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U *SERIES*

5-Axis Vertical Machining Center

U-250 WORLD STANDARD MACHINE

Design Concept

Column traveling structure

- ▶ Separated axes movement and machining areas
- ▶ Compact dimensions for minimum floor space requirement
- ▶ Multiple units connected to set up production line for mass production

Zero malfunction

- ▶ Cam type tool clamping
- ▶ Coil spring for spindle clamping mechanism, instead of disc spring
- ▶ Spindle to tool magazine direct tool changing, without arm mechanism
- ▶ Reinforced spindle water-proof design avoids bearing damage

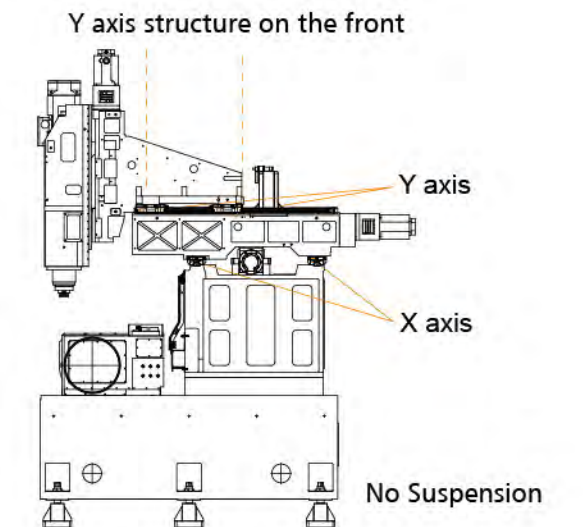
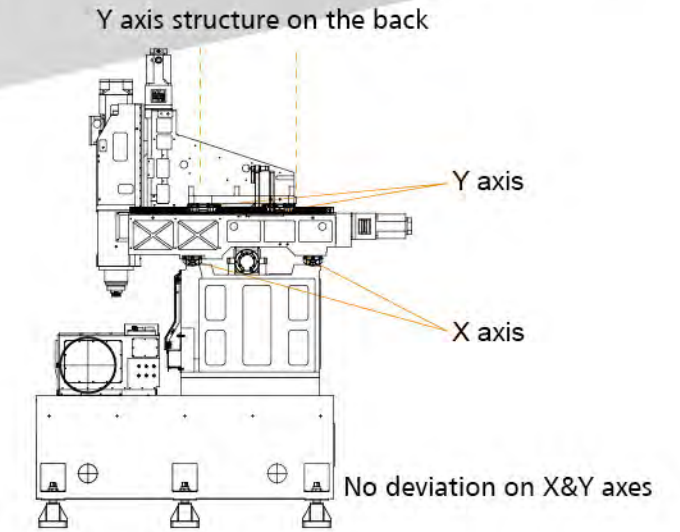
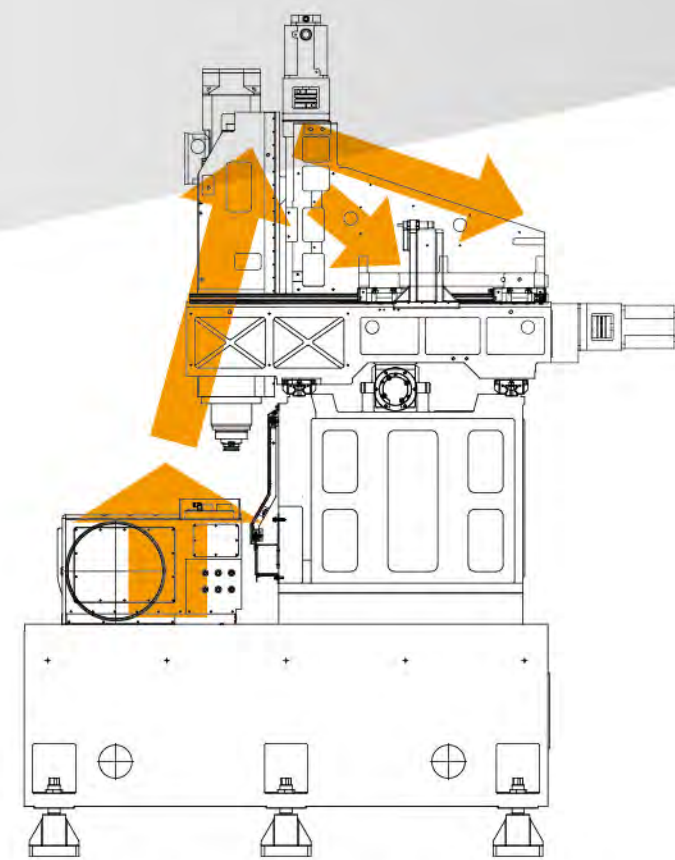


A/C axis table

Adopts A/C axis table to enable 4+1 axis contour machining.

High Efficiency
High Stability
High Productivity

Effective Design Designed by Abbe's principle



U model design eliminates suspension structures on the 3 axes; thereby reducing loading/stress on the axes. Such stress is caused by the counter force generated when machining the workpiece.



“Realizing heavy duty cutting with high rigidity and accuracy”

The overlapped-3 axes, travelling-column structural design features deviation-free movement while Y axis and X axis are travelling. The spindle is mounted on Z axis with minimum distance and suspension. Therefore, the variable loading on spindle is controlled in a low range for best possible dynamic balance.

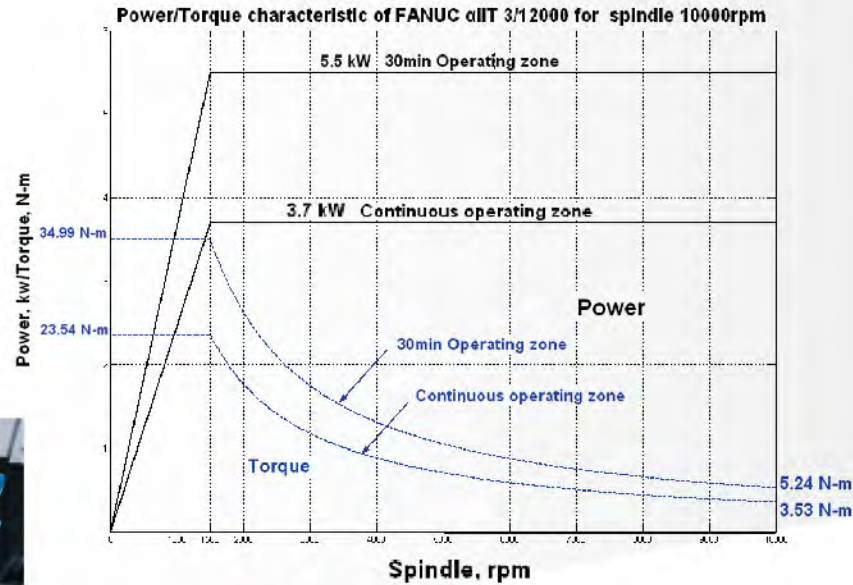
Features

Spindle

Spindle taper #30

Spindle bearing $\phi 60$

Transmission DDS



Speed 10,000 RPM

Power (cont. /30min) 3.7 / 5.5KW

2-face Tool Holding (BBT30)

2-face tool holding provides excellent dynamic rigidity and accuracy

Coolant through spindle (CTS)

Increase deep hole capability, coolant with high pressure through spindle and tools upon cutting point.

Roller Type Guide Rails

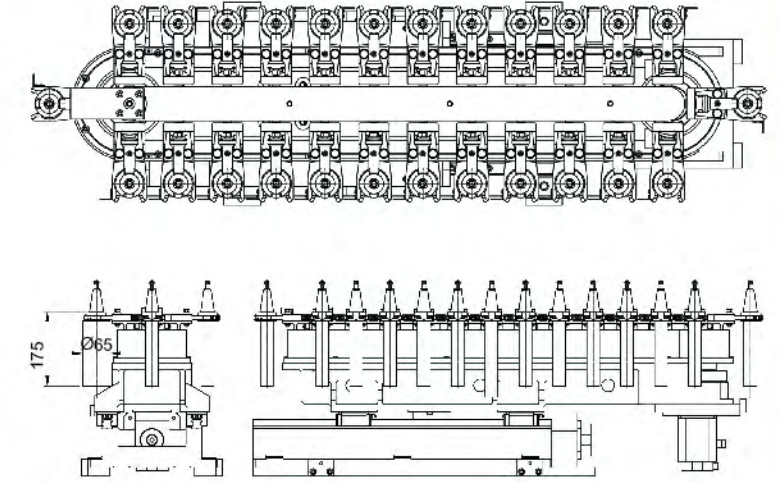
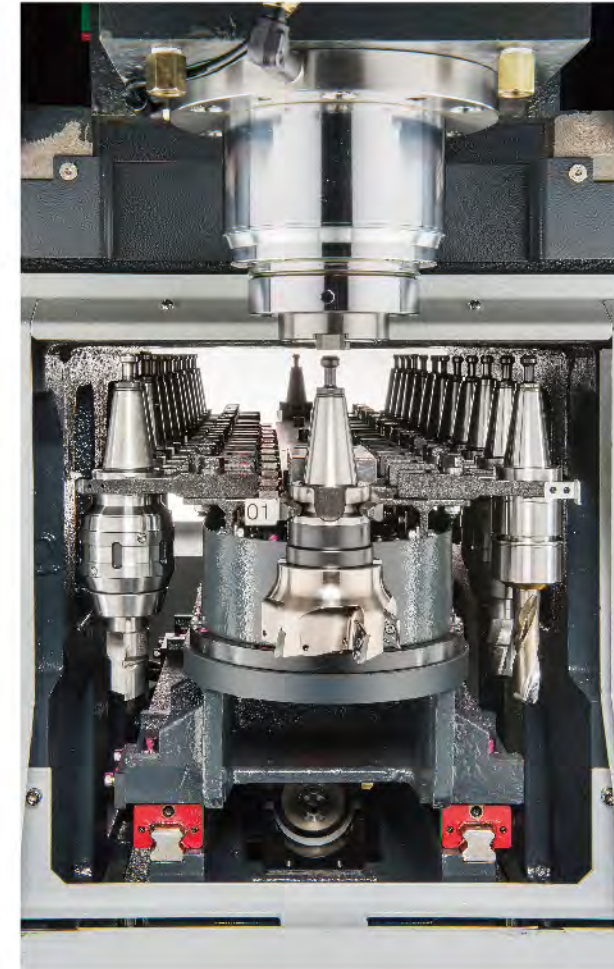
Roller type guide rails on X/Y/Z axes provide optimal rigidity and reliability

Cutting Capacity

Material : Aluminum

Type	
Tapping	Boring
Diameter(mm) × Pitch(mm/rev)	Width(mm) × depth(mm/rev) × federate(mm/min)
M12/M16-M20	$\phi 60 \times 10 \times 3000$

Wine Rack ATC Mechanism



26 tools servo of ATC (STD.)

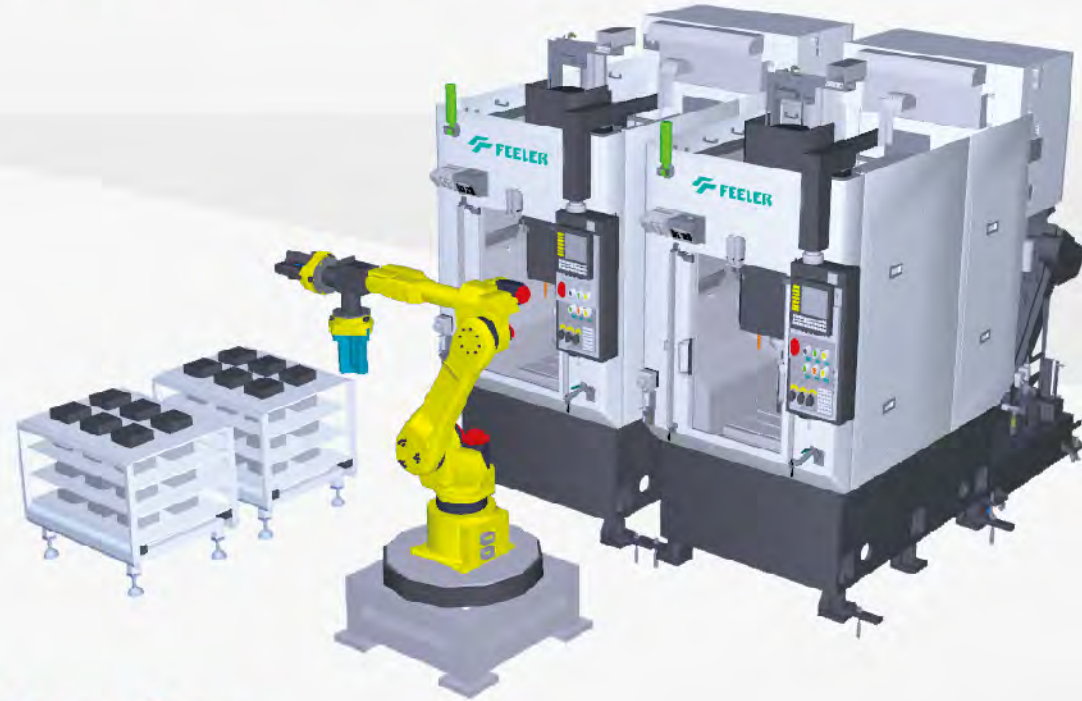
Automation and Lineup Mass Production

Automated, unmanned production when robots are employed

Multiple units lined up with gantry robot to realize a production line



Robot Automation system



Working Area

Fully covered working area avoids oil mist spreading and prevents chip from entering mechanisms. LED light is equipped for energy-saving and bright illumination



Chip Flushing

Main flushing flows on 2 sides and nozzle on the bottom provide effective and strong chip removal. Chips are discharged from the center channel.



Centralized chip removal

High efficiency of chip removal from a center channel. Perfect solution for mass production.



Easy Maintenance

Lube and valves are placed together for easy maintenance.



Control Box

Swivel upper arm of the control box allows flexible positioning of the control box for operational needs.

U-600P 5-Axis Vertical Machining Center

Features:

Intelligent Machining Function

The U-600P employs anti-chatter technology of "Chatter Lobe" program, which predicts and prevents occurrence of chatter during machining.

Users need to simply input parameters into Chatter Lobe, and then possible chatter and corresponding adjustment of cutting conditions will be provided.

5-axis Machining Feature: (Patent: M437221)

Different from general BC-type, the U-600P is designed as AC type for extensive machining capacity that allows workpiece diameter larger than axis travel. Additionally, such configuration favors view and access.

Wide Operation Area (Patent: M436520)

The operation area is defined with 2 sliding doors granting wide open space. The user can operate from 2 directions corner facilitating the operations and clearing the workpiece monitoring process. This design also favors the loading/unloading, featuring excellent access.



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Automotive



3C Products



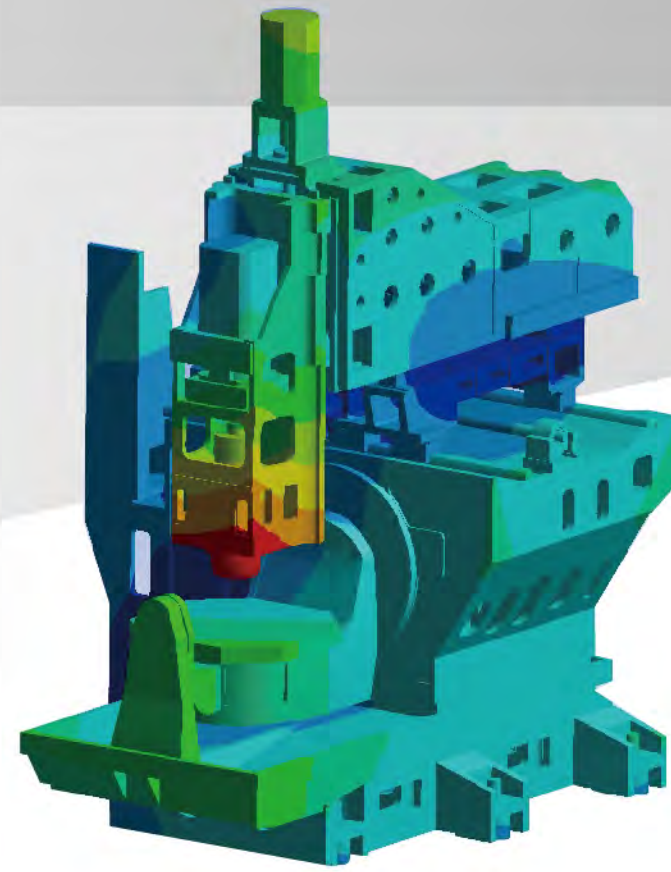
Automotive Motorcycle Parts



Medical Products



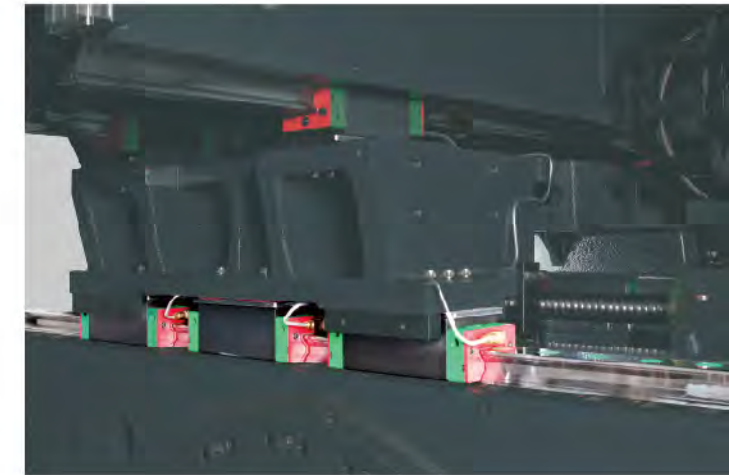
Parts of Aerospace



Highlighted Features

Finite Element Method

Fair Friend utilizes Finite Element Method (FEM) software for rigidity and FEM analysis. The end result is superior machines with optimum combination of structure, price/performance ratio, accuracy and reliability.



Front three slider design to increase rigidity.

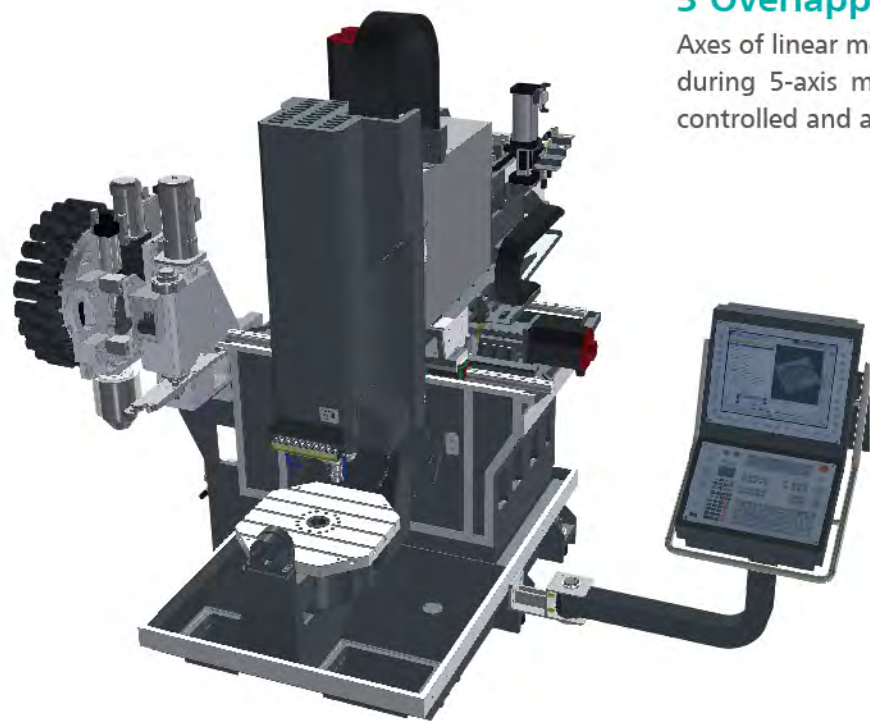
Three axes high precision roller type linear guide ways

One-piece Base-Column:

The base and column are structured as one-piece casting, which eliminates possible tolerance of the jointing interfaces. The tool magazine is directed mounted onto this one-piece structure so that torque twist is decreased and stability increased. Box-structure casting and optimal span realize exceptional rigidity and stability. Large hole on the back offers convenience for assembling and maintenance.

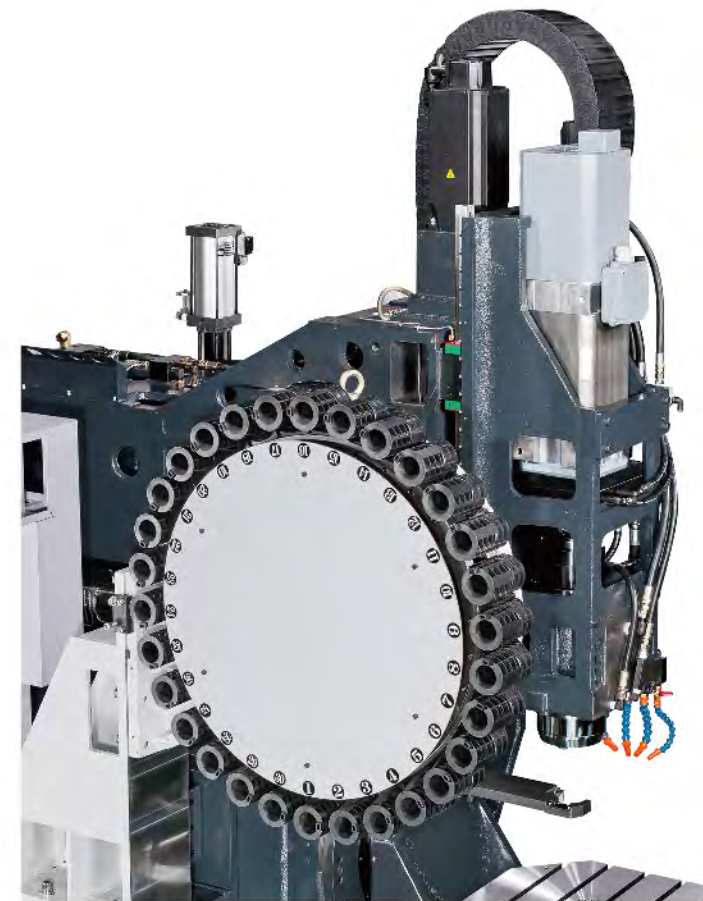
3 Overlapped Axes with 2 Rotating Axes:

Axes of linear movement and rotation are separated so that during 5-axis machining, curve tolerance or error can be controlled and adjusted rather easily.

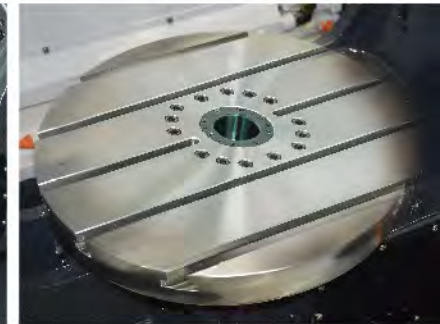


Applications:

- General machining
- Molds
- Prototyping (Flexible production)



(STD)



(OPT)

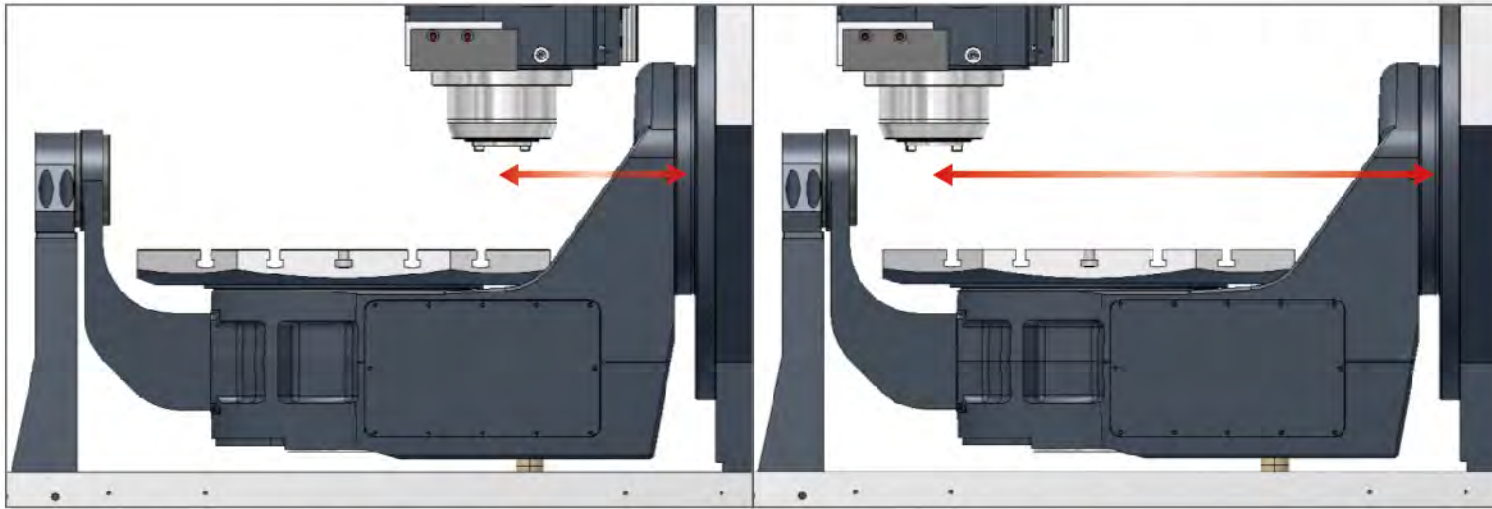
Special design base to mounted ATC can increase rigidity of structure and machining accuracy to reduce accumulated error.

Base with special support is easy to move and install machine with forklift. Machine can put in the ground and then put the leveling pads which don't need to aim by technic.

LCM rotary working table is made in Italy



Applicable loads		
A/C axis	Tilting axis	Rotary axis
Rotation range	+110°/-90°	360°
Working torque	3108 Nm	613 Nm
Max rotation speed	25 rpm	25 rpm
Max allowable load	350 kg	
Max allowable thrust 0°	10000 N	
Max allowable thrust 90°(FxL)	1800 Nm	



Short spindle hanging distance creates stable structure. It reduces possibility of thermal drift and bending for cutting force.

Linear scale (OPT.)

Five axes can equip with Linear scale and thermal compensation technology on CNC machine center to increase the accuracy.



CTS

Spindle with CTS satisfies deep holes machining and adjust the pressure of coolant. It also has thermal compensation to increase efficiency of spindle.

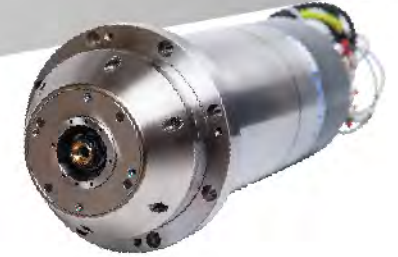
High precision and High Power spindle

Special design for Aerospace, Mold and Die, Automobile machining. It can peak max torque in 1500 rpm/ 7.5kw to provide best torque/rpm with big area heavy milling. Maximum Spindle nose distorting is 0.024mm with in X axis traverse 460mm. Spindle center line and table keep verticality 4.0μm within Z axis 250mm. Spindle rotary accuracy are controlled within 4.0μm. It is guaranteed for precise machining. Modular spindle design which can provide varieties options for customer.



12,000 rpm DDS spindle

For universal machining and five axes machining



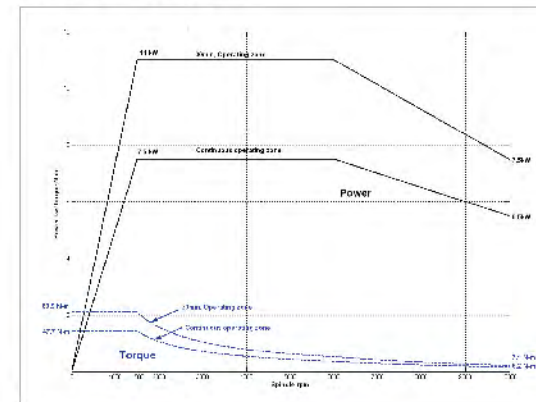
15,000 rpm DDS spindle

For mold machining and five axes machining

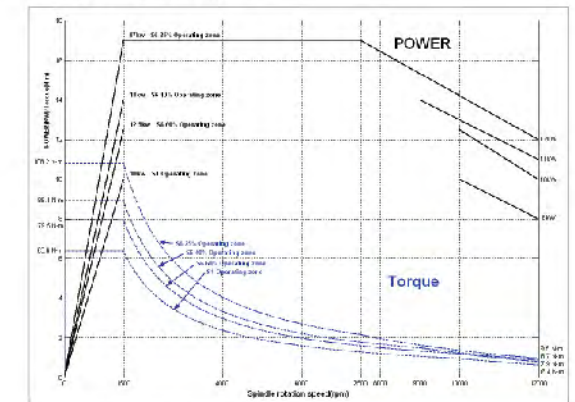
24,000 rpm built in spindle

For complex curve machining and five axes machining

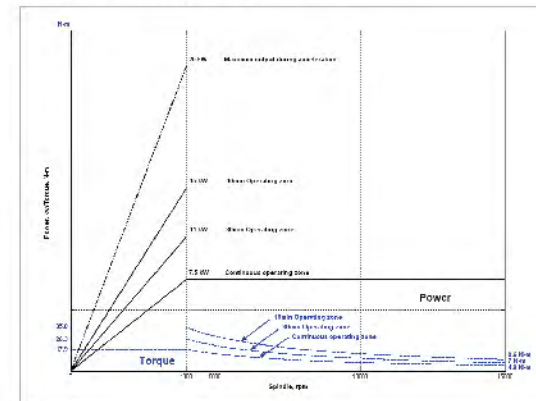
Power/Torque characteristic of FANUC α8-10000i DDS for spindle 10000rpm



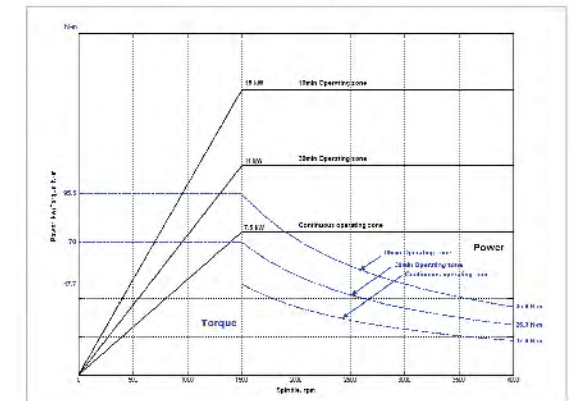
Power/Torque characteristic of Haidemhan QAN200UH for 12000 rpm spindle



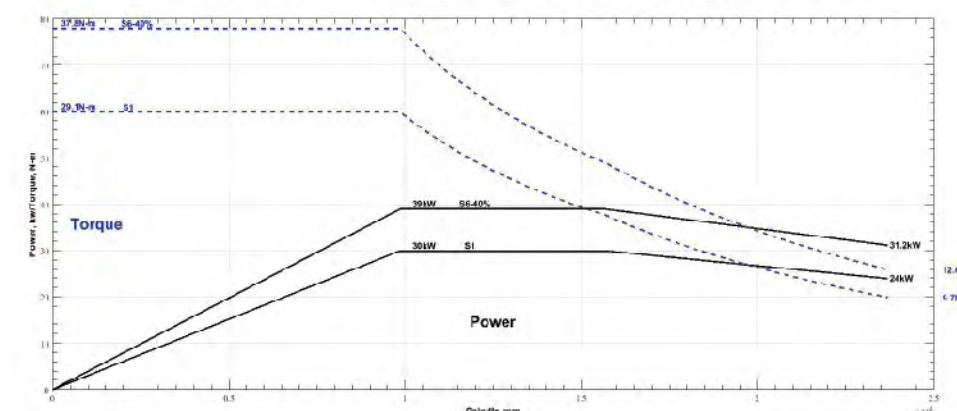
Power/Torque characteristic of FANUC αT8-15000HVi for spindle 15000rpm-High winding



Power/Torque characteristic of FANUC αT8-15000HVi for spindle 15000rpm-Low winding

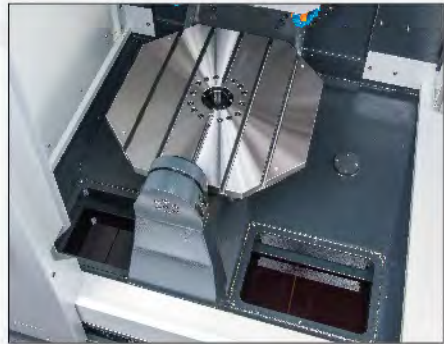


Power/Torque characteristic of IBAG HF170.4 AI 20 FOR spindle



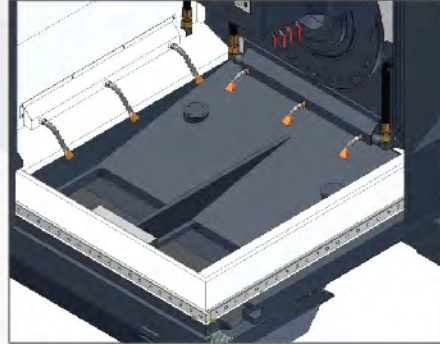
Maintenance

Chip Discharge



Funnel type collection chips in single chips drop hole can increase efficacy for chips removal

Chip Flushing



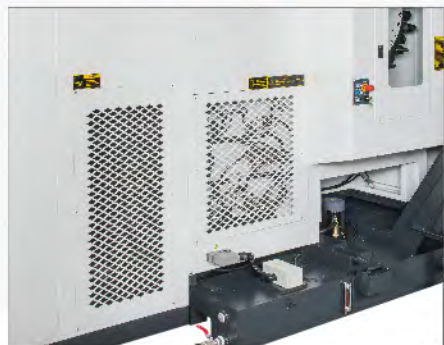
Chips are flushed off and working area is kept clear without interference on work-piece and devices.

Full Top Cover



- Corner sliding door design
- Oil mist collector

Enlarged Maintenance Space



On the back and the side, the doors/covers can be detached for larger space.

Pneumatic unit / magazine Door



Openings for pneumatic unit (hydraulic/pneumatic/electric), magazine maintenance and manual tool insert.

Hydraulic Unit



Hydraulic components assembly (hydraulic/pneumatic/electric)

Large Hole

The large-sized opening at rear side of the base offers extra convenience for assembly and maintenance.



Controller Swing Arm

- Swivel design
- Dual side operation



U-800-5AX



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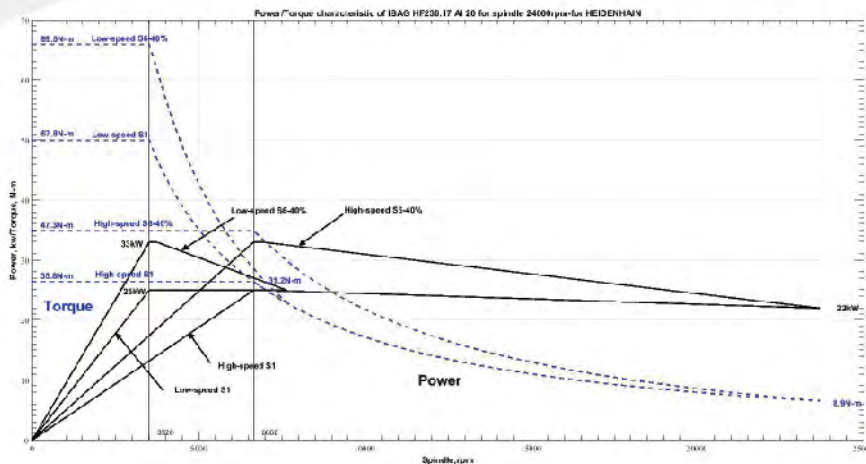
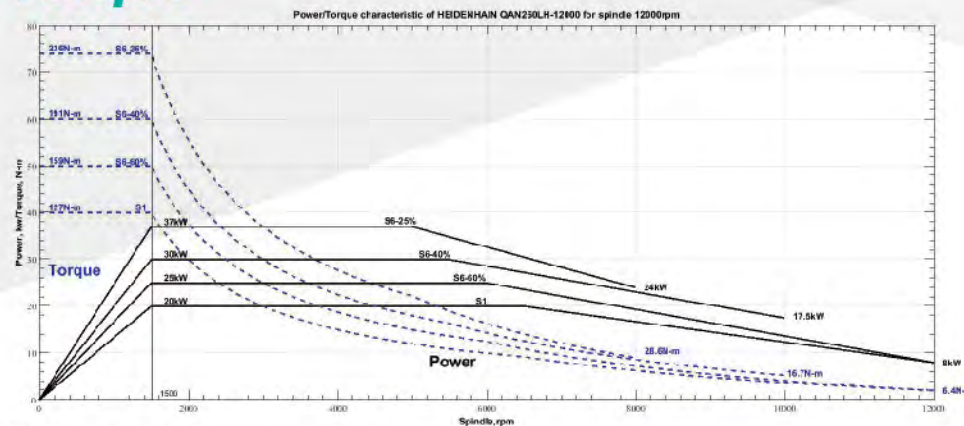
U-800-5AX

High Speed Precision Machining, Unmatched Performance

The Feeler 5-axis machining center is design specifically for high precision machining and creating extra fine finish. Its gantry type structure together with U-shaped base and column brings the structural stability to a new level. The swiveling rotary table diameter is 800mm and capable of resisting heavy loads. This machine is equipped with a 12,000rpm direct-drive spindle that fully satisfies customers' expectation in high speed and high efficiency machining.

12,000 rpm Direct Drive Spindle

Spindle Output And Torque

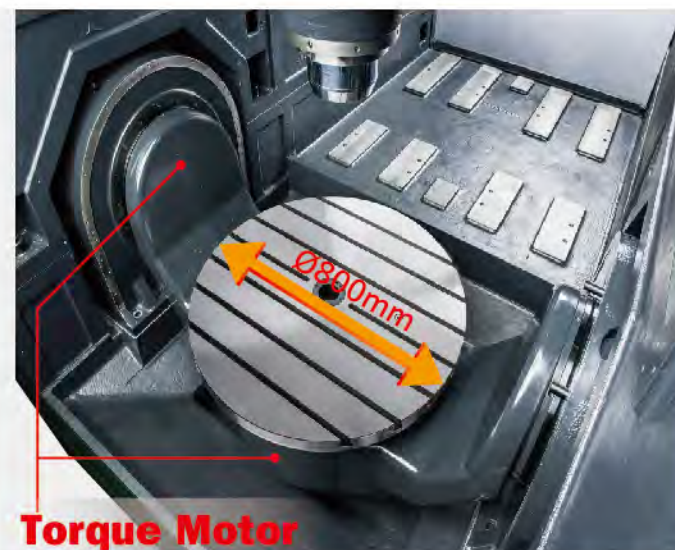


DDM Tilting Rotary Table (A/C axis)

Applicable loads

A/C axis	Tilting axis	Rotary axis
Angle degree	+120°/-120°	360°
Working torque	3340 Nm	1230 Nm
Max. Speed	50 rpm	100 rpm
Max allowable load	1200 kg	
Max allowable thrust 0°	25000 N	
Max allowable thrust 90°(FxL)	5000 Nm	

- Features
- No Backlash
 - Rapid Rotation
 - Durable



Gantry Type Structure

Designed with a gantry type structure, the Feeler U800-5AX 5-axis machining center has the feature of spacious machining space, allowing large workpiece to be loaded and unloaded with ease. It is also convenient for operator to check the current machining condition at any time.

U-shaped Construction of Base and Column

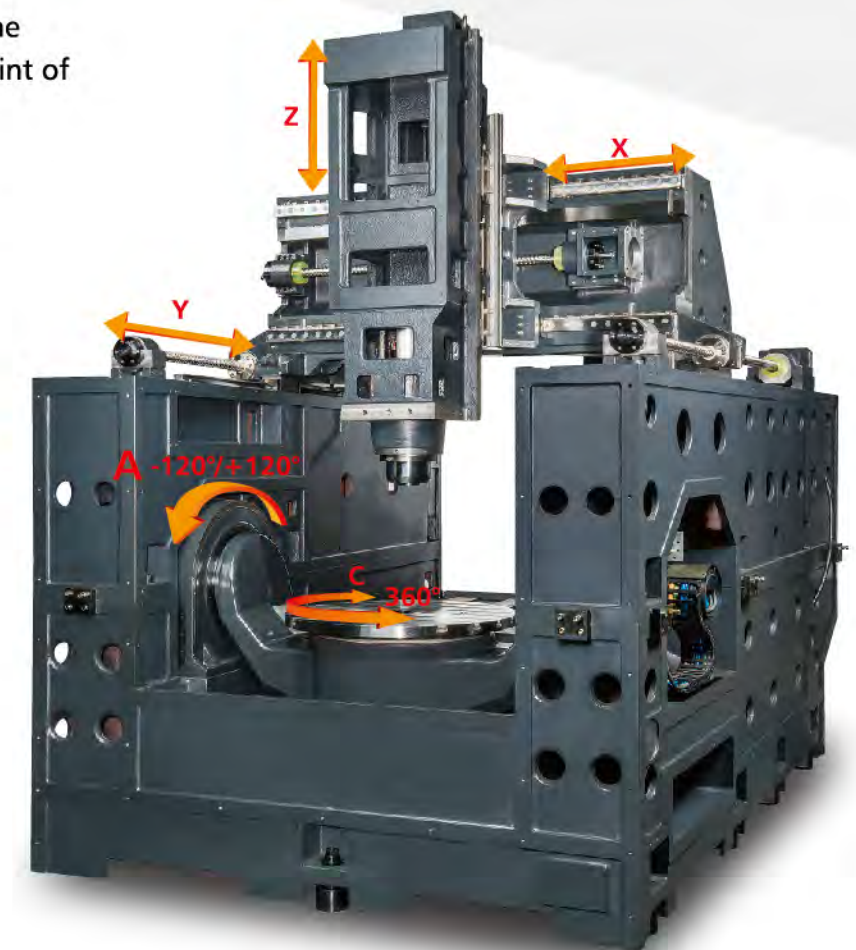
- The advanced U-Shape structure significantly increases structural rigidity and machining accuracy.
- X.Y.Z-axis rapid traverse rate reach 48m/min.
- Suitable for equipping with a large diameter of rotary table.

Three Axes Overlap and Separated from Two Rotary Axes

- This design avoids a distance between the machining point and the intersection point of two rotating axes.
- Easy to compensate for the errors of radius on rotating axes and movement on three linear axes to ensure the machine's stability and accuracy.

Separated Design for Three Axes Moving Area and Machining Area

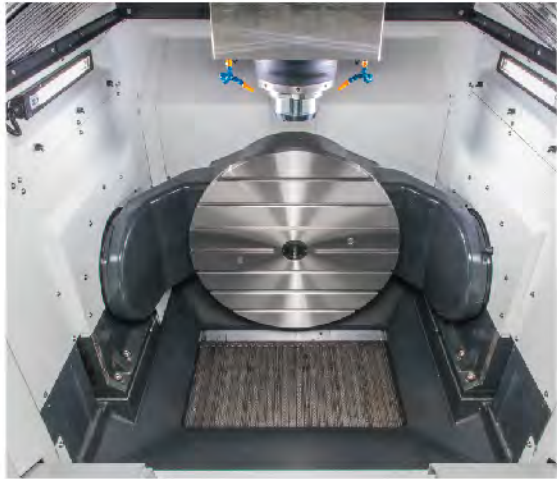
- This design feature not only makes chip removal more convenient, but also enables better chip-prevention capability of the machine.



Gantry Type Structure

Efficient Chip Removal

- With the one-piece fabricated hopper-shape outlet port, chips in the machine can be quickly removed.



5-Axis Linear Scales

- Standard only for Universal type 5 axis machine. It provides a closed-loop feedback control and achieves the highest positioning accuracy.



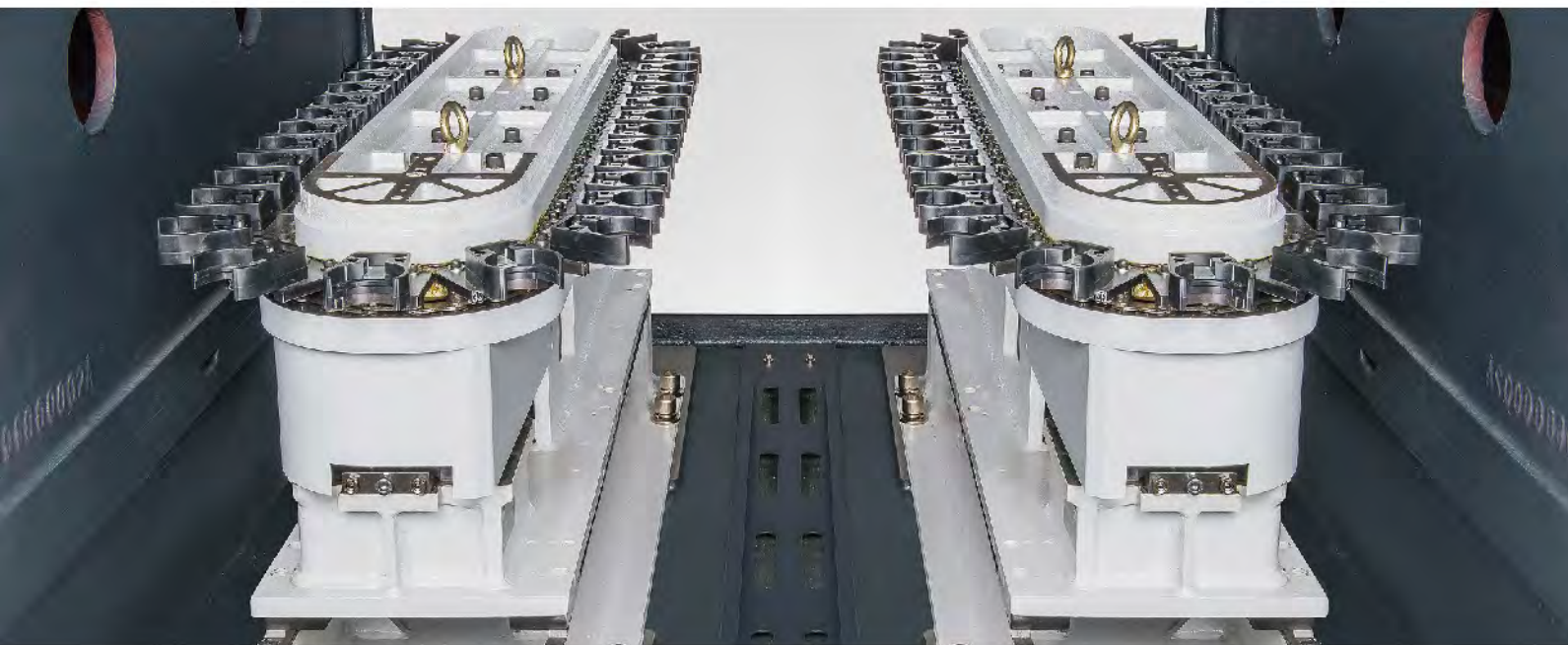
THK Roller Type Linear Guides

- Satisfy the requirements for high rigidity, high speed and high accuracy cutting.

Horizontal Type Tool Magazine

32 Tools Standard 48/64/96/128 tools optional

- Driven by a servo motor, the automatic tool changer provides fast tool change with extremely smooth motions.
- Horizontal type construction permits uniform weight distribution of the entire magazine unit.
- Light weight with simplified structure design reduces trouble to a minimum and increases convenience in maintenance.



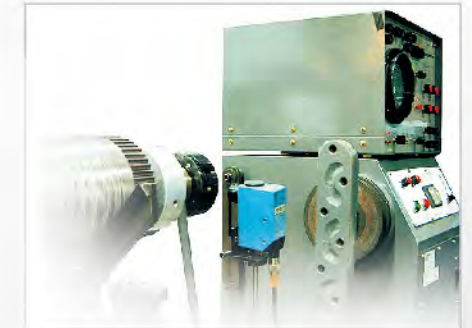
Precision Inspection Accuracy Guaranteed

At FEELER, we have a strong commitment to provide the best possible machining centers that meet or exceed customers' expectations. Over the years, we have implemented a world class quality control system and the state-of-art inspection equipment.



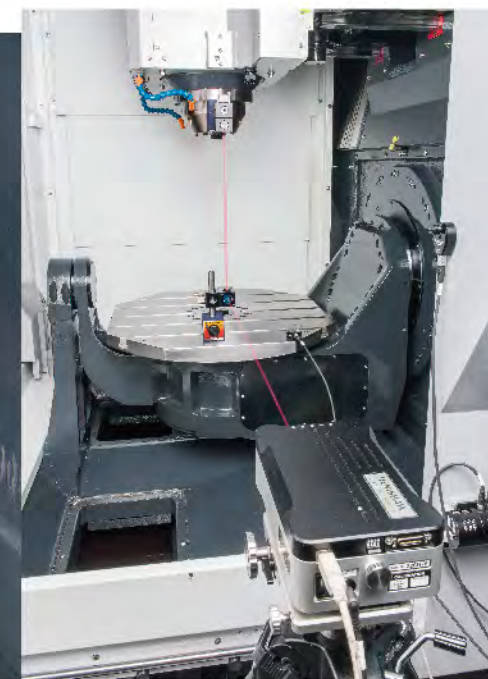
ZEISS 3D Coordinate Measuring Machine

FEELER utilizes the 3D Coordinate Measuring Machine (CMM) to inspect critical parts ensuring outstanding parts accuracy.



Spindle Dynamic Balance Test

A high precision balance tester is applied to inspect the spindle dynamic balance. It is also employed to inspect the spindle chattering at high speed. Rigid CastIron.



Laser Inspection

The laser equipment provides positioning accuracy inspections, ensuring machining accuracy and repeatability.



Ball Bar Testing

The ball bar tester is used to inspect the circularity accuracy for a servo axis running on a surface. This test will ensure circle cutting accuracy.

U1000

5-AXIS Horizontal Machine Center with High-Rigidity Structure Design

When designing FEELER U1000, their creators focused the attention on achieving a set of quality guidelines established for a new FFG product: high rigidity, high precision, high efficiency and stability and extensive applicability. The result is a machine that provides excellent levels of productivity.

With a 45° vertical and horizontal design of the spindle, the machine can effectively mill complex surfaces and respond well to a large variety of instructions.

5-axis lessens the frequency of load/unload of the workpiece and the manufacturing of the fixture. The rotary table changer can, at the same time, carry out the loading and unloading of the workpiece while processing.

The servo automatic tool changer can accurately memorize which specific tool is needed for a certain machining. This type of technology gives the machine the ability to refine and complete rough surfaces and this ability is especially suitable for processing hard metals and non-metallic materials, satisfying the needs and expectations of every now day user.



Application Areas

- Aerospace industry
- Automobile industry
- Mold manufacturing industry
- Energy industry
- 3C industry
- Machinery manufacturing industry



1 Spindle

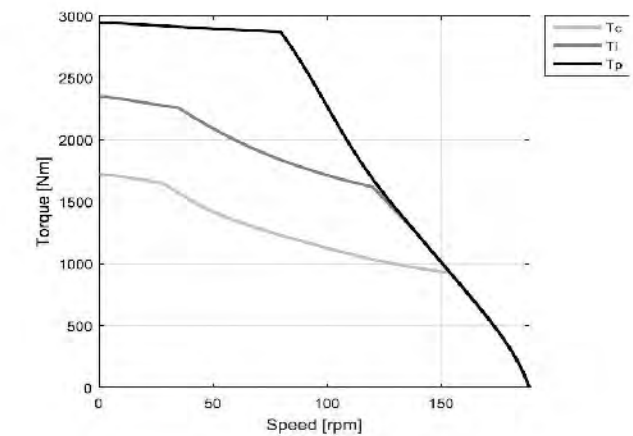
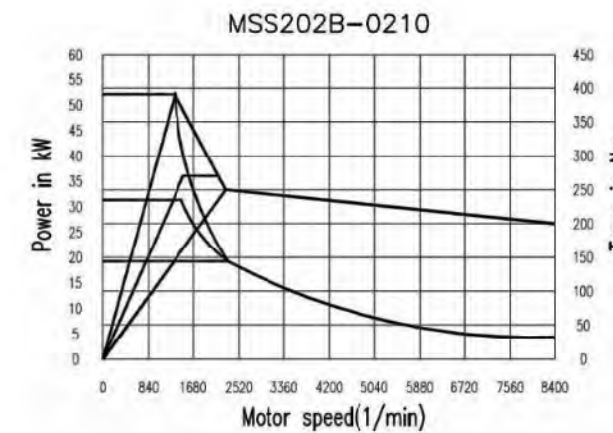
- Use built-in motor to improve machining accuracy
- Spindle speed 8000 rpm
- combines the turning and milling function
- Optional coolant through spindle.

Vertical-Horizontal Spindle Head:

- The 45 degree spindle head gives a superior level of stability
- The structural rigidity by finite element analysis optimizes the performance by lightening the spindle head
- Has standard B-axis optical scale
- Combines the turning and milling function.

2 B axis

- Use DD motor to provide high torque and rigidity
- Direct drive system to show excellent dynamic performance
- Can reach a position from 0° to 180° while machining
- Can carry out three-dimensional continuous machining.



B-axis Using YRT Cross Roller Bearing

- High axial and radial loading capacity;
- With anti-rust capability;
- Corrosion resistance;
- High heat resistance.

Five Surfaces Processing Applications

- The spindle head is positioned at 0° degrees for vertical machining.
- The spindle head is positioned at 180° degrees for horizontal machining.

Back Wall Structure

High rigidity design allows achieving maximum machining performance. The FEELER U1000 5-axis vertical and horizontal machine center machine adopts a back wall structure for the design of the main body. With this optimization, a lightening of the weight of the entire structure and an outstanding rigidity advantage are achieved. As a consequence the machine results having a substantial quality increase of the performance, achieving a level of precision that is higher than other models.

A. Main Structure

- Columns use high tensile steel
- The rest of the structure adopts high-quality, evenly distributed cast iron.

B. APC Servo Rotary Exchange Table

- The maximum diameter of the table is 1000mm
- Unilateral maximum loading capacity of the table is 2000kg
- The large positioning taper cones enhance the position accuracy
- The servo system ensures high precision and repeatability of the rotation

C. Chain Magazine with Tool Changing Servo System

- Standardly equipped with 60 tools, to guarantee large variety of cutting shapes
- Provides the longest 550mm and 250mm diameter, the largest diameter of the tool selection (adjacent tool).
- Optimization of the design of the oil water recollection system.
- Tool change system using servo control, allowing the regulation of the speed according the weight of the tool.

D. The 3-Axis Use High-Rigidity Ball Screw

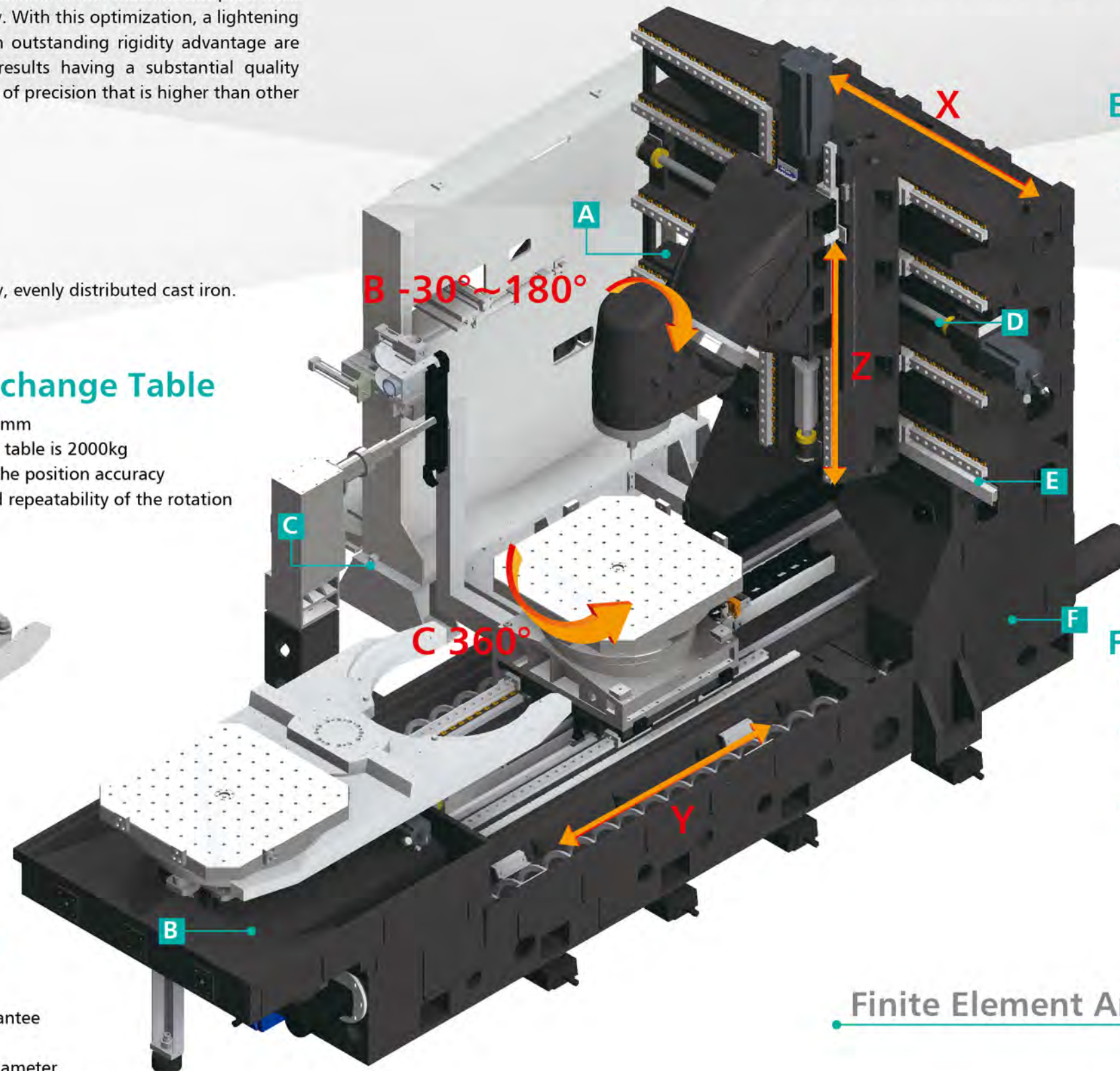
- Large size drive system ensures an improvement in rigidity.
- Optional 3-axis ball screw oil cooler hollow.

E. 3-Axis Use of Heavy-Load Roller Type Linear Guideways

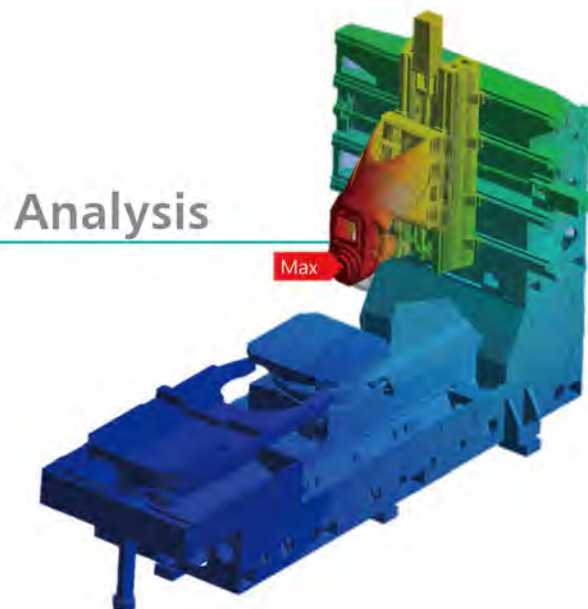
- Line contact guideways type can withstand heavy loads. Special elastic properties allow beneficial microscopic deformations that greatly enhance the rigidity of the linear slide to maintain high-precision machining.
- X-axis designed with 4-guidelines placed at a large spam, provide a solid support base to the vertical-horizontal.
- Y-axis with linear guidelines placed at large spam is a design studied according to a formula that better sustains the fulcrum of the machine providing the least possible amount of deformation to the beam and to the entire structure.
- Z-axis guideline without weight counterbalance, designed to provide a quick response and allow symmetrical heating of the structure, that avoids deformations due to excessive temperature rise.

F. Structure Design Optimization

- The back wall of the structure was strengthened with a new high-rigidity design.
- A finite element analysis and a modal analysis are carried out for the entire structure to ensure the optimization of the rigid design.
- 3 support points are optimized to guarantee machine rigidity and cutting efficiency.

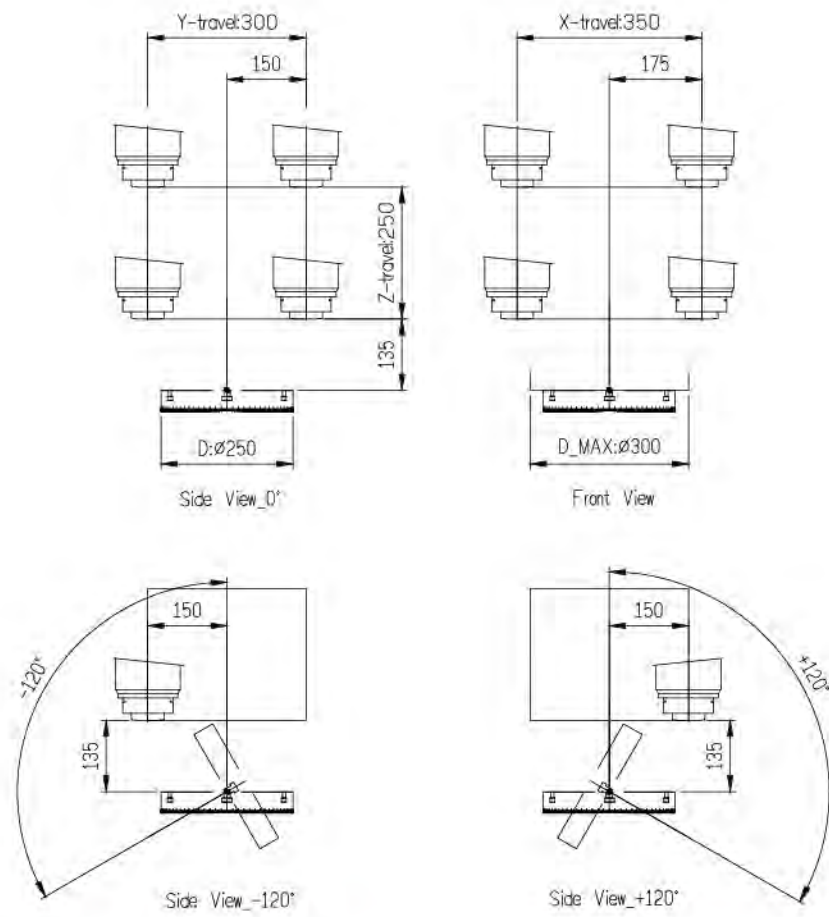


Finite Element Analysis

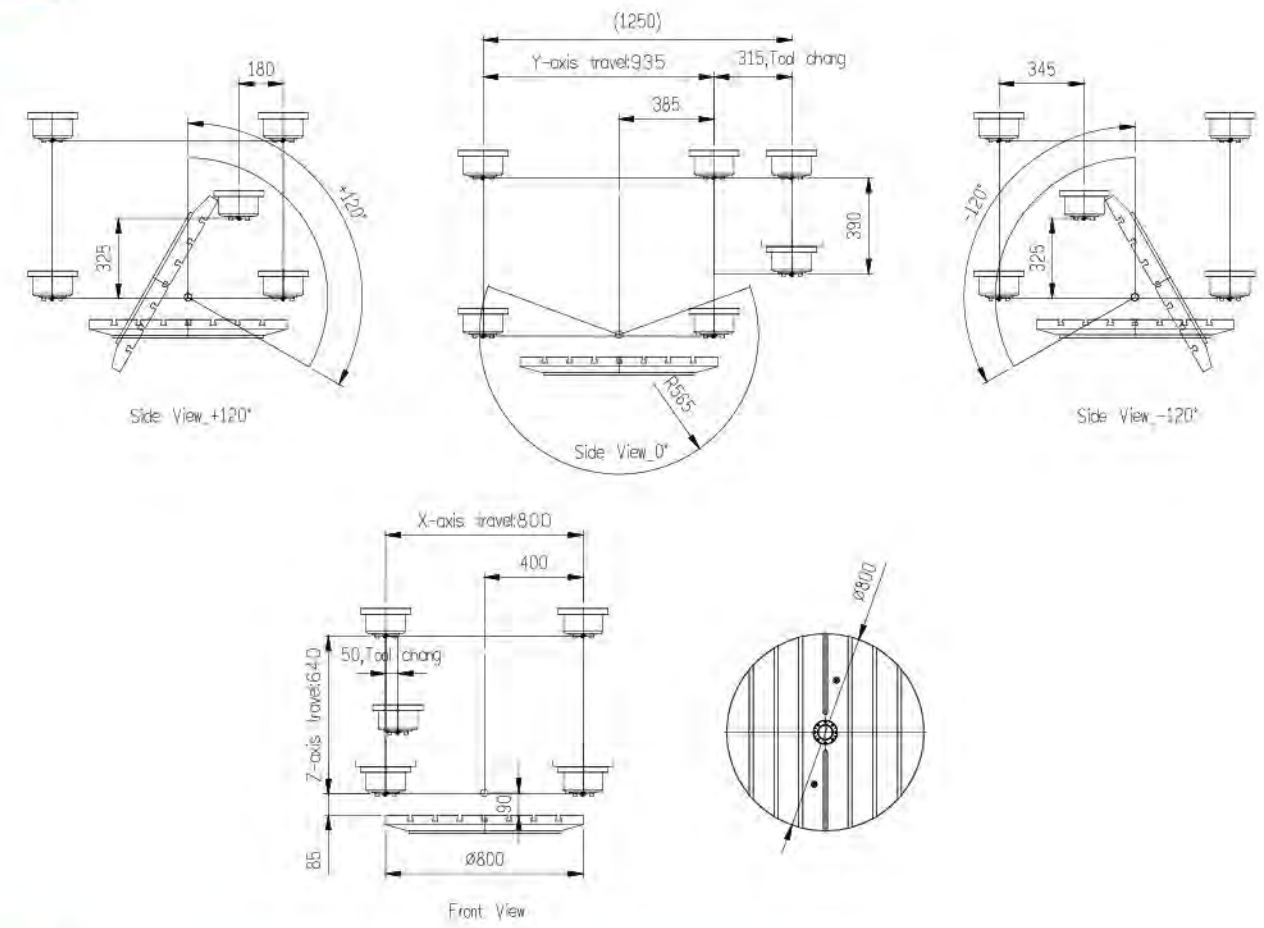


Working Area

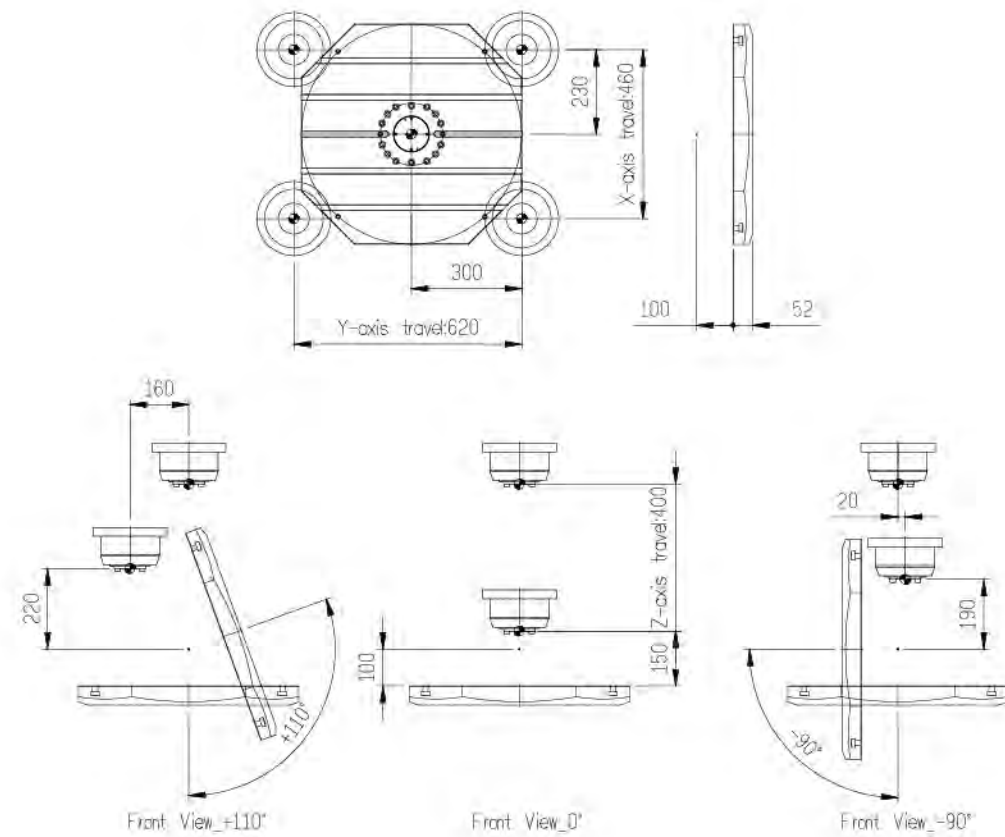
U250



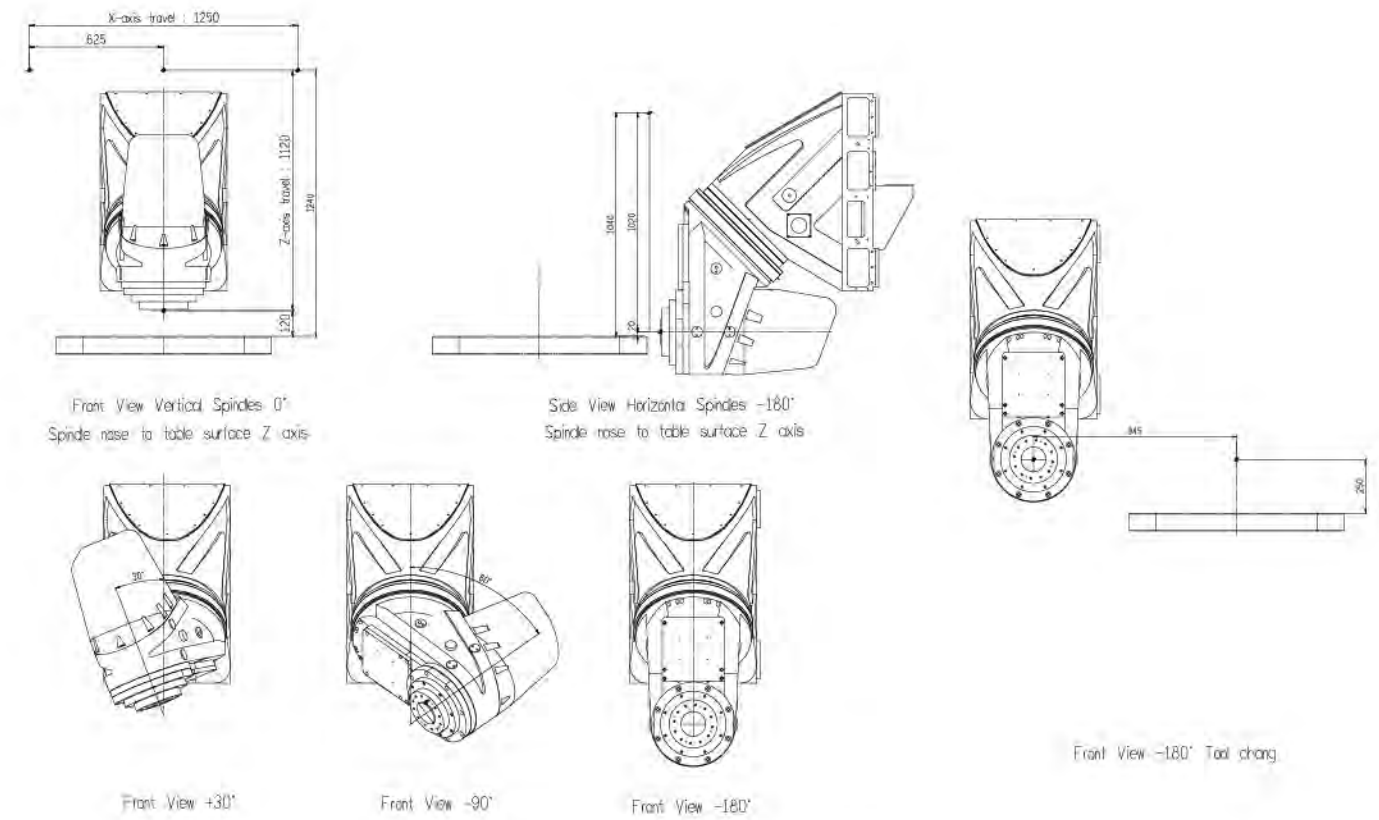
U800



U600P

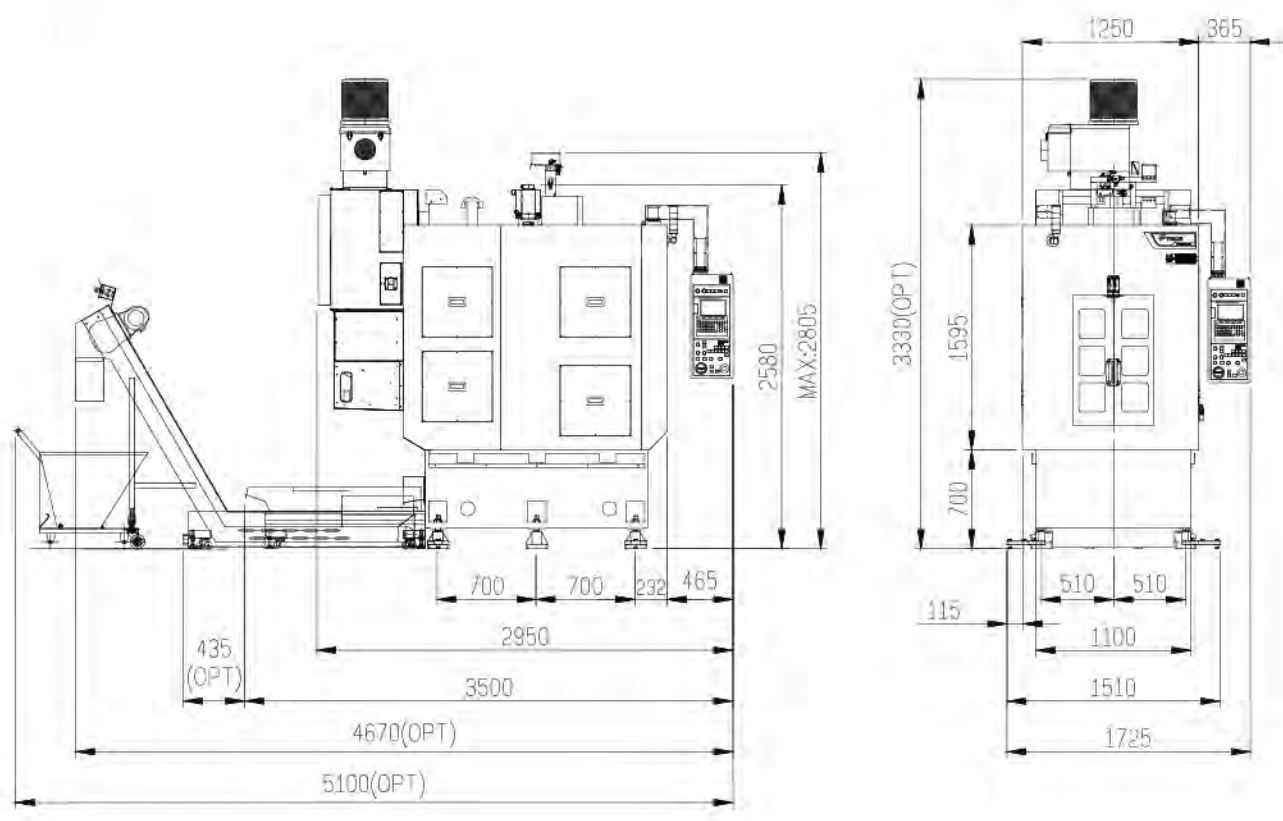


U1000

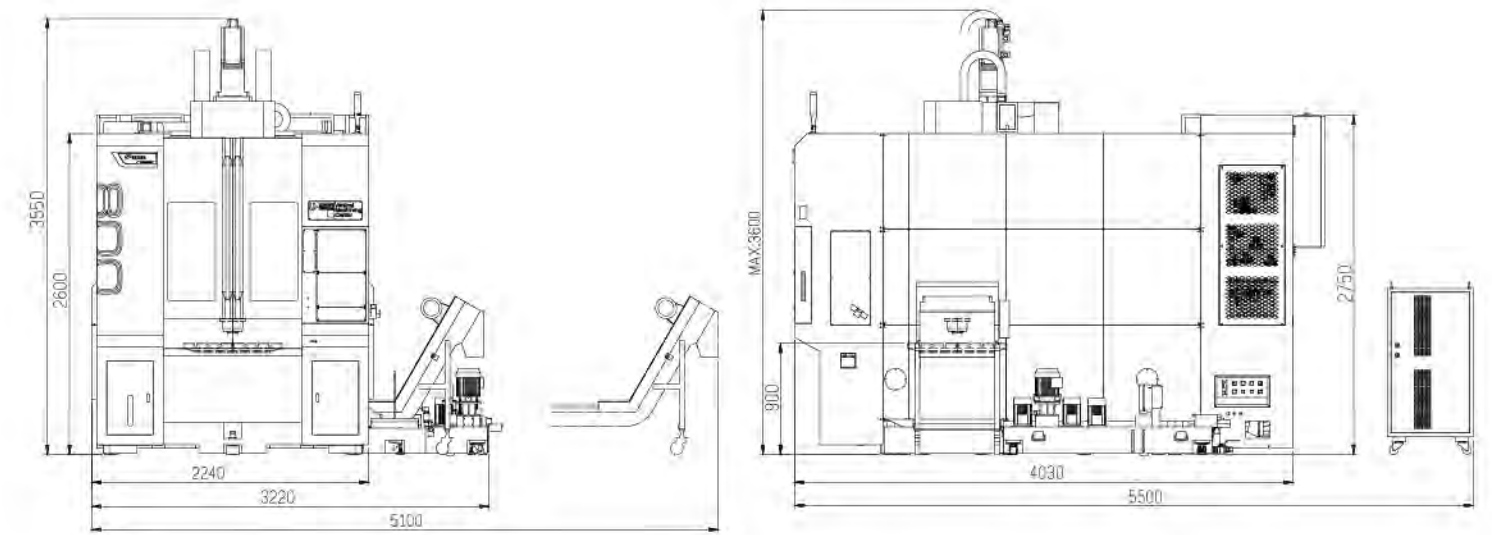


Floor Space

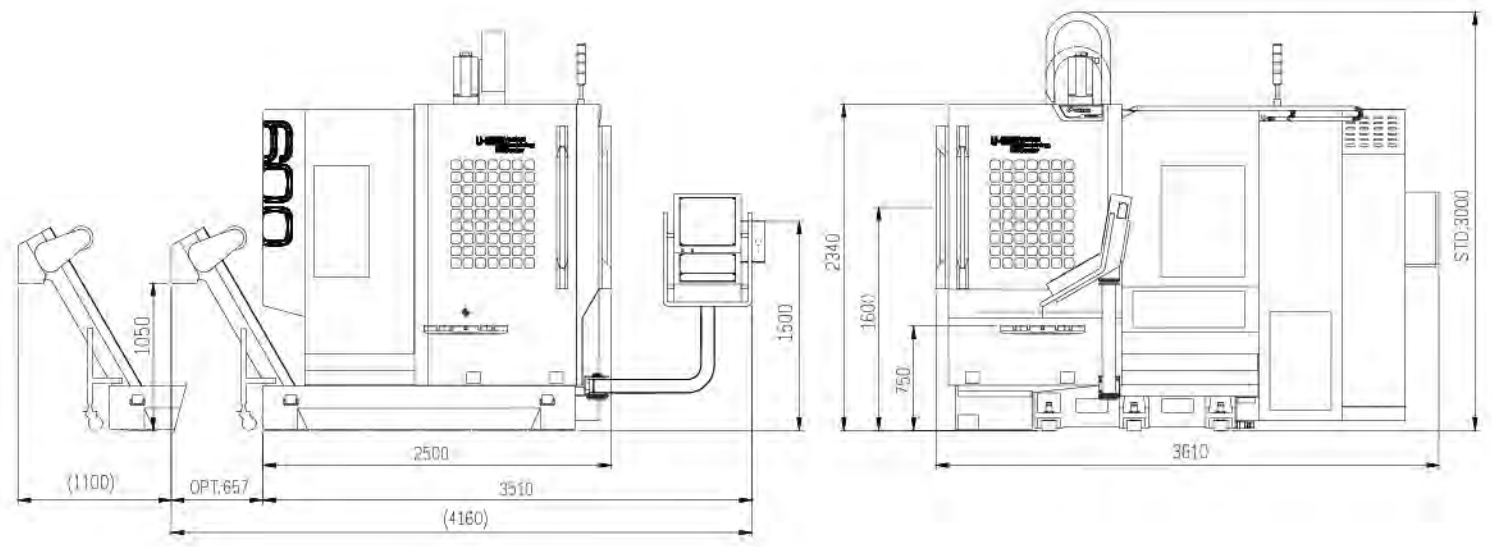
U250



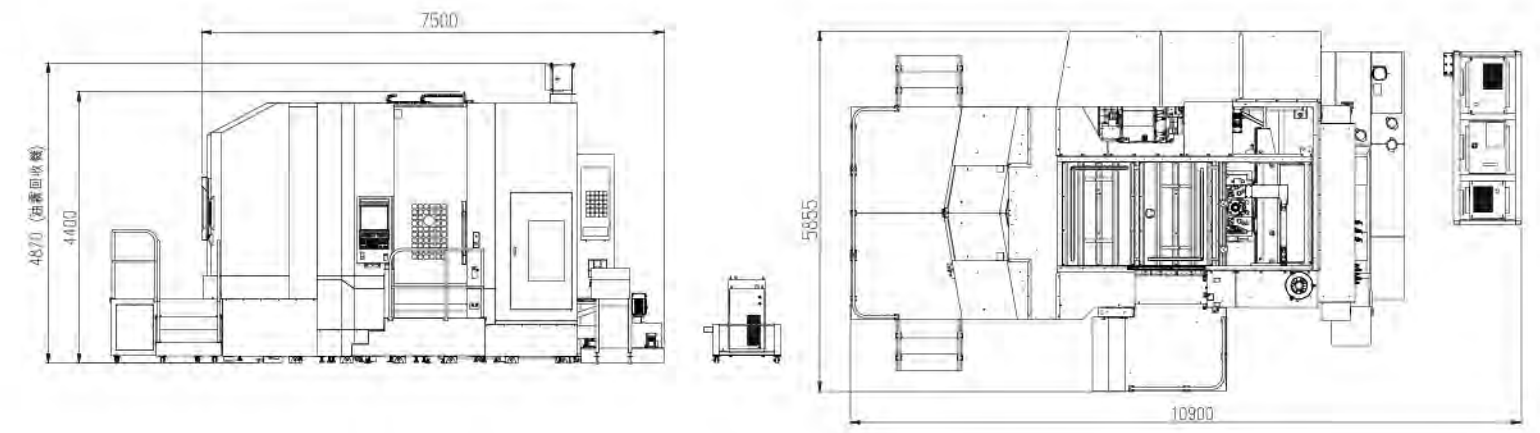
U800



U600P



U1000



NO	Features	U-250		U-600P		U-800		U-1000	
		Standard	Optional	Standard	Optional	Standard	Optional	Standard	Optional
1	3-Axis Pro-Tensioned Ballscrew	●		●		●		●	
2	Automatic Lubrication System	●		●		●		●	
3	10000rpm Direct-Drive Spindle (#30)	●							
4	12000rpm/15000rpm Direct-Drive Spindle		●						
5	10000rpm Direct-Drive Spindle (#40)			●		●			
6	12000rpm/15000rpm/18000rpm Direct-Drive Spindle				●	●			
7	24000rpm Built-in Spindle				●	●			
8	8000rpm Built-in Spindle							●	
9	CTS & Filtering System(20bar/30bar/50bar/70bar)		●		●	●			●
10	Spindle Oil Cooler		●	●		●		●	
11	Spindle Air Blast	●		●		●		●	
12	Spindle Air Sealing	●		●		●		●	
13	3 Axes Coolant Through				●	●			●
14	24T Nos. ATC (#40)			●					
15	30T/40T/60T Nos. ATC (#40)				●				
16	40T Nos. ATC (#50)							●	
17	60T Nos. ATC (#50)								●
18	26T (26 * 1) Horizontal Type Magazine	●							
19	32T (32 * 1) Horizontal Type Magazine					●			
20	48T/60T/64T/96T/120T Horizontal Type Magazine						●		
21	Turning Function				●				●
22	Linear Scale on X/Y/Z-Axis		●		●	●		●	
23	Angle Encoders on 4/5-Axis		●		●	●		●	
24	Heat Exchanger	●		●		●		●	
25	Air Condition(Note:European control must be optional)		●		●		●		●
26	Dust-Tight Electrical Cabinet	●		●		●		●	
27	Hydraulic Unit	●		●		●		●	
28	Air Blow (M Code)		●	●		●			●
29	Air Blast		●	●		●			
30	Flush	●		●		●		●	
31	Ethernet Interface	●		●		●		●	
32	Levelling Bolts & Plates	●		●		●		●	
33	Chip Conveyor-Rear Side Discharge		●		●				
34	Chip Conveyor-Left Side Discharge						●	●	
35	Chip Conveyor-Right Side Discharge						●		
36	Chip Cart		●		●		●		●
37	Flushing		●		●				
38	Front Shower Tube						●	●	
39	Top Roof	●			●			●	
40	CE		●		●		●		●
41	Coolant Gun		●	●		●		●	
42	LED Working Light	●		●		●		●	
43	3-Color Signal Light	●		●		●		●	
44	Wireless Workpiece Measurement		●		●		●		●
45	Laser Tool Length Measurement		●		●		●		●
46	Automatic Door		●		●		●		
47	Automatic Top Roof				●		●		
48	Water-Oil Separator System		●		●		●		●
49	Water-Oil Separator			●		●		●	
50	Operation & Maintenance Manual	●		●		●		●	

Specifications

MODEL	Unit	U-250	U-600P	U-800	U-1000
Travel					
X axis travel	mm	350	460	800	1250
Y axis travel	mm	300	620	935	1250
Z axis travel	mm	250	400	640	1000
Rotary Axis Rotation Angle	degree	0°~360°	0°~360°	0°~360°	0°~360°
Tilting Axis Rotation Angle	degree	+120° ~ -120°	+110° ~ -90°	+120° ~ -120°	+30° ~ -180°
Spindle nose to table surface Z axis	Vertical Spindles =0	mm	135-385	150-550	80-725
	Horizontal Spindles =180	mm	-	-	-
Table surface to floor	mm	860 ± 5	750 ± 5	900 ± 5	1472 ± 5
Table					
Table dimension	mm	Ø250	Ø600	Ø800	1000x1000
Table hole dimensions	mm	Ø75 H7	Ø60 H7	Ø60 H7	Ø55 H7
T slots	mm	6x12	5x14	7x14	M20x2.5
Max. table load	kg	100	350	1200	2300
	Working Torque	N-m	600	613	1230
Max. rotation speed	Rotary Axis	rpm	50	25	100
	Tilting Axis	rpm	33.3	25	50
Max. diameter of workpiece	mm	Ø350x250(H)	Ø600x400(H)	Ø800x640(H)	Ø1000x1000(H)
SPINDLE					
Spindle speed	rpm	Direct-drive type 10000	Direct-drive type 10000	Direct-drive type 12000	Built-in spindle 8000
Spindle taper	-	7/24 Taper NO.30	7/24 Taper NO.40	7/24 Taper NO.40	7/24 Taper NO.50
Spindle power	Kw	3.7 / 5.5	7.5 / 11	20 / 37	19 / 28
FEED RATE					
X-axis rapid traverse	m/min	36	30	48	50
Y-axis rapid traverse	m/min	36	30	48	50
Z-axis rapid traverse	m/min	36	30	48	50
ATC					
Tool changing time (Tool-to-Tool)	sec	4 / 60Hz	7 / 60Hz	10 / 60Hz	3.2 / 60Hz
Tool changer	-	Drum type	Arm type	Drum type	Arm type
No. of Tools	-	26	24 (30 · 40 · 60)	32 (48 · 64 · 96 · 128)	40 (60 / 90 / 120)
Pull stud	-	P-30T (45°)	P-40T (45°)	P-40T (45°)	P-50T (45°)
Max. Tool weight	Kg	3	7	7	30
Max. Tool length	mm	150	280	300	550
Max. Tool diameter	mm	φ 60	φ 80	φ 75	φ 125
Max. Tool diameter (No adjacent tool)	mm	φ 65	φ 150	φ 125	φ 250
FLOOR SPACE	mm	1725(W)X3500(D)	3650(W)X3500(D)	3220(W)X4030(D)	10900(W)X5855(D)
MACHINE WEIGHT	Kg	4600	8850	18500	38000
MAX. MACHINE HEIGHT	mm	2805	3000	3600	4870
POWER CAPACITY	KVA	25	40	90	150
AIR SOURCE	bar	6~8	6~8	6~8	6~8