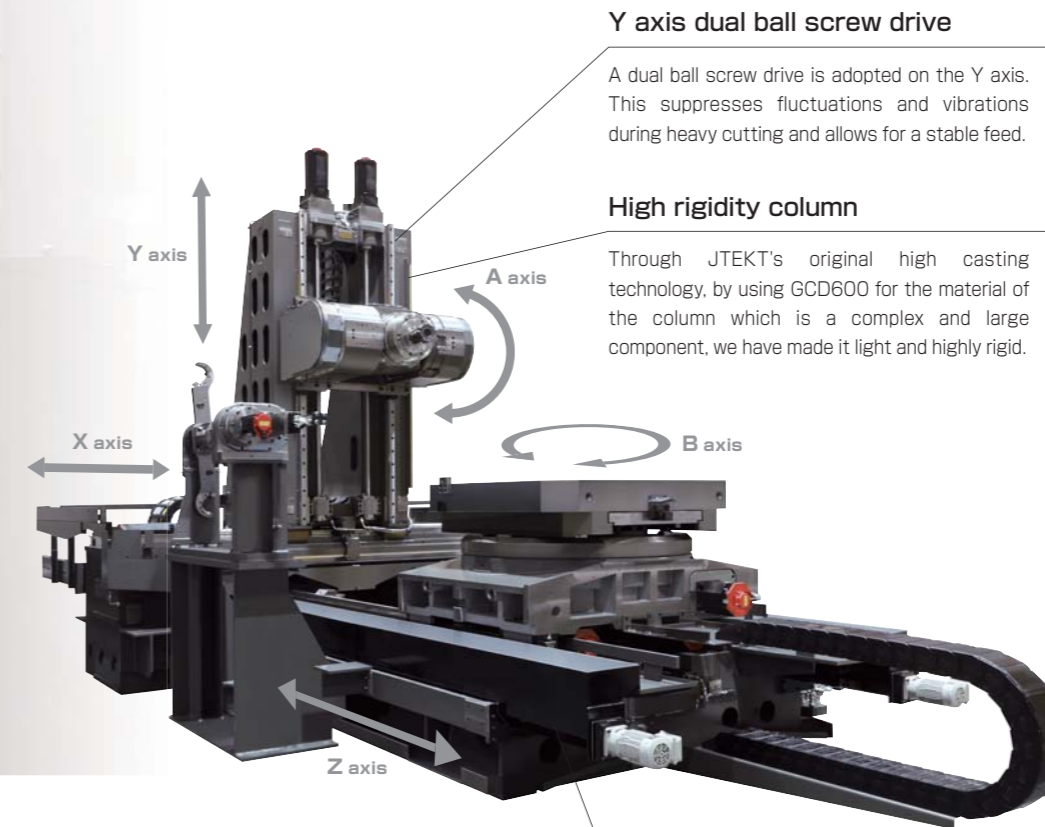
FH1250SX-5Axis

maximum & fastest

An unmatched sturdy platform, utilizing the 5 axis function to the fullest.

Y axis dual ball screw drive

A dual ball screw drive is adopted on the Y axis. This suppresses fluctuations and vibrations during heavy cutting and allows for a stable feed.

High rigidity column

Through JTEKT's original high casting technology, by using GCD600 for the material of the column which is a complex and large component, we have made it light and highly rigid.

A rigid Platform incomparable to any others assures stable production over a long period.

JTEKT's basic approach towards machine design is to minimize displacement caused by external forces that may impact on cutting accuracy. The rigid bed of the FH Series provides the answer towards withstanding large cutting resistance as well as inertial forces of feed acceleration and deceleration. --The immobile bed is placed as a solid stationary matter and moving bodies such as the column is light-weight but at the same time rigid--simple, yet requiring high level analysis techniques and material technology.

Y axis
A axis
X axis
B axis
Z axis

Tilt spindle (A axis unit)

By adopting a tilt spindle, large workpieces can be loaded on the pallet. A turning axis (A axis) on the spindle prevents workpiece weight from swaying right to left, keeping the machining accuracy of large workpieces stable.

+45°
0°
−100°

Spindle

Equipped with a newly developed, low heat-generating spindle with a maximum spindle rotation of 10,000 min⁻¹ and maximum torque of 263 N·m. It can machine a wide range of difficult-to-cut materials from aluminum to titanium and so on.

High-class cast steel high rigidity bed

The bed which supports movable bodies uses FEM analysis technology, securing sufficient rigidity and significantly enhancing the movable level. This has made stable axis feed possible.

Triple trough

3 screw conveyors have been installed on the bed to process cutting chips smoothly.

High rigidity cylindrical roller slide

While maintaining rigidity, by adopting a cylindrical roller slide which can endure high speed, high acceleration axial movement, orientation change upon rapid acceleration, rapid stopping is slight, becoming possible to locate smoothly and contributing to production improvement.

Workpiece maximum dimensions and mass

φ2,400mm
Pallet load capacity 5,000kg
1,800mm
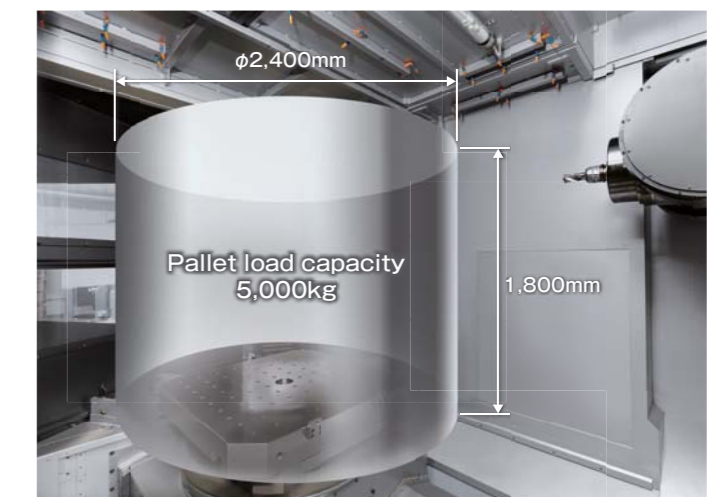
Simultaneous 5 Axes Milling of Aluminum Aircraft Part

1,100mm×250mm×25mm

[Workpiece material] A5052（Aluminum）

Machining conditions

■ Rough milling
[Tool to use] φ32 R2 radius cutter
[Spindle rotation speed] 10,000min^{-1}
[Feedrate] 5,000mm/min

■ Semi Finish & Finish milling
[Tool to use] φ10 R2 radius end mill
[Spindle rotation speed] 10,000min^{-1}
[Feedrate] 2,000mm/min

■ Finish milling
[Tool to use] φball nose end mill
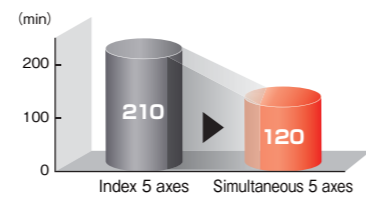[Spindle rotation speed] 10,000min^{-1}
[Feedrate] 3,000mm/min

Machining performance
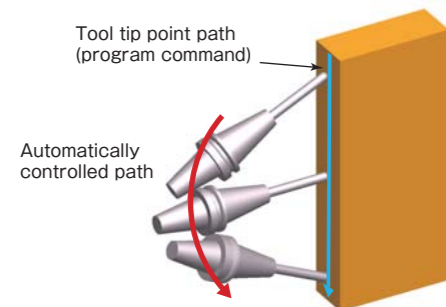
■ Surface roughness

0.86~1.5μmRa

■ Cutting time (min)

200
100
210 ▶ 120
0
Index 5 axes   Simultaneous 5 axes

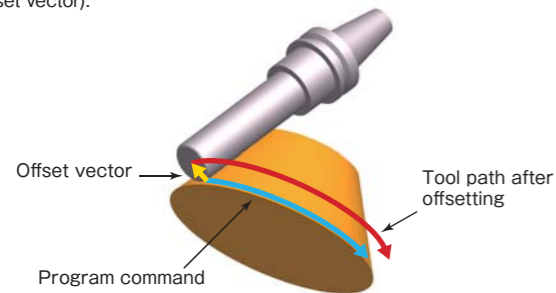## 5 axis machining support function

■ Tool tip point control

In machining where the tool orientation chances, the path and speed of the tool tip is automatically controlled using program commands.

Tool tip point path (program command)

Automatically controlled path

■ Tilted surface machining command

When machining holes and pockets in tilted surfaces it is possible to automatically convert the program created in XY coordinates to a tilted surface.

Locates the center axis of the tool vertically in the tilted machining surface
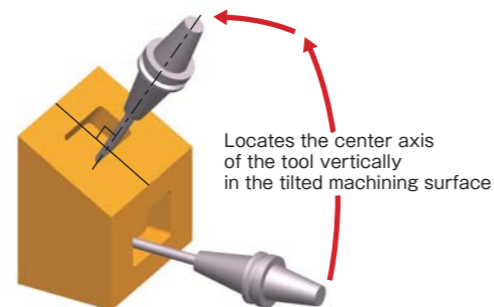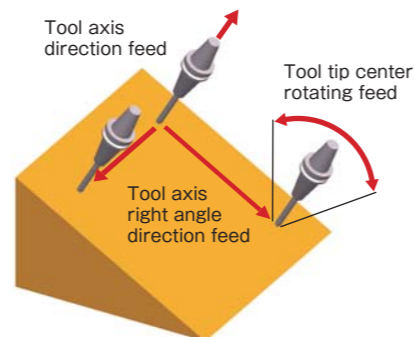
■ 3D tool diameter offset

When machining using the side of the tool, it is possible to offset the tool diameter in a vertical direction against the center axis of the tool (offset vector).

Offset vector

Tool path after offsetting

Program command

■ 3D manual feed

Tools can be moved in various directions using manual feed.

Tool axis direction feed

Tool tip center rotating feed

Tool axis right angle direction feed

OP SupporterⅡ
JTEKT's machining centers feature an automation function which makes the automation of the machine possible and supports the operator's work.

The 4 supporting features of the OP SupporterⅡ

Program control support
- ■Required information can be obtained without opening multiple pages … Program check & edit
- ■Command to machine can be executed with using cycles of eight drilling patterns…NC program edit
- ■The state of tools can be displayed by using NC program list (so as to check the state of tools before machining) …List of use tool
- ■The configuration of sub programs can be displayed by using NC program list (so that time to edit can be reduced) …NC program configuration diagram

Tool control support
- ■Simple program … Tool number conversion function
- ■Direct tool setting capability … Tool correction function
- ■Detailed control … Tool life control function
- ■Limiting arm speed according to tool weight … ATC control function
- ■Feedrate and rotation speed can be set in each tool…Machining condition setting function
- ■Faulty tool indexing … Automatic magazine indexing function
- ■Storing the removed tool data and reusing it…Stored tool data storing function
- ■Setting the max. rotation speed in each tool and checking S-command…Limit rotation speed setting function
- ■Compensation value can be set till 3 sets in each tool…Second/third compensation function

Pallet control support
- ■Automatic cutting program call … Program call function
- ■Omission of unnecessary cutting operations … Multi-workpiece installation skip function
- ■Correction between pallets … Pallet correction function

Maintenance control support
- ■Equipment fault recording … Fault history display function ■Periodic inspection item reminder … Periodic inspection instruction function
- ■Maintenance work of ATC unit is made easy.…Unit maintenance function
- ■How to process at the time of trouble occurrence is described with photo and illustration.…Trouble shooting instruction function

Attached functions: Item marked with 「○」is attached.
Item with 「NO MARK」can be attached as option.

Classification			Function name	Accessories	Remarks
①Operation state			Current position display	○	
			Modal information display	○	
			Program check & edit	○	
②Program control			NC program edit	○	
			List of using tool	○	
			NC program structure	○	
			Insertion by M code list	○	
③Help			M code	○	
			Operation manual	○	
			Maintenance manual	○	
④Tool management	Control function		Tool number conversion function	○	
			Tool offset function	○	
			Tool life managing function	○	
			ATC speed override function	○	
			compensation value update function	○	
			AC function (condition control)		●
			Machining condition setting function		●
			Automatic index function of tool requiring replacement	○	
			Data update function at tool clamp/unclamp	○	
			Storing tool data storage function		●
			Tool ID function		●
			Limit rotation speed setting function	○	
			second/third compensation function	○	
	Display function		Trouble tool list display	○	
			Spare tool list display	○	
			Tool position display	○	
			Image list display	○	
			Using tool list display	○	
⑤Pallet			APC control		※
			Pallet compensation		※
			Multi-parts mounting		※
⑥Auxiliary			Function ON/OFF switch	○	
			Lamp display	○	
			Mearement result display		●
⑦Maintenance			Alarm history	○	
			Periodic inspection display	○	
			Load monitor	○	
			Periodic measurement display	○	
			Unit maintenance	○	
			Operation history display	○	
			Parameter setting	○	
			Trouble shooting instruction	○	
			Diagnostic data	○	
⑧Function for DNC					●
⑨Report			Accumulated hours	○	
			Machining result	○	
			Operation result	○	

Program control

■List of use tool

The status and type of tool is indicated with photos, descriptions and colors and can all be viewed at a glance.

- ●Setting the compensation value till 3 sets in each tool
- ●Spindle rotation restriction control when the touch sensor function is in use

Tool details display screen

- ●ATC speed controlled in line with tool mass

Maintenance control

■Periodical inspection instruction

The details of periodical inspections and measurement items are shown using diagrams and photos.

Periodical inspection list

Periodical inspection details screen

Machine specifications

	Item	Unit	FH1250SX-5Axis Standard specifications	FH1250SX-5Axis Special specifications
Table & Pallet	Table dimensions (pallet dimensions)	mm	□1250 (Pallet)	1,250×1,600
	Rotary table indexing angle	°	0.001° (NC)	1°
	Pallet height (from floor)	mm	1,500	
	Max load on pallet	kg	5,000	
	Table indexing time (90° indexing)	sec	5.6	5.3
	Pallet change time	sec	85	
Stroke	X-axis	mm	2,200	
	Y-axis	mm	1,600	
	Z-axis	mm	1,850	
	A-axis	°	−100〜+45	
	B-axis	°	360	
	Distance from spindle endface to table center (with spindle at 0°)	mm	−150〜1,700	
	Distance from spindle center to pallet upper face (with spindle at 0°)	mm	100〜1,700	
	Distance from spindle endface to pallet upper face (with spindle at -90°)	mm	−240〜1,360	
	Distance from spindle center to table center (with spindle at -90°)	mm	200〜2,050	
	Max. workpiece swing × Max. workpiece height	mm	φ2,400×1,800 ※1	
Feeds	Rapid feed rate (X, Y, Z)	m/min	32, 32, 42	
	Rapid feed rate (A)	min⁻¹	30	
	Cutting feed rate (X, Y and Z)	m/min	0.001〜30	
	Rapid acceleration (X, Y, Z)	m/s² (G)	3.13 (0.32),1.47 (0.15), 3.92 (0.4)	
	Rapid acceleration (A)	°/sec²	500	
	Ball screw diameter (X, Y, Z)	mm	φ63 (X), φ50 (Y, Z)	
Spindle	Spindle speed	min⁻¹	50〜10,000	
	Spindle diameter (front side bearing inner diameter)	mm	φ110	
	Spindle nose shape		BT No.50	
	Spindle motor short time/continuous	kW	30/25	
ATC	Tool holding capacity	tool	60	121, 180, 240, 330 ※2
	Tool selection		Absolute address	
	Tool (dia. × length)	mm	φ120×800 ※1	
	Tool mass	kg	35	
	Tool change time (Tool-to-Tool)	sec	8.4 (15kg), 10.3 (15〜35kg)	
	Tool change time (Chip-to-Chip)	sec	10.3 (15kg), 12.2 (15〜35kg)	
	Tools Holder		MAS BT50	
	Pull stud		MAS P50T-1	
Dimensions & Weight	Floor space (width × depth)	mm	6,320×9,900 ※3	
	Machine height	mm	4,520	
	Machine weight	kg	49,500	
Various Capacities	Working oil	L	63	
	Slide lubricant	L	5.5	
	Table	L	4	
	Spindle coolant	L	70 (35×2)	
	Power supply capacity	kVA	64	
	Control voltage	V	DC24	
	Air source capacity	NL/min	900	
	Air source pressure	MPa	0.4〜0.5	
Capability & Performance	Positioning accuracy ※4	mm	± 0.003	± 0.002
	Repeatability ※4	mm	± 0.0015	± 0.001
	Table indexing accuracy ※4	sec	± 7	± 3.5 (with NC encoder)
	Table indexing repeatability ※4	sec	± 3.5	± 2 (with NC encoder)

※1 For detail shape, refer to the tooling data. ※2 The matrix magazine is used for 180-tools or more. ※3 For details, refer to the layout plan. ※4 According to our inspection method
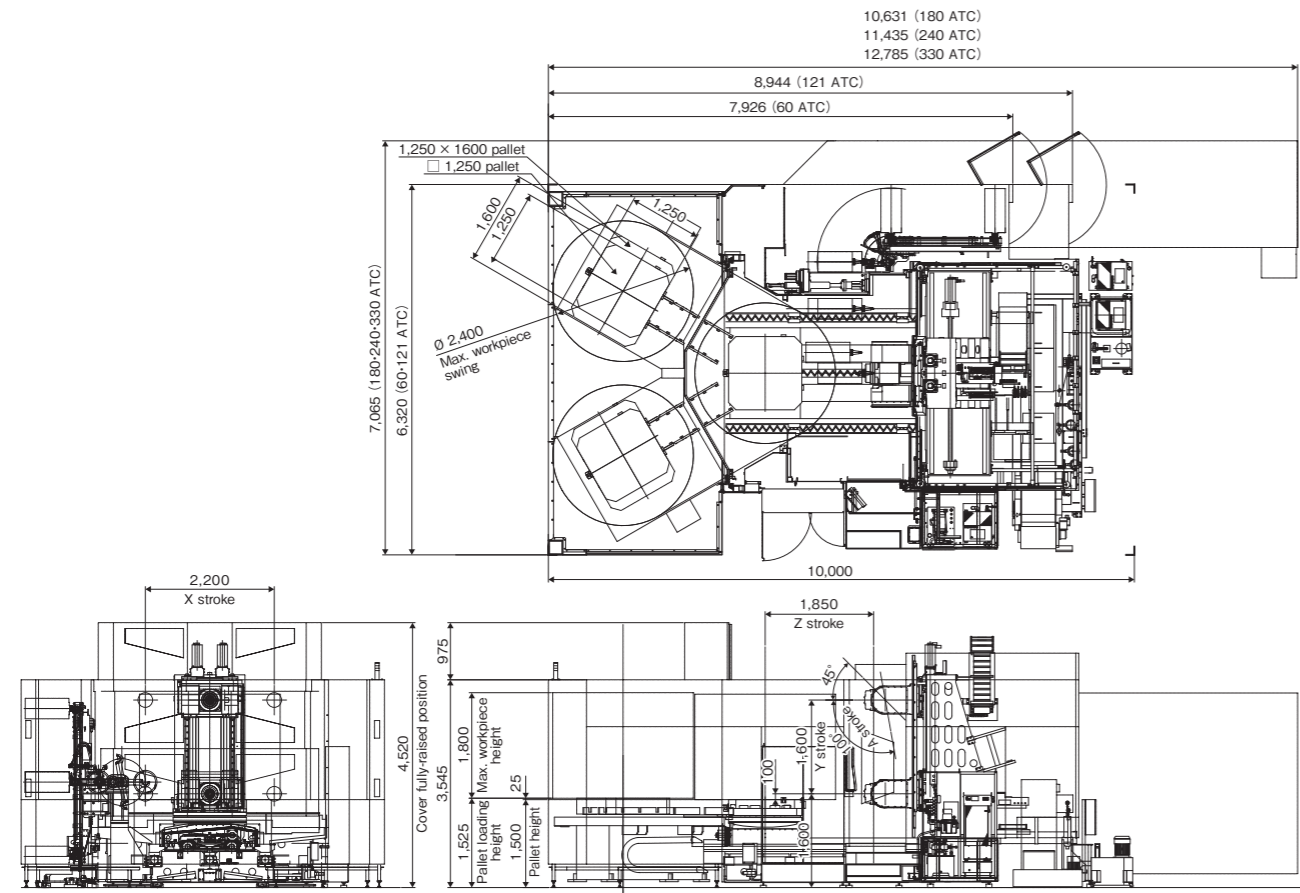
CNC unit FANUC 31i ●: Standard ╱ □: Optional

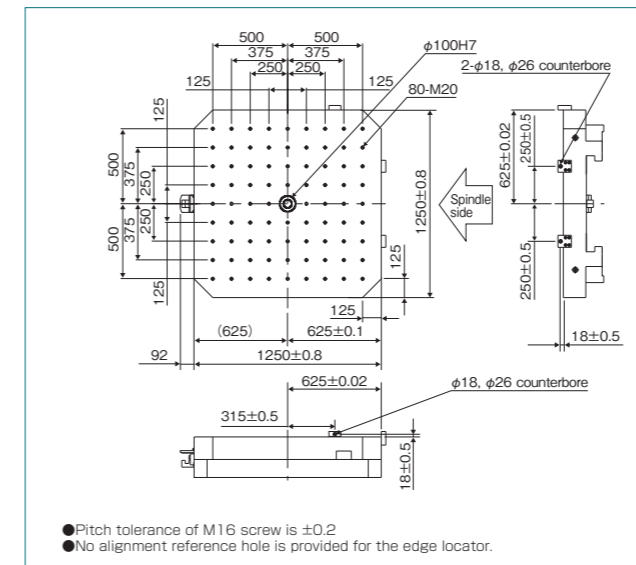| Division	Name	FH1250SX-5Axis
Axis control	Min. input increment (0.0001mm)	●
	Machine lock	●
	Absolute position detection	●
	Inch/metric switch	□
Operation	Dry run	●
	Single block	●
	Manual handle feed 1 unit	●
	Program restart	□
	Manual handle interrupt	□
Interpolation function	Nano interpolation	●
	Positioning (G00)	●
	Exact stop mode (G61)	●
	Tapping mode (G63)	●
	Cutting mode (G64)	●
	Exact stop (G09)	●
	Linear interpolation (G01)	●
	Arc interpolation (G02, G03)	●
	Dwell (G04)	●
	Helical interpolation	●
	Reference point return (G28, G29)	●
	Second reference point return (G30)	●
	Third and fourth reference point return (G30)	●
Feed function	AI contour controlⅡ (pre-read 30 blocks)	●
	F1-digit feed	□
	AI contour controlⅢ (pre-read 200 blocks)	□
Program entry	Local coordinate system (G52)	●
	Machine coordinate system (G53)	●
	Workpiece coordinate system (G54 to G59)	●
	Additional workpiece coordinate systems (48 sets)	□
	Additional workpiece coordinate systems (300 sets)	□
	Custom macro	●
	Additional custom macro common variables (#100 to #199, #500 to #999)	●
	Fixed drilling cycle (G73, G74, G76, G80 to G89, G98 and G99)	●
	Additional optional block skip (9 pieces)	□
	Automatic corner override	□
Spindle function	Rigid tap	●
Tool function	Tool corrections (99)	●
Tool correction function	Tool corrections (200)	□
	Tool corrections (400)	□
	Tool corrections (499)	□
	Tool corrections (999)	□
	Tool corrections (2,000)	□
	Tool position offset	●
	Tool diameter and cutter radius compensation	●
	Tool length compensation (G43, G44 and G49)	●
Editing operation	Program storage capacity (128K bytes)	●
	Program storage capacity (256K bytes)	□
	Program storage capacity (512K bytes)	□
	Program storage capacity (1M byte)	□
	Program storage capacity (2M bytes)	□
	Program storage capacity (4M bytes)	□
	Program storage capacity (8M bytes)	□
	Number of registered programs (250)	●
	Number of registered programs (500) ※Storage capacity 256K bytes compulsory	□
	Number of registered programs (1,000) ※Storage capacity 512K bytes compulsory	□
	Number of registered programs (2,000) ※Storage capacity 1M bytes compulsory	□
	Number of registered programs (4,000) ※Storage capacity 2M bytes compulsory	□
	Simultaneous multi-program editing(incl. background editing)	●
Data entry/display	Touch panel control	●
Communication function	Built-in Ethernet	●
Others	12,1" color LCD	●
5 axis machining support function	Fast data server function	□
	Tilted surface machining command	□
	3D coordinates conversion	□
	3D tool diameter offset	□
	3D manual feed	●
	Tool orientation control	□
	Cutting point command	□
	Tool tip point control	□

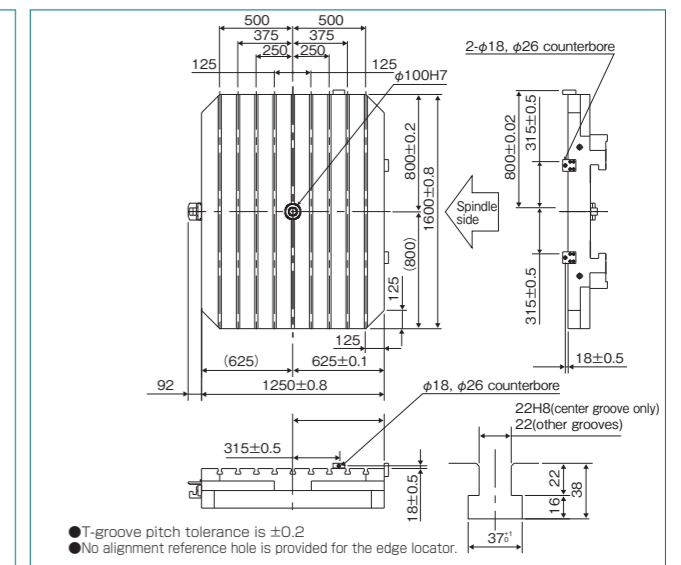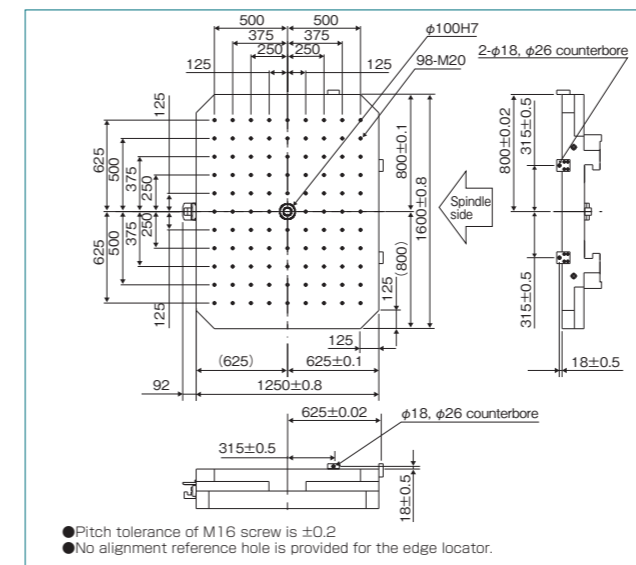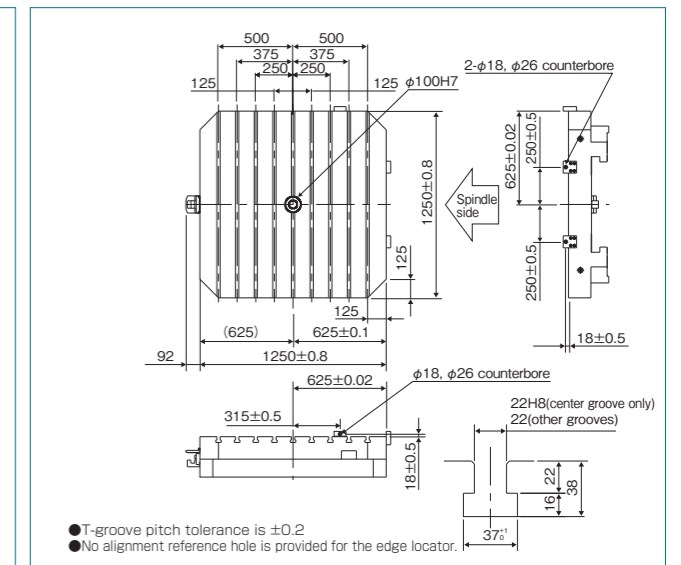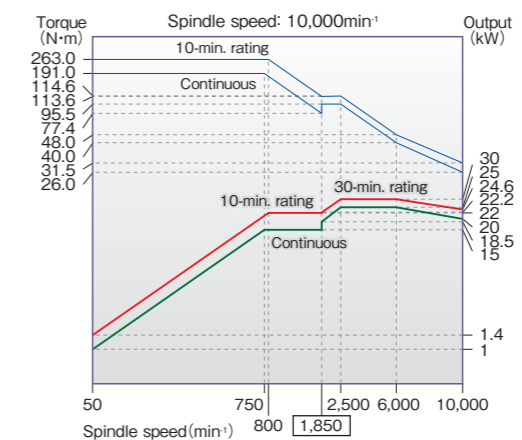FANUC is a registered trademark of FANUC LTD.

FH1250SX·5Axis

Layout plan

10,631 (180 ATC)
11,435 (240 ATC)
12,785 (330 ATC)
8,944 (121 ATC)
7,926 (60 ATC)
1,250 × 1600 pallet
□ 1,250 pallet
1,600
1,250
1,250
7,065 (180·240·330 ATC)
6,320 (60·121 ATC)
Ø 2,400 Max. workpiece swing
10,000

2,200 X stroke
975
4,520
Cover fully-raised position
3,545
1,800 Max. workpiece height
1,525 Pallet loading height
1,500 Pallet height
25
1,850 Z stroke
45°
1,600 Y stroke
Y stroke
45°

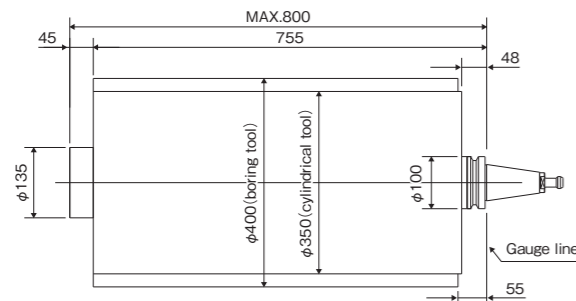## Limitations in tool holder shape (JIS·CAT·DIN BT No.50)

The tool holder is subject to limitations in the shape during ATC (automatic tool change). If the maximum tool diameter exceeds φ100, the 48mm range from the gauge line must be φ100 in the outside diameter. The 55mm range from the gauge line must be within φ210 in the outside diameter. The total mass must be within 35kg and the length from the gauge line must be within 800mm.

MAX.800
755
45
48
φ135
φ400 (boring tool)
φ350 (cylindrical tool)
φ100
Gauge line
55

Item	Max. spec
Tool length	800mm
Tool diameter	With 60 tools magazine: φ120mm (with no limitations caused by adjacent tools) With 121 tools magazine: φ130mm (with no limitations caused by adjacent tools) With 180, 240 and 330 tools magazines: φ110mm (with no limitations caused by adjacent tools)
Tool weight	35kg: The moment at the spindle nose must be within 29N·m.
Tool imbalance	30 × 10-5N·m or less (tools not exceeding 6,000min⁻¹)

Tools with diameters exceeding those described above are subject to limitations in the diameter of adjacent tools in the magazine, key good position of the tool holder and so on. Refer to the tool charts for limitations of spindle rotation speed according to the tool shape.

Threaded hole pallet

φ100H7
2-φ18, φ26 counterbore
80-M20
Spindle side
500 375 375 250 250 125
125
500 375 250 500 375 250 125
625±0.02
250±0.5
1250±0.8
250±0.5
125
92
(625) 625±0.1
1250±0.8
625±0.02
φ18, φ26 counterbore
315±0.5
18±0.5
18±0.5

● Pitch tolerance of M16 screw is ±0.2
● No alignment reference hole is provided for the edge locator.

φ100H7
2-φ18, φ26 counterbore
98-M20
Spindle side
500 375 375 250 250 125
125
625 500 375 250 625 500 375 250 125
800±0.02
315±0.5
800±0.1
1600±0.8
800
125
92
(625) 625±0.1
1250±0.8
625±0.02
φ18, φ26 counterbore
315±0.5
18±0.5
18±0.5

● Pitch tolerance of M16 screw is ±0.2
● No alignment reference hole is provided for the edge locator.

T-groove pallet

2-φ18, φ26 counterbore
φ100H7
Spindle side
500 375 375 250 250 125
125
500 375 250 500 375 250 125
625±0.02
250±0.5
1250±0.8
250±0.5
125
92
(625) 625±0.1
1250±0.8
625±0.02
φ18, φ26 counterbore
22H8 (center groove only)
22 (other grooves)
315±0.5
18±0.5
37°

● T-groove pitch tolerance is ±0.2
● No alignment reference hole is provided for the edge locator.

2-φ18, φ26 counterbore
φ100H7
Spindle side
500 375 375 250 250 125
125
800±0.02
315±0.5
800±0.2
1600±0.8
800
125
92
(625) 625±0.1
1250±0.8
625±0.02
φ18, φ26 counterbore
22H8 (center groove only)
22 (other grooves)
315±0.5
18±0.5
37°

● T-groove pitch tolerance is ±0.2
● No alignment reference hole is provided for the edge locator.

Output and torque diagram

Torque (N·m)
Spindle speed: 10,000min⁻¹
Output (kW)
263.0
191.0
114.6
113.6
95.5
77.4
48.0
40.0
31.5
26.0
10-min. rating
Continuous
10-min. rating
30-min. rating
Continuous
30
25
24.6
22.2
22
20
18.5
15
1.4
1
50
750
2,500 6,000 10,000
800 1,850
Spindle speed (min⁻¹)