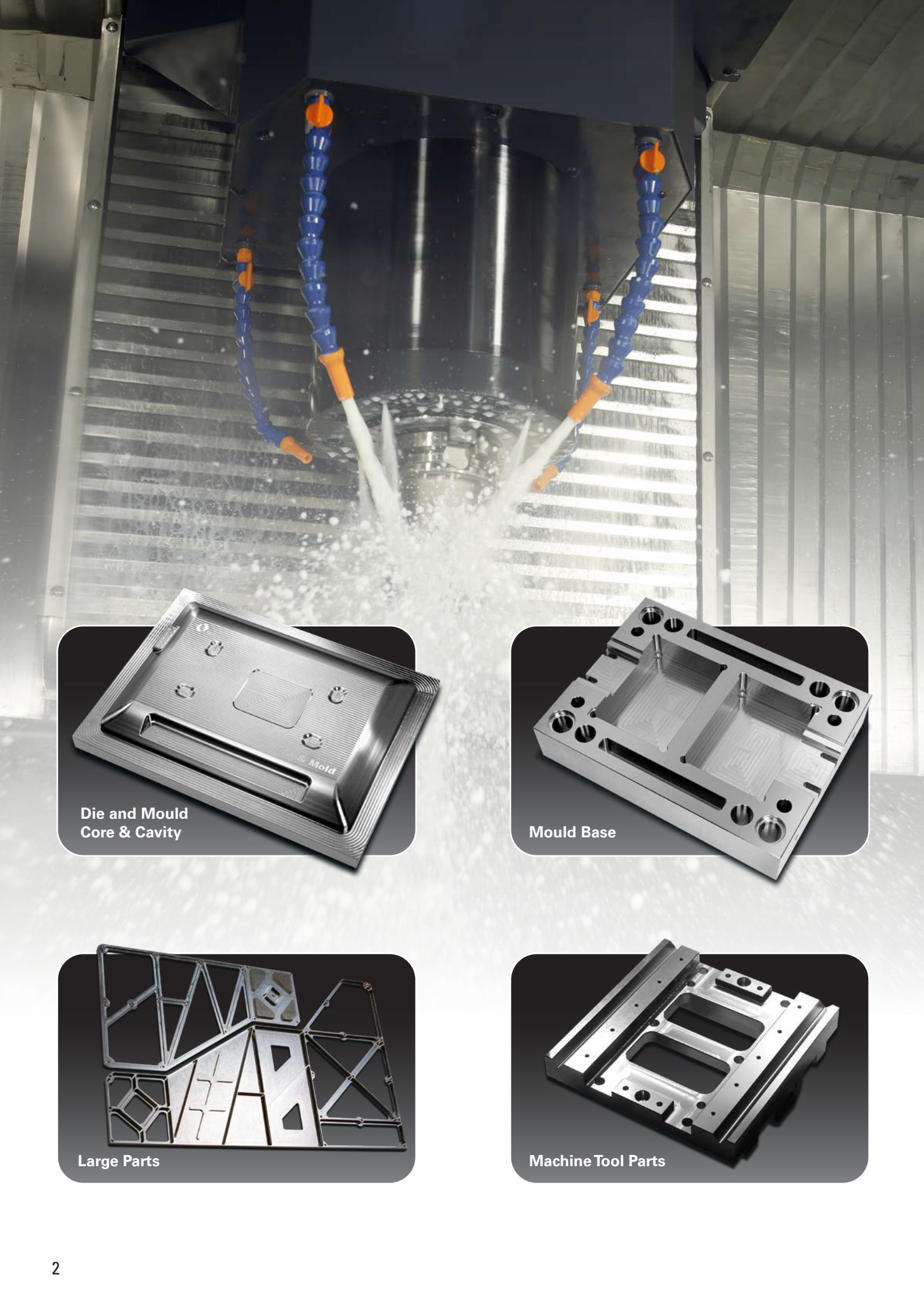


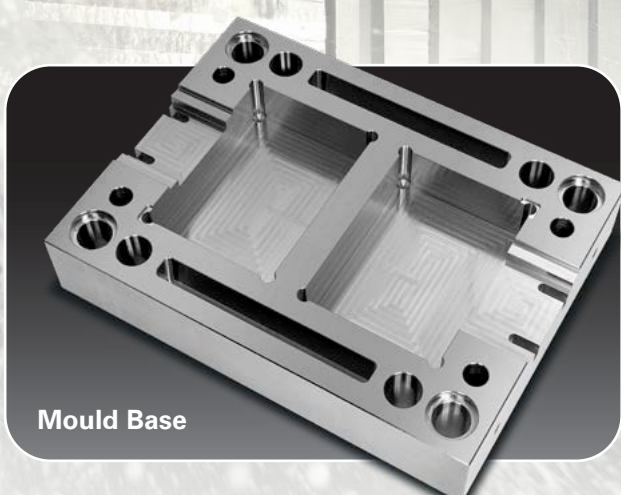


F8/F9

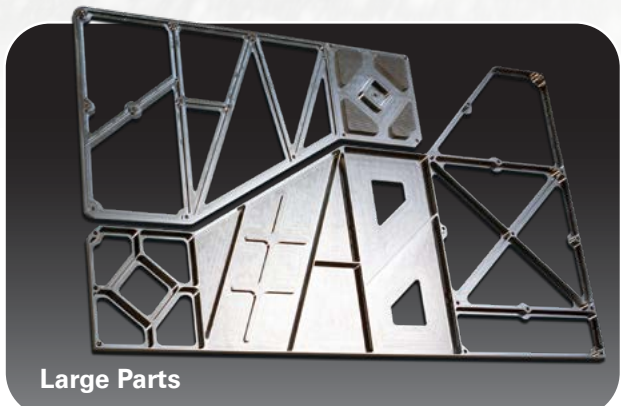
Vertical Machining Centre



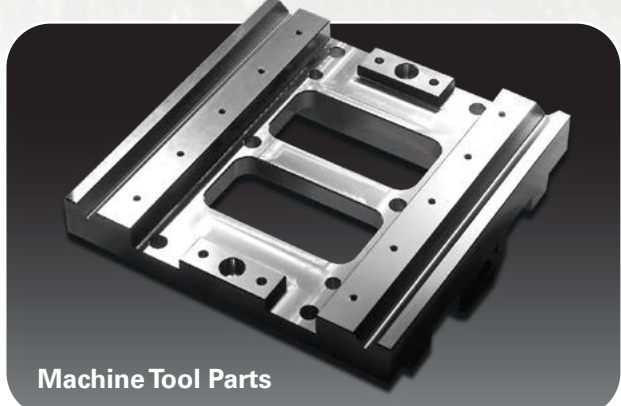
Die and Mould
Core & Cavity



Mould Base



Large Parts



Machine Tool Parts

“Faster throughput, finer finishes, and lower cost. Made possible with Makino’s intelligent technology”

In the evolution of consumer goods, there is a demand for continuous improvement in aesthetics, styling, cost and performance. Large moulds/parts present challenges due to the size, weight and complexity. It is a tremendous challenge for manufacturers to provide an efficient and competitive solution to die/mould, production and aerospace industries.

Each industry has its own demanding requirements on surface finish, contouring accuracy, and tool life, with the ultimate goal of achieving a lower cost with improved quality.

Makino is well-established in bringing this value to these diverse markets through the reliability of our product line, the innovation of the technologies employed in them, and the expertise of our engineering and applications personnel. Makino’s large F-series vertical machining centre is another example of Makino’s ability to bring the finest machining solutions to the marketplace.

Four elements make this possible:

- **Rigid Structure**
- **Thermal Stability**
- **High-Performance Spindle Technology**
- **Motion Technology**

The large F-series combines these advantages with an user friendly, ergonomic design and an efficient chip evacuation system. This line was designed with the customer and operator in mind providing unparalleled access to ease of setup and changeover, speeding up loading and unloading of large moulds/parts and accomplishing roughing and finishing on the same machine to reduce overall lead time. Moulds/Parts are easily loaded, programs easily run, and high-quality machining finishes are achieved - all at a lower cost per part.



Competitive Solutions for large and precision parts



The F8/F9 machines are designed to provide stiffness and rigidity for chatter-free cutting, agility expected from a hard milling machine and accuracies for tight-tolerance blends and matches typical of complex, 3-D contoured geometry associated with:

- Plastic, die cast to blow moulds
- Stamping to forging
- Prototype to production
- Medical, electronics, aerospace, optical consumer products, to packaging

Centre Console

- Virtually eliminating adjustments during matching
- Low vibration spindle even with using long cutters L/D=9

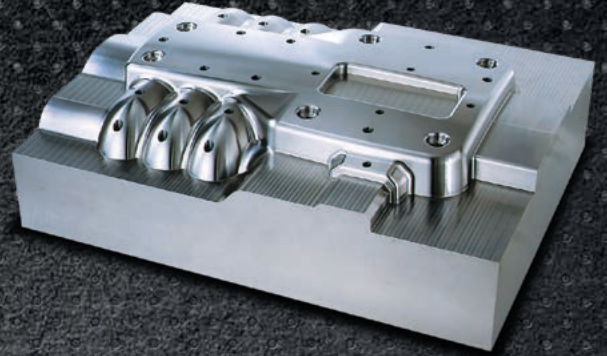


Unbeatable Performance



Door Panel

- Complete process, roughing to finishing in 1 machine
- No mismatch between large and small tools during long hours operation
- 20,000 rpm spindle



Engine Cover

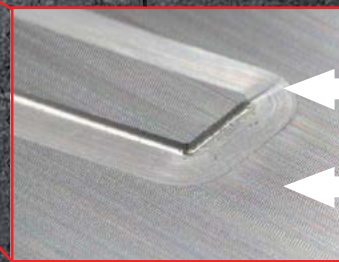
- Complete process, roughing to finishing in 1 machine
- No mismatch between large and small tools during long hours operation
- 10,000 rpm spindle



Plastic Mould

Air Conditioner Panel

- Low spindle vibration enhancing surface finish quality
- 20,000 rpm spindle
- Less than 2 μm step between large and small tools

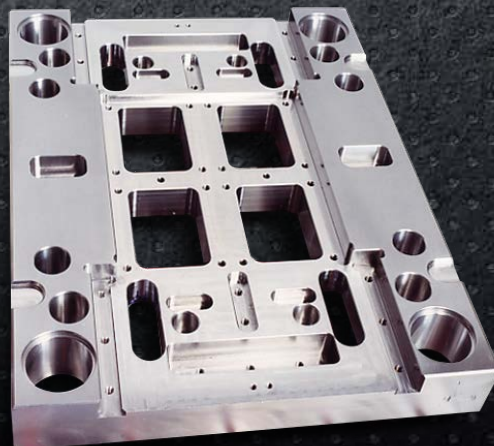


R0.5

R4



Stamping die



Mould Base

- Powerful and low vibration spindle increases productivity
- High performance guide hole drilling with 80 mm
- 10,000 rpm spindle

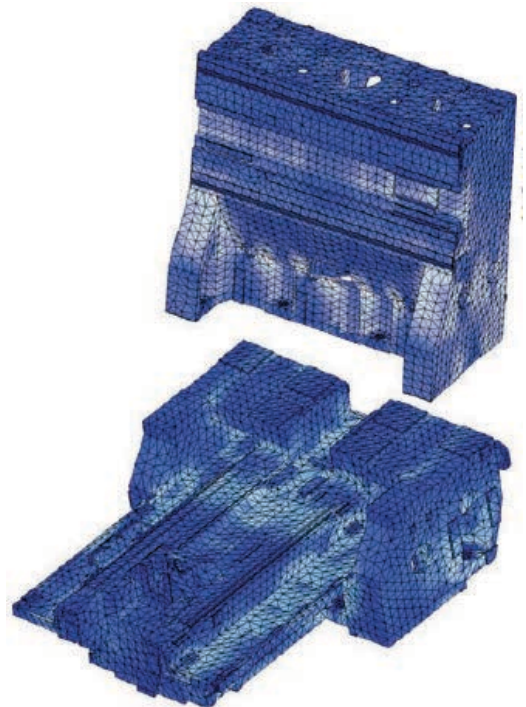
Rigid Structure

Heavy cast iron construction and an unique axis configuration provides outstanding stiffness, rigidity, thermal stability, accuracy and unequaled axis support throughout the full travel of each axis:

- **X and Z on the column**
 - Constant spindle support distance
 - Fully supported throughout the complete axis travel
- **Y under table**
 - No "stack-up" of X and Y
 - No off-centre table load condition
 - Fully supported throughout the complete axis travel

The Finite Element Analysis (FEA) of the basic components ensures optimized structural rigidity and torsional stiffness for ultimate performance characteristics and consistent results.

This structural rigidity is the foundation for superior cutting performance, provides damping against vibration, and sustained accuracy for the life of the machine.



Most competitive machines feature some variation of a traditional "C-frame" design. Therefore, in most die and mould applications, by virtue of the machine configuration and associated geometry, the machine tool elements significantly overhang their support structure:

- The Z axis is cantilevered from the X axis (Figure 1)
- The X axis is "stacked up" on the Y axis (Figure 2)
- The X axis is overhung from the Y axis (Figure 3)

As a result, cutting forces - combined with these long, unsupported, cantilevered distances create stiffness, rigidity and dynamic distortion issues that produce vibration and chatter. Such instabilities, inertial factors and bending moments during cutting dramatically impact surface finish, final part accuracy, cutting speeds and feeds, achievable depth of cut, cycle time, tool life, and productivity. By virtue of the unique F-series construction, the machine provides a stiffer, more rigid, highly accurate, chatter-free platform for even the most difficult of cuts.

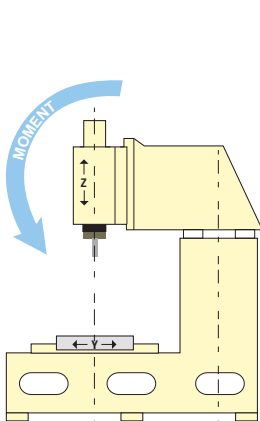


Figure 1

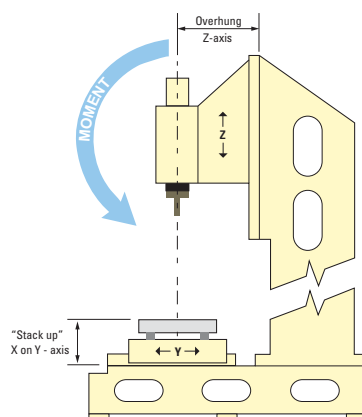


Figure 2

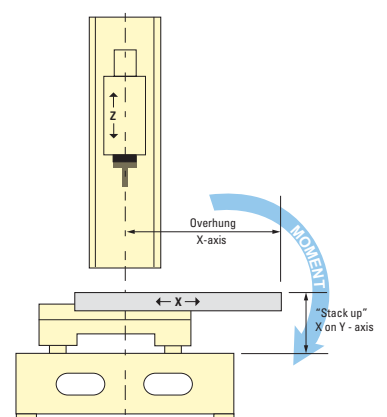
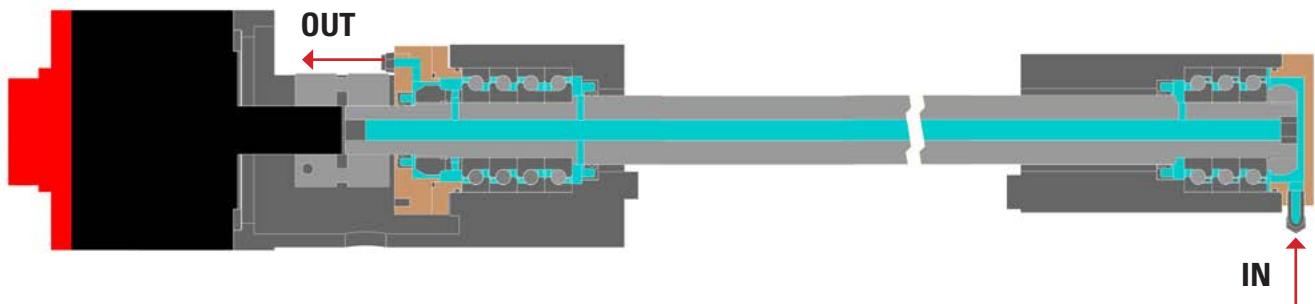


Figure 3

Thermal Stability

Ball screw core cooling

- Cooling oil controlled to the machine temperature is circulated through the inside of the ball screws to minimise or control heat generation during high-speed movement.
- In addition, cooling oil is also circulated to the support bearings providing the dual effect of cooling and increasing the life.

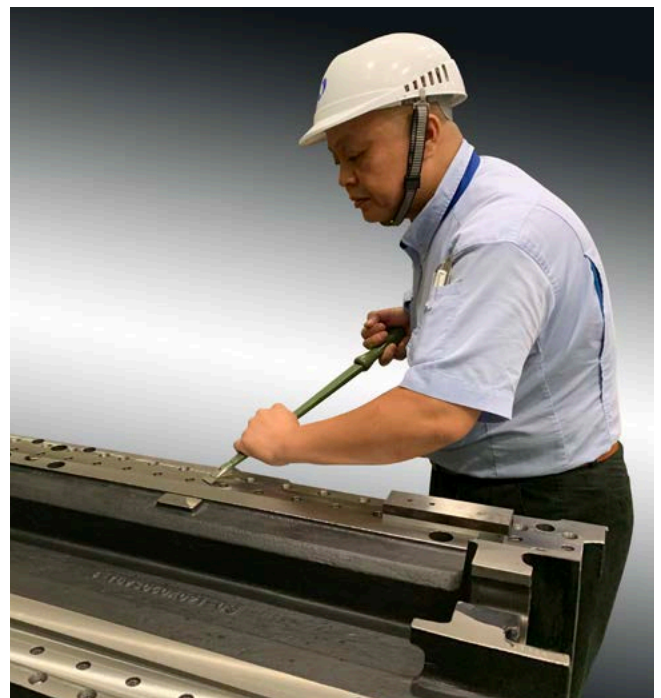


High performance linear motion guideways provide extremely precise, anti-friction motion. In addition, pre-tensioned, dual supported, large diameter ball screws and powerful, direct-coupled, digital servo motors – tuned for peak performance - provide the stiffness and rigidity for the most challenging applications.

Achieving High Precision Accuracy Through Mechanical Means

Parts are accurately manufactured, meticulously adjusted and assembled with exacting precision.

Scrapping is incorporated in the machine assembly in order to achieve better profile accuracy and surface matching which results to mechanical accuracy in order to further enhance and increase the machine performance and increase the machine life at the same time.

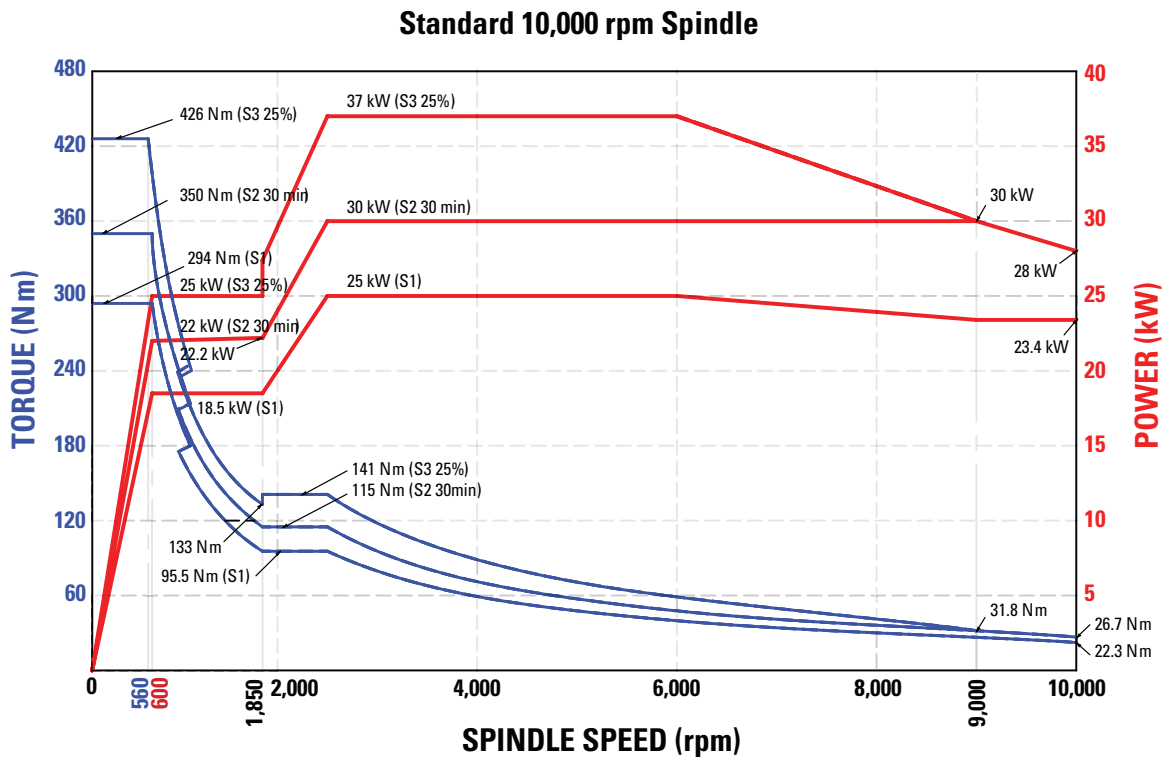


High Performance Spindle Technology

Makino's leadership in spindle technology is renowned throughout the world. Spindle rigidity, higher rpm, constant pre-load, multi-plane balancing, minimizing vibration, and controlling thermal growth are all issues that Makino has solved through years of experience and application of spindle design, manufacture, and assembly.

Blend of Speed, Power and Torque

Included in the standard configuration of the large F series machines is a highly productive 10,000 rpm, BT50 (optional HSK-A100) spindle. The air-oil spindle design provides a unique blend of speed, power and torque, and jacket cooling provides the thermal stability to meet the widely variable manufacturing needs of both the large part production and big die and mould component markets which needs the capability of heavy milling, drilling, roughing and finishing on the same machine.



HSK Spindle (Option)

The HSK tool interface with two restrained surfaces simultaneously couples the taper portion of the shank and the flange end face.



1. Improved Heavy-Duty Cutting Performance

The difference in cutting performance is especially noticeable when machining with longer shank tools.

2. Improved Accuracy

Excellent attachment accuracy is faithfully reproduced for greater machining accuracy.

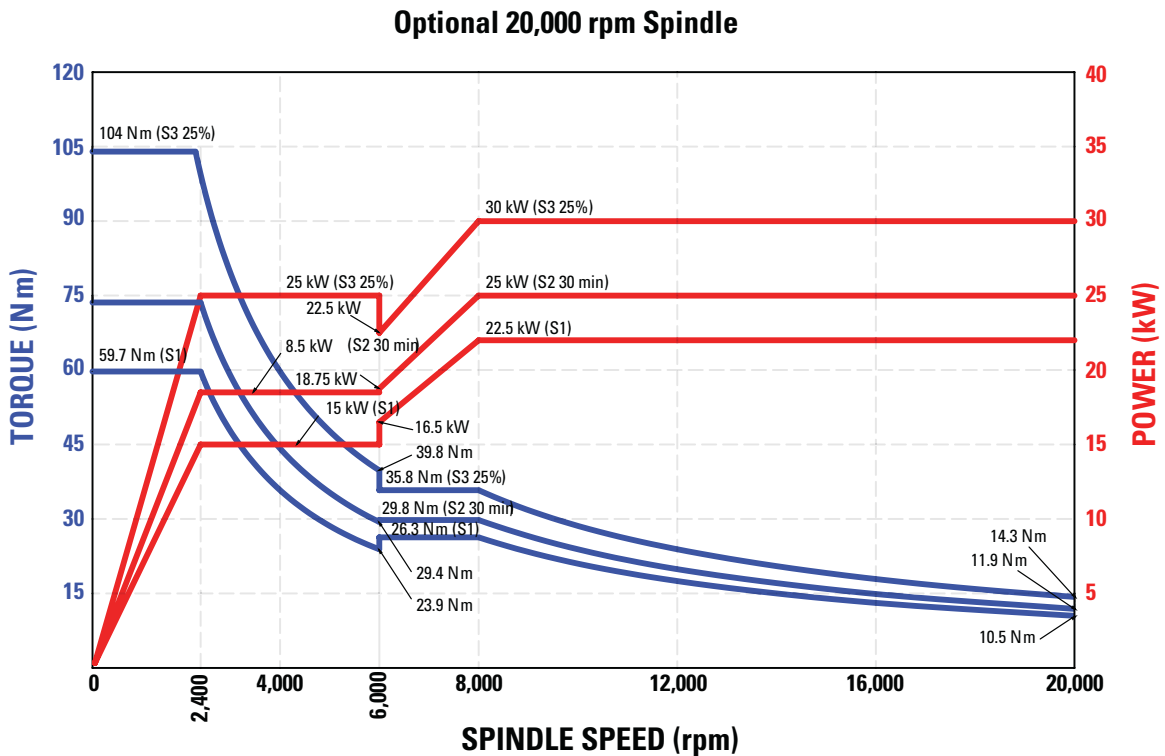
This system firmly secures the tool holder both on face and the shank and provides very high rigidity and improved accuracy. Strongly recommended for high-speed applications.

Optional Spindle Configuration

The optional 20,000 rpm, HSK-A63 spindle incorporates Makino’s patented spindle technology:

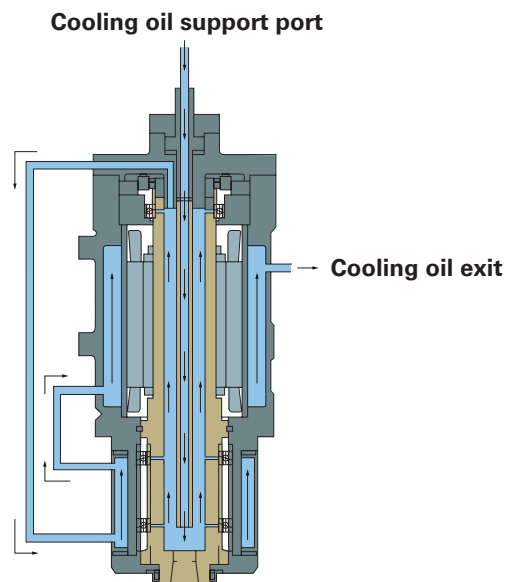
- Spindle core cooling
- Under-race bearing lubrication
- Closed loop oil temperature control

The spindle provides characteristics required in any number of high-speed machining applications typical of the die and mould industry. The two-range, unique integral design provides wide-range capability with stiffness and rigidity at lower ranges (roughing operations) to vibration & chatter-free production of small details and fine features when using small tools at a high rpm.



Spindle Temperature Controller

The large F series machine is the only machine of its class to combine a large capacity, heat dissipating spindle chiller, and the Makino technologies mentioned above. This maintains tight control over the spindle, bearings, and motor area, thus minimizing any spindle thermal growth effects upon spindle pre-load that impacts spindle stiffness and rigidity, tool life, surface finish, and ultimately final part accuracy. In addition, the oilmatic provides outstanding temperature control to the X, Y and Z axis ball screw bearing packages and core – cooling to each ball screw creating an ambient manufacturing zone between the spindle and machine axes.





Motion Technology

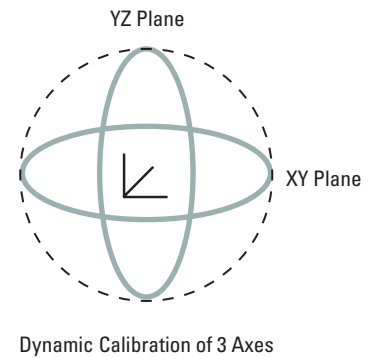
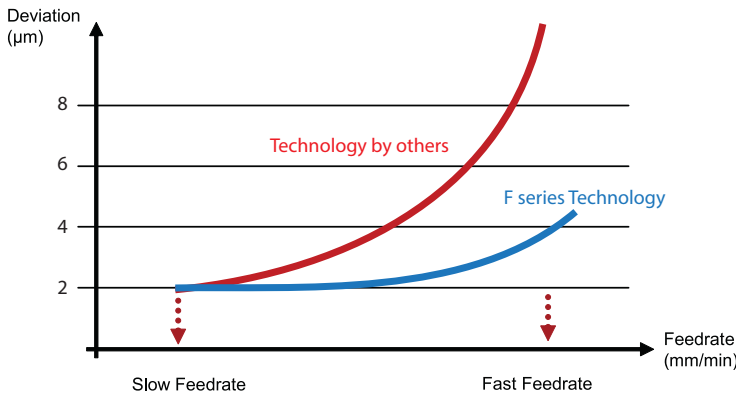
Super Geometric Intelligence (SGI.5) software-developed specifically for high feedrate, tight tolerance machining of complex, 3D-contoured shapes involving continuous tiny blocks of NC data. It ensures production rates faster than standard CNC systems while maintaining high profile accuracy. SGI.5 facilitates improved cycle times.

- Fine motion control even at high feedrate
- F-series provides advanced acceleration and deceleration control technology
- High-Speed and High-Accuracy machining made possible

G.I. & S.G.I.

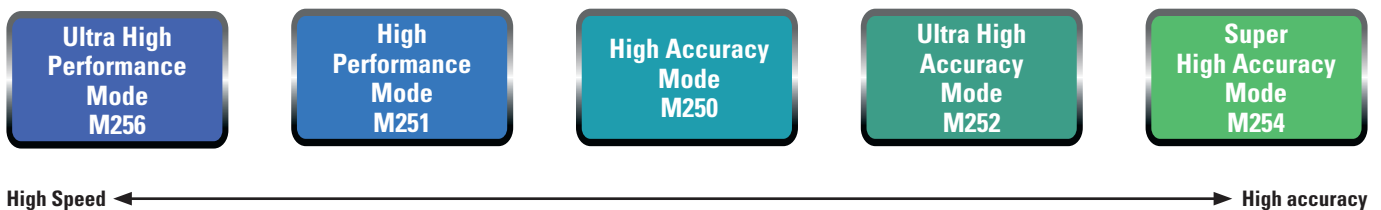
- Enhanced cutting point accuracy
- Cutting mode selection
- CMD optimized machine

- Look ahead
- AICC II (Artificial Intelligence Contour Control)



The machining mode that optimally matches the machining job can be selected with M code commands, which facilitates to achieve desired surface quality and shape accuracy, which in turn increase machining efficiency and improving productivity.

The machining mode that optimally matches the machining job can be selected with M code commands.



Without GI control



With Super GI.5 control

Controller

Pro 6 Controller

With a perfect blend of the proven stability of FANUC hardware and Microsoft Windows Embedded Standard OS, the cutting-edge Pro6 provides:

- Streamlined operation: The screen layout matches the operator's process flow from setup to production.
- Operator assistance: Guidance functions, parameters, code and manual search function are available on screen when and where they're needed.
- Additional standard functionality is now available to make sure operators are ready for any job.
- Enhanced safety: Dual-check safety, 3-D graphic viewer, maintenance screens and easy access to machine information are included.



Easy to see with larger 15 inch LCD

Multi touch screen to adapt both flick and pinches operations

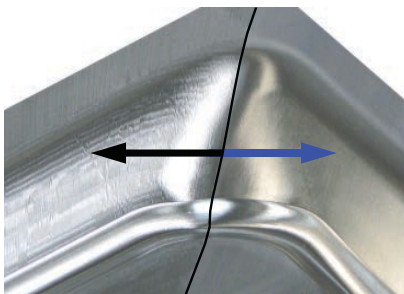
Full QWERTY keyboard

Simplified operation panel with minimum number of buttons and dials

Portable MPG with display is standard

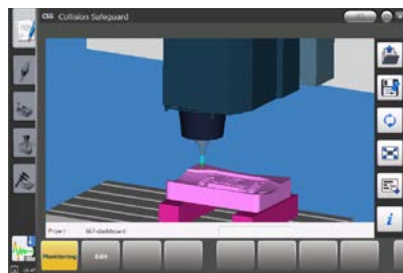
Easy to see 100% position with LED indicator

GI Smoothing¹



Intelligent GI-Smoothing function optimises tool path when CAM tolerances are too rough and thus eliminates the undesired marks at the surfaces to be machined, achieving excellent surface quality.

Crash avoidance function Collision Safeguard¹



Interference check is done in real time in tandem with the machine, thereby to prevent collisions.

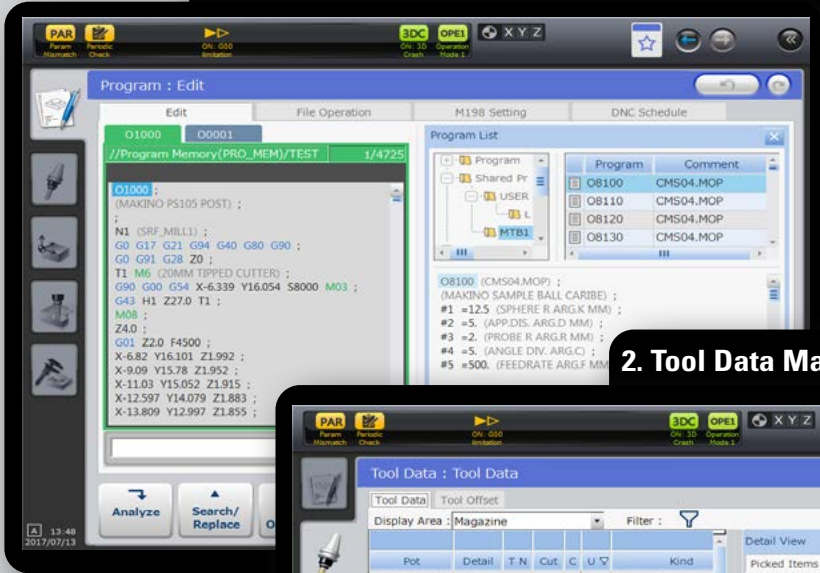
i-Setup¹



- Quick and easy measuring setup for intuitive operation
- Code-free programming on dialogue screen

5 Step Screens for streamlined ease of operation

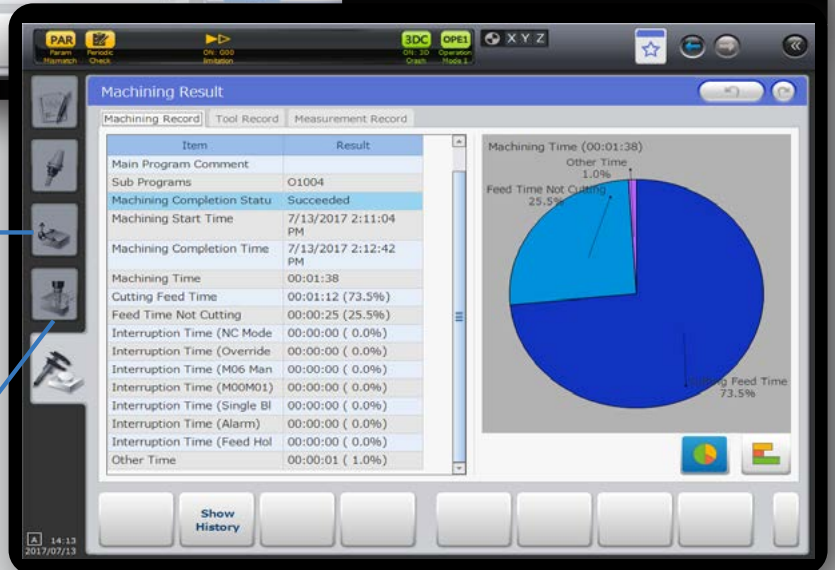
1. Program Preparation/Analysis



2. Tool Data Management



5. Machining Results



3. Work Coordinate Management

4. Machining Execution

Efficient Chip Removal

The F8 and F9 are equipped with a 750 litre rear coolant tank to provide effective coolant flow. Equipped with four built-in nozzles around the spindle, two flexible nozzles, two air blow nozzles and chip flushing nozzles for tele-cover, the machine is configured to meet the wide ranging material and cutting requirements of the large mould/part market.



Through-spindle air (optional specification)

- Air is supplied from the tool tip and holder.

Through-spindle coolant (1.5 MPa and 3.0 MPa) (optional specification)

- Coolant is supplied from the inside of the holder through the tool tip.

Within the work zone, chip and coolant recovery is very quick and efficient due to a number of design features. All internal chip and splashguard surfaces are steeply sloped. High centre or T shaped telecovers and flushing nozzles ensure that all chips and coolant are directed into the integral chip trough, with a dual spiral screw design that provides a four auger chip management system. Chips and coolant are transferred to a large capacity chip and coolant recovery system conveniently located at the rear of the machine.



An optional lift up chip conveyor can be installed at the rear of the machine to further improve the chip management of the machine.



Ease of Operation



The uniquely designed splashguard doors provide unparalleled access to the large machine work zone.



The side door provides easy operator access for quick checks. The front doors work together to facilitate easy handling of big, heavy workpieces and provide unobstructed accessibility for an overhead crane. Combined with the movement of the table, and the convenient table loading height, the F8 and F9 machines significantly reduce part exchange loading times, improving productivity and reducing operator fatigue.

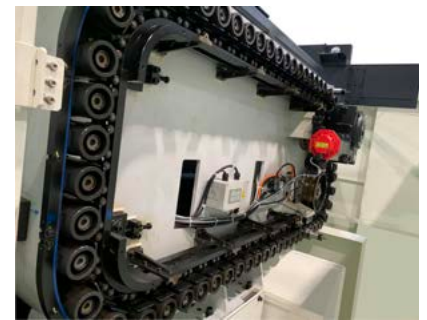


The operator has easy access for manually loading and unloading of tools directly to the spindle. A floor foot pedal permits the operator to utilize both hands for handling larger, heavy tools.



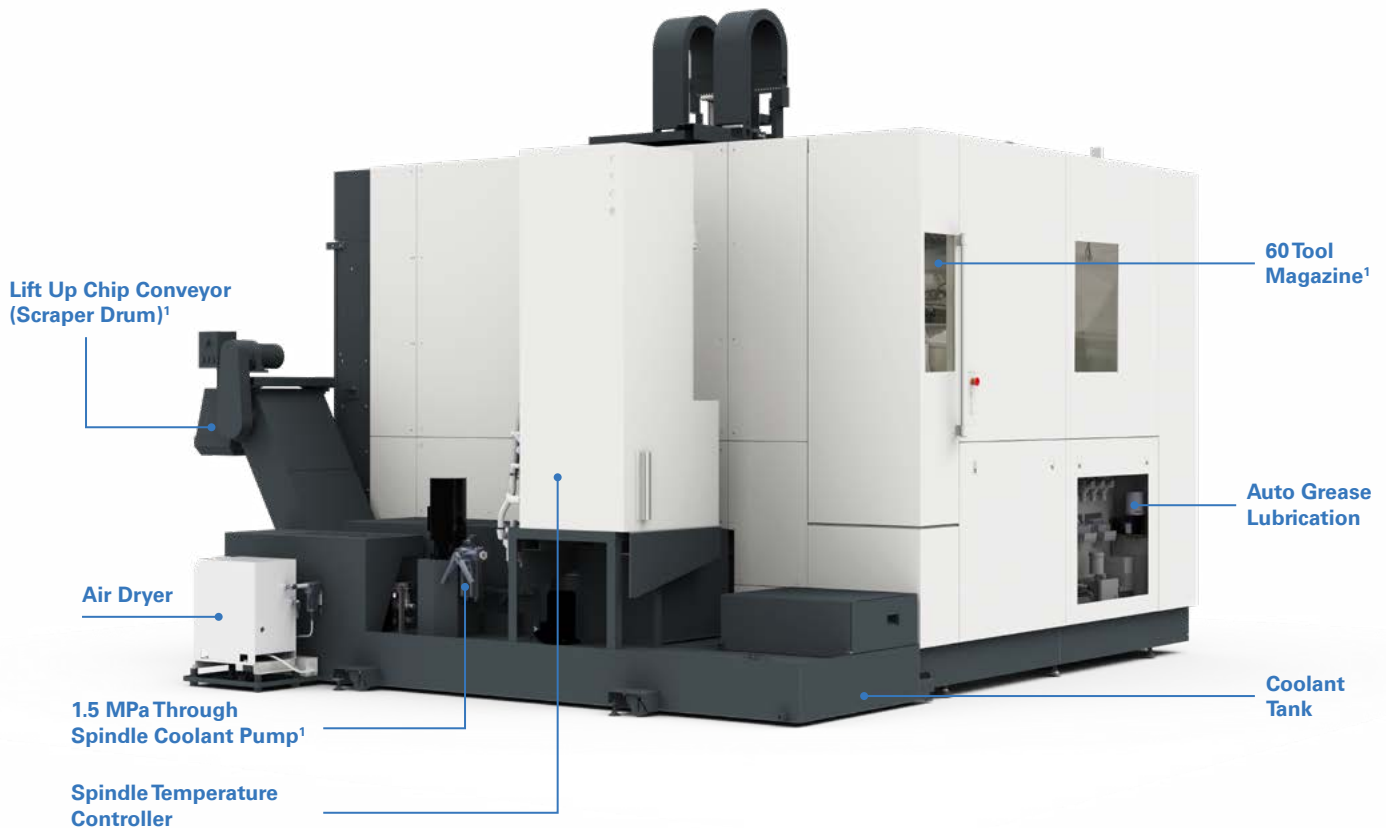
Automation ready

Robot integration for unattended continuous operation provides numerous opportunities to improve the efficiency of the large mould and parts machining multi-fold. Optional Auto Door facilitates front and top loading. Optional ATC60 and ATC90 configuration are available to support automation.



Optional ATC60

F8 and F9 machines are ready with options to support automation.

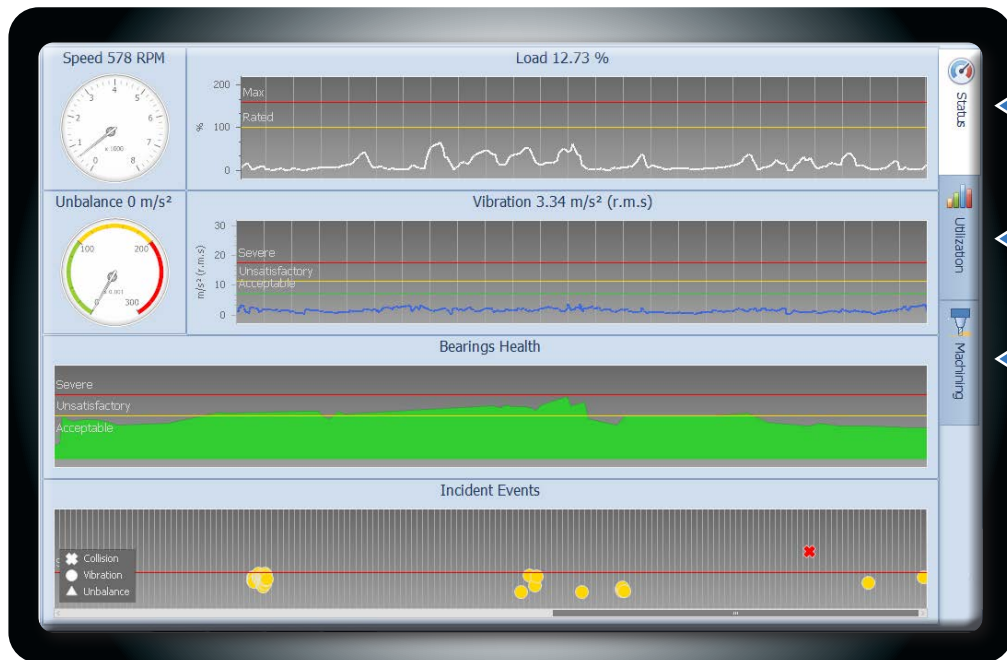
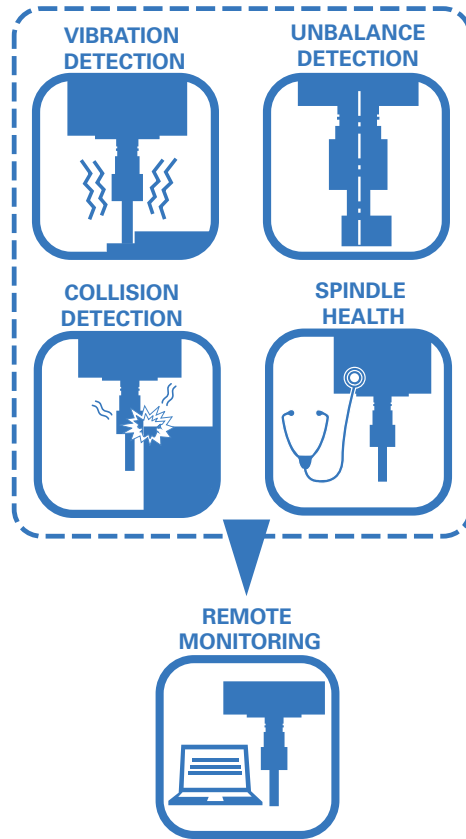


Intelligent Technology

Spindle Active Care (SAC)¹

Spindle Active Care allows more effective monitoring of spindle health and machining condition to achieve following benefits:

- Eliminate unplanned downtime due to spindle catastrophic failure, which can be detected at early stage of defects
- Prolong spindle life by protecting the spindle from extreme vibration or unbalance
- Easy optimization of machining productivity, without compromising spindle health/life
- Improve tool life management through progressive evaluation of tool cutting performance



Status –
Real time monitoring of machining vibration, spindle health and spindle-related events

Utilization –
Accurate evaluation and understanding of spindle utilization

Machining –
Historical recording of programs and tool machining performance

Screenshot from machine monitor (image above).
Remote Monitoring PC also has also similar screenshot.

Specifications

	Description	F8	F9	Option ¹
Travels	X x Y x Z axes	1,300 x 800 x 650 mm	1,600 x 800 x 650 mm	
	Table Top to Spindle End	250–900 mm		
Table	Size (Length x Width)	1,550 x 800 mm	1,850 x 800 mm	
	Max. payload	2,500 kg		
	Max. workpiece size	1,550 x 800 x 550 mm	1,850 x 800 x 550 mm	
	Loading Height	950 mm		
Spindle	Taper	# 50		HSK-A63
	Speed	20–10,000 rpm		50–20,000 rpm
	Power (10 min/cont.)	37 kW / 25 kW		30 kW / 22 kW
	Torque (25% ED/cont.)	426 N m / 294 N m		104 N m / 60 N m
Feedrates	Rapid/Cutting	24,000 mm/min / 1–24,000 mm/min		
	Guideway	Linear Roller Guide		
Automatic Tool Changer (ATC)	Tool storage capacity	30 (60) ¹		30 (60, 90) ¹
	Max. tool diameter (Length)	125 (200 ¹) mm / 400 mm		75 (150 mm ¹) / 300 mm
	Max. tool Weight	20 kg		7 kg
Power	Electrical Power Supply	380 V - 415 V (52 kVA)		
Accuracy	Positioning: w-scale/wo-scale	JIS Standards: ±0.0015 mm / ±0.0025 mm ISO 230.2 (1997): ≤0.006 mm / ≤0.010 mm		
	Repeatability: w-scale/wo-scale	JIS Standards: ±0.001 mm / ±0.002 mm ISO 230.2 (1997): <0.004 mm / <0.008 mm		
Machine (standard specification)	Floor Space (Width x Depth)	3,850 x 4,090 mm	4,300 x 4,090 mm	
	Height	3,540 mm		
	Weight	16,000 kg	17,000 kg	

¹ Alternate pockets empty

Standard Specification

- 10,000 rpm, #50 spindle
- 30-tool ATC
- Spindle temperature controller
- Ballscrew core cooling
- Ballscrew support bearings cooling
- LED lighting within splash guard
- 3 layer signal light
- Splash guard and ATC door inter-lock with lock
- Automatic air blow
- Centralized auto grease
- Portable manual pulse generator with the handle enable button
- Rigid tapping
- Professional 6 controller
- Super G1.5 control
- Linear interpolation positioning
- User memory 2 GB + 1 GB
- 1,000 Registerable programs
- Tool offset memory type C
- Tool offset 400 pairs
- Custom macro variables, 600 numbers
- Auto power out
- ECO mode functions
- Power fail monitor

F8/F9

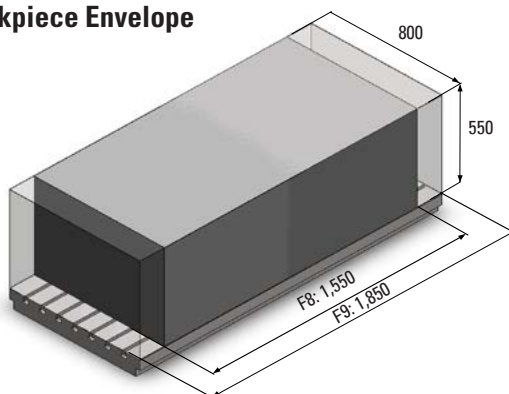
• **Optional specifications** (Not retrofittable)

- HSK-A100 Spindle (10,000 rpm)
- HSK-A63 Spindle (20,000 rpm)
- 60 Tools ATC (HSK-A100/BT50)
- 60,90 Tools ATC (HSK-A63)
- Through Spindle Coolant (1.5/3 MPa)
- Through Spindle air
- i-Setup

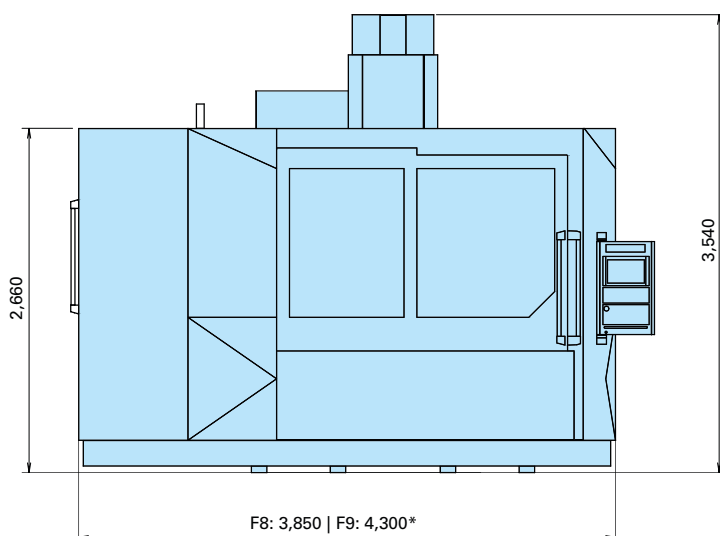
★ **Optional equipment** (retrofittable)

- ★ 4th Axis NC Rotary Table Interface
- ★ ATLM (Automatic Tool Length Measurement)
- ★ Lift Up Chip Conveyor
- ★ AWM (Automatic Work Measurement)
- ★ Chip bucket for lift-up chip conveyor
- ★ Air dryer
- ★ Mist collector
- ★ MTC cabinet door interlock
- ★ Coolant temperature controller
- ★ Scale feedback 0.05 μm (X, Y & Z axes)
- ★ Work wash gun
- ★ Robot interface
- ★ Spindle Active Care
- ★ GI smoothing
- ★ Collision safeguard

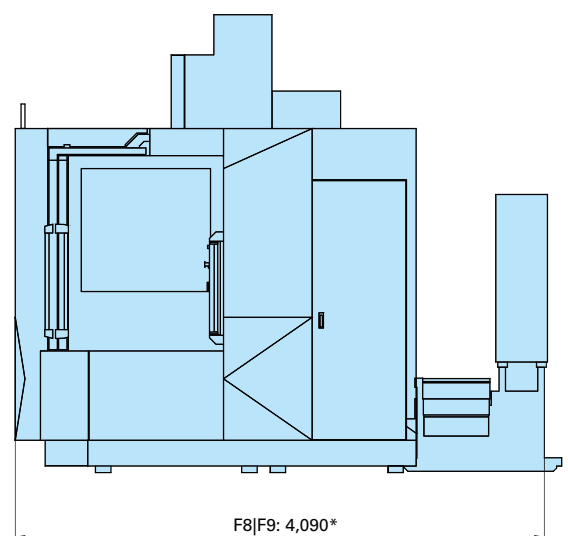
Workpiece Envelope



Front view



Side view



*Dimension is same with LUCC option

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