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NIDEC OKK A DIVERSIFIED MANUFACTURER OF MACHINE TOOLS

Specializes In:

Machining centers
Graphite cutting machining centers
Grinding centers
CNC Milling machines
Conventional milling machines
Total die and mold making systems
Flexible manufacturing cells and systems

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High Rigidity Vertical Machining Center

VM 660 R
VM 940 R

VM 660 R / VM 940 R



**Best-in-class heavy-duty cutting capability is available!
This series enables highly-efficient machining of
difficult-to-cut materials.**

Machine main body has highly rigid box-shaped structure.
The solid square slide guide is used for the slideway of each axis for improved vibration attenuation property.
No. 50 taper spindle and large-diameter bearings enable highly-efficient machining of dies and molds,
automobile parts and aircraft parts.

High Rigidity Vertical Machining Center

VM 660 R



● Main Specification

- Travel distance (X axis × Y axis × Z axis)
1300×660×660mm (51.18"×25.98"×25.98")
- Table size (X axis × Y axis)
1400×660mm (55.12"×25.98")
- Maximum tool diameter
φ200mm (7.87")
- Maximum tool mass
**Maximum 20kg (44lbs) / Average 10kg (22lbs)
Total 300kg (661lbs)**
- Spindle rotating speed
4500min⁻¹
- Spindle motor output
18.5/15kW (25/20HP)
- Maximum tool length
350mm (13.78")
- Magazine Capacity
30 Tools

- Spindle rotating speed
4500min⁻¹
- Spindle motor output
18.5/15kW (25/20HP)
- Maximum tool length
400mm (15.75")
- Magazine Capacity
40 Tools



High Rigidity Vertical Machining Center

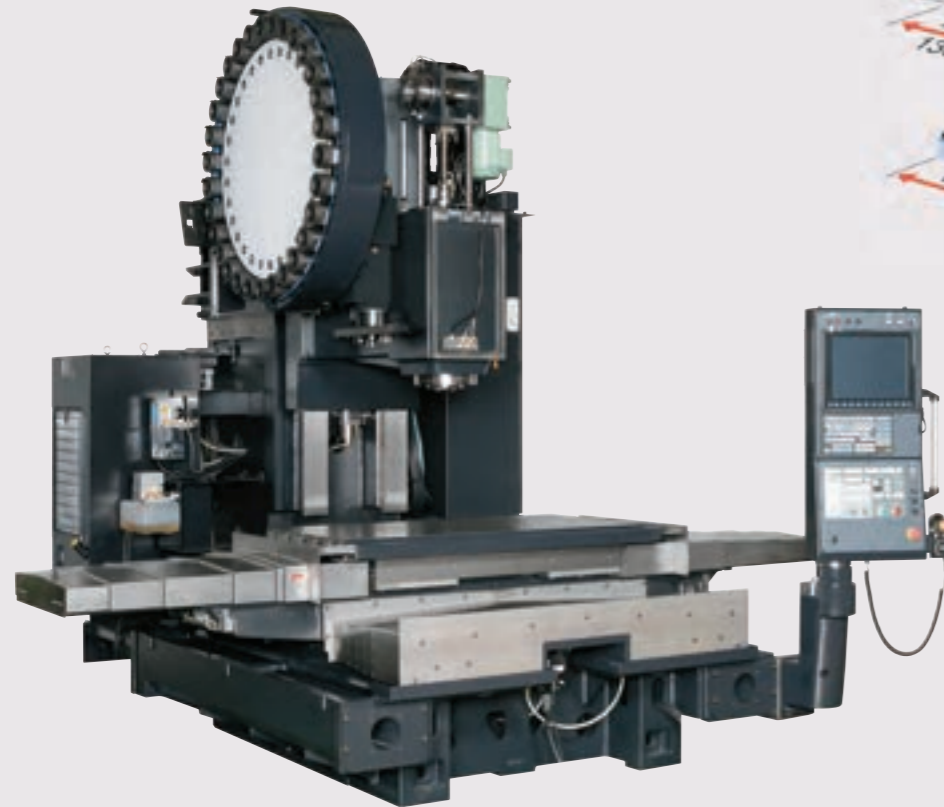
VM 940 R

● Main Specification

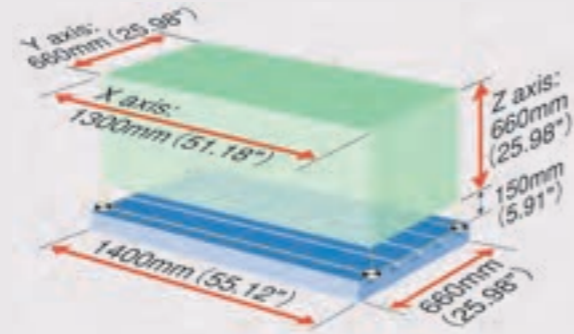
- Travel distance (X axis × Y axis × Z axis)
2060×940×820mm (81.10"×37.01"×32.28")
- Table size (X axis × Y axis)
2300×940mm (90.55"×37.01")
- Maximum tool diameter
φ200mm (7.87")
- Maximum tool mass
**Maximum 20kg (44lbs) / Average 10kg (22lbs)
Total 400kg (882lbs)**
- Spindle rotating speed
4500min⁻¹
- Spindle motor output
18.5/15kW (25/20HP)
- Maximum tool length
400mm (15.75")
- Magazine Capacity
40 Tools

VM 660 R

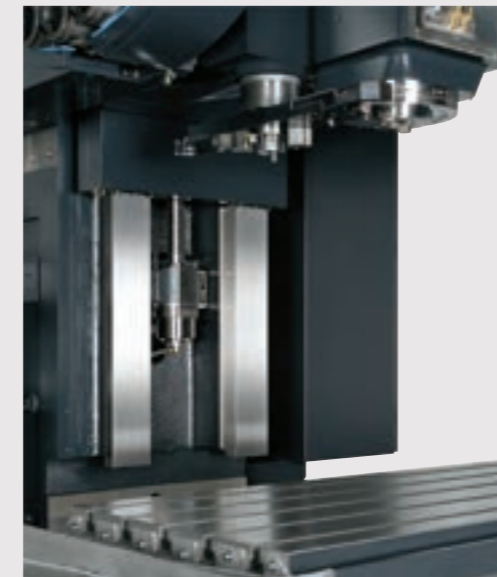
Machines with Highest in the class
Heavy duty Cutting Performance for
Proficiently Machining Hard to cut Materials



Wide machining area



Strokes as large as 1300mm(51.18")
660mm(25.98") and 660mm(25.98")
for the X-, Y- and Z-axis respectively,
allowing the accommodation of even
longer workpieces.



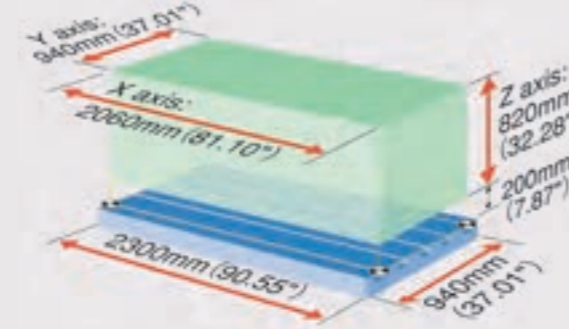
Square slide guide

Wide slideway

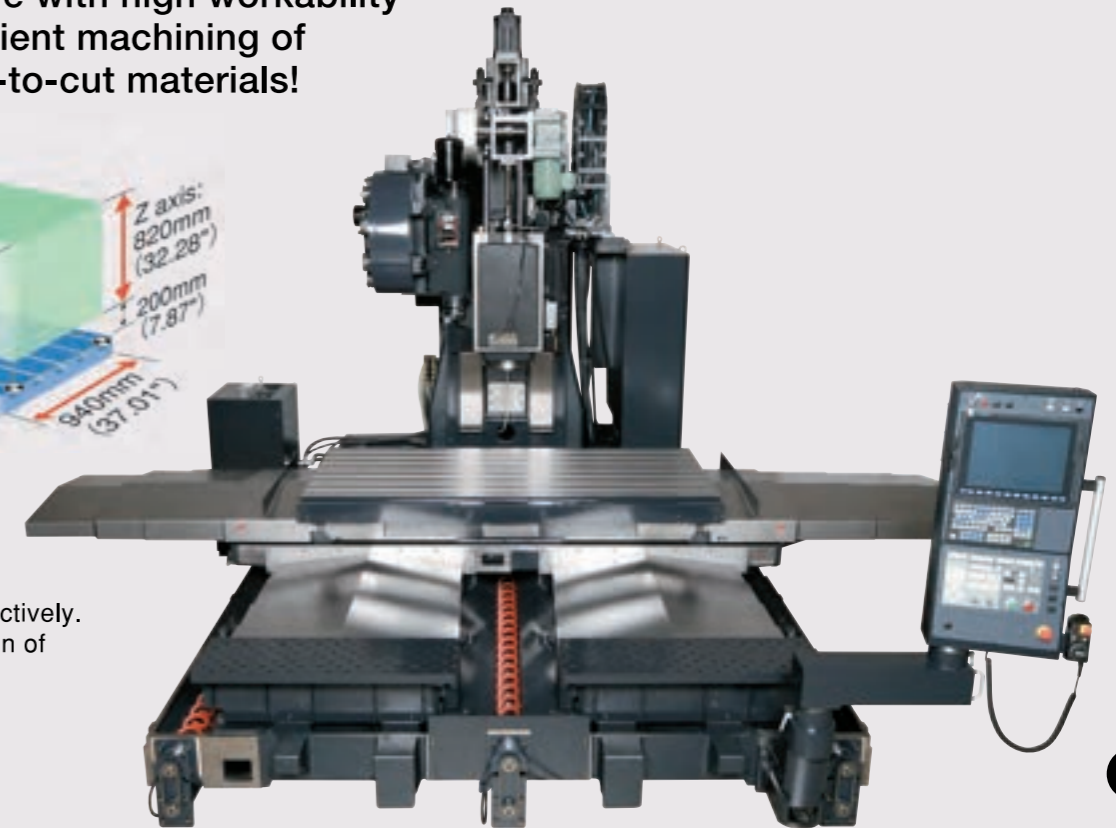
The X, Y & Z axes utilize highly rigid and
accurate box slide ways.
This enables the machining of all types of
materials from aluminum to the difficult to
cut materials like titanium.

VM 940 R

Highly rigid structure with high workability
enables highly-efficient machining of
large-sized difficult-to-cut materials!

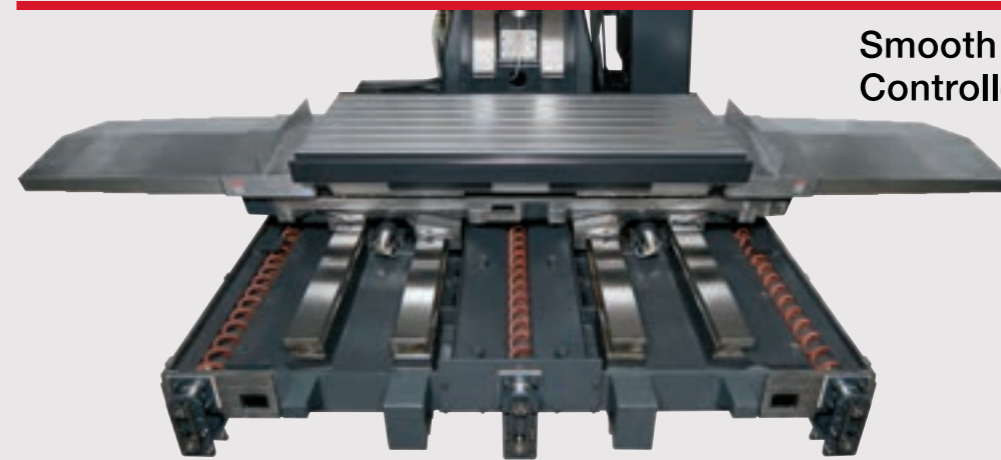


Strokes as large as
2060mm(81.10")
940mm(37.01") and
820mm(32.28") for
the X-, Y- and Z-axis respectively,
allowing the accommodation of
even longer workpieces.



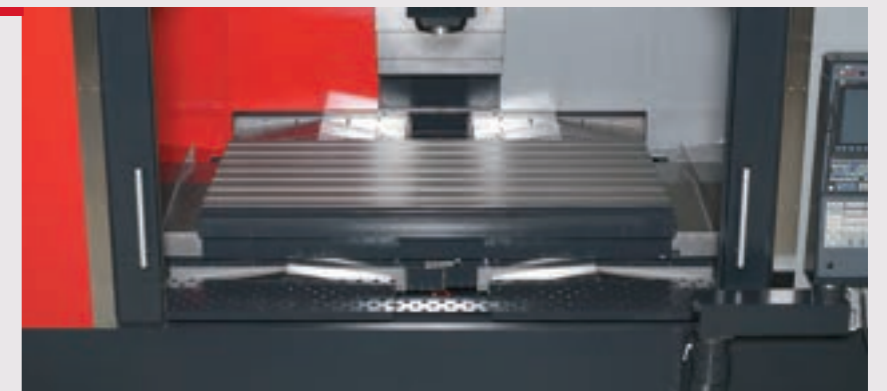
Smooth movement characteristic/ Controlled lost-motion property

Even under the heavy load, smooth
movement characteristic and good
lost-motion property are secured and
high accuracy is maintained over long
hours with the balanced twin ball
screws on the Y axis



Improvement in operability

Wide step is included as standard for
easy access to the machine inside.



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Easy loading and unloading

As the top cover also opens together with the door, the workpiece loading and unloading operation with a crane can be carried out smoothly.

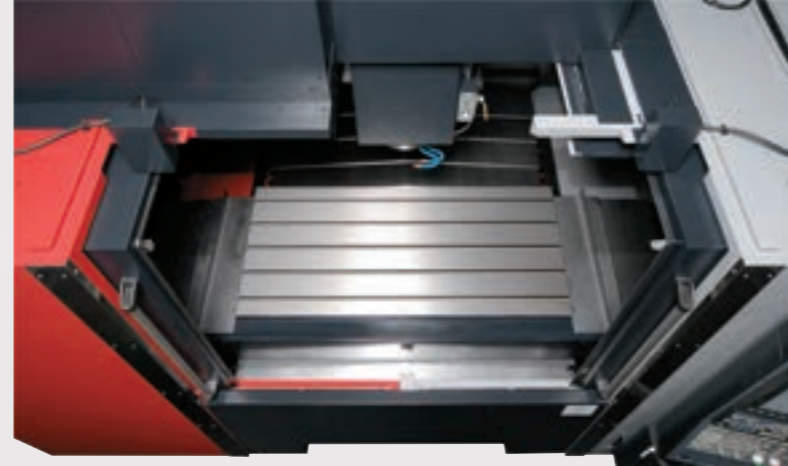


Photo is VM660R

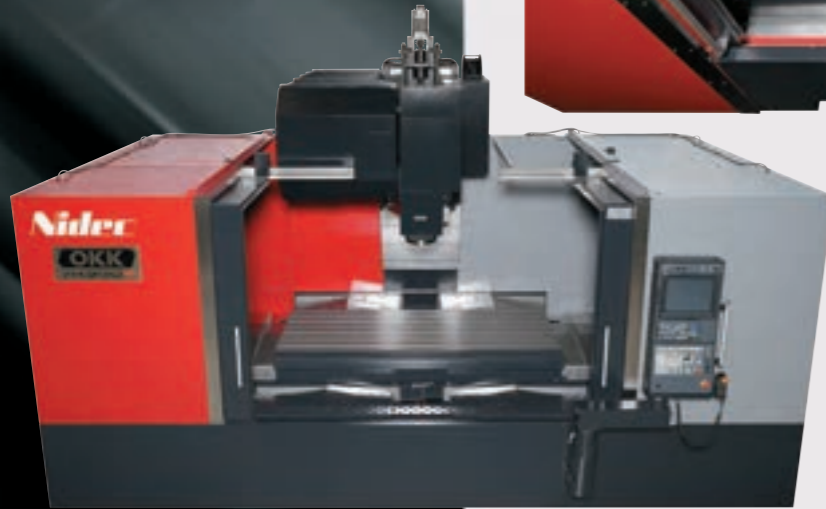
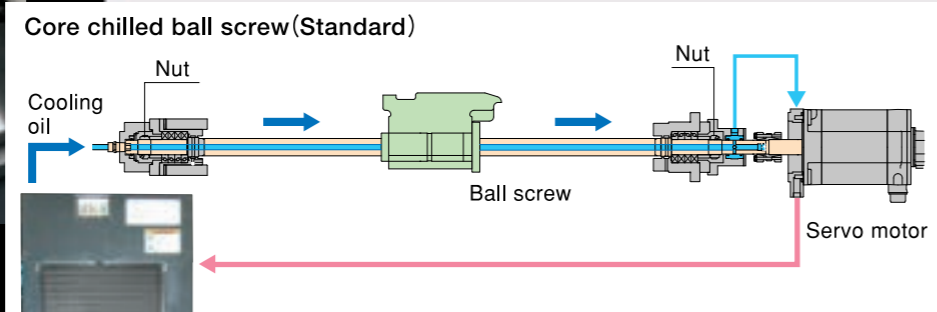


Photo is VM940R

Measures against thermal displacement

In order to minimize influences of chips and heat of coolant over the machining accuracy, the machines use the sidewall cooling structure for the spindle head and the core cooling structure for the ball screws and have troughs in the bed section for flushing coolant.



Thermal displacement is reduced by circulation of cooling oil

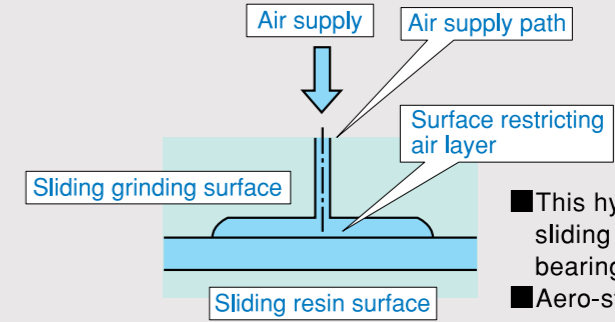


Photo is VM660R

Controlled lost-motion property

hybrid guide faces of low friction and high rigidity for the X and Y axes.

Hybrid guide face VM660R(OP) VM940R



- This hybrid guide face consists of the sliding guide face and the aerostatic bearing pad (shown in the photo).
- Aero-static bearing pad pressure opposes the guide ways face contact load.
- The reduction in guide way face friction improves the positioning accuracy, fine step feed characteristics and circular cutting accuracy.

ATC [Automatic Tool Changer]

Consistent tool change operation and superior durability are ensured by use of OKK's original proven cam-controlled high-speed synchronized tool changer (OKK patent).



Photo is VM660R

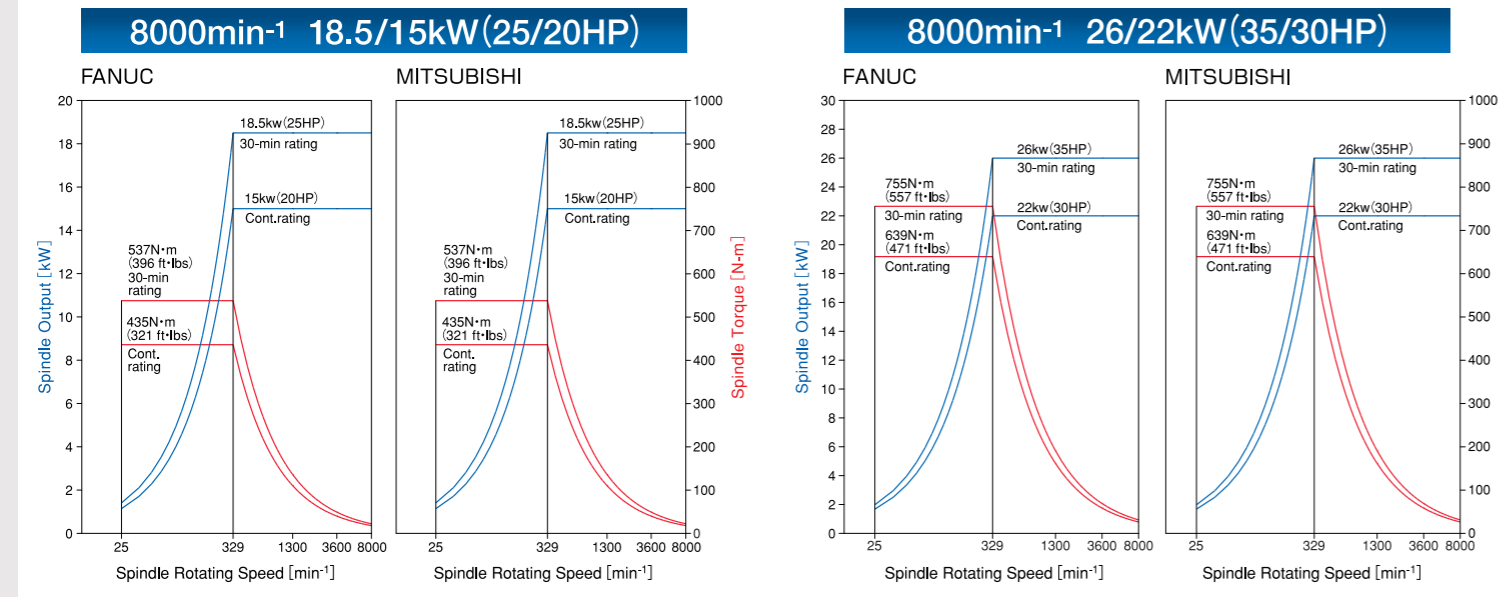
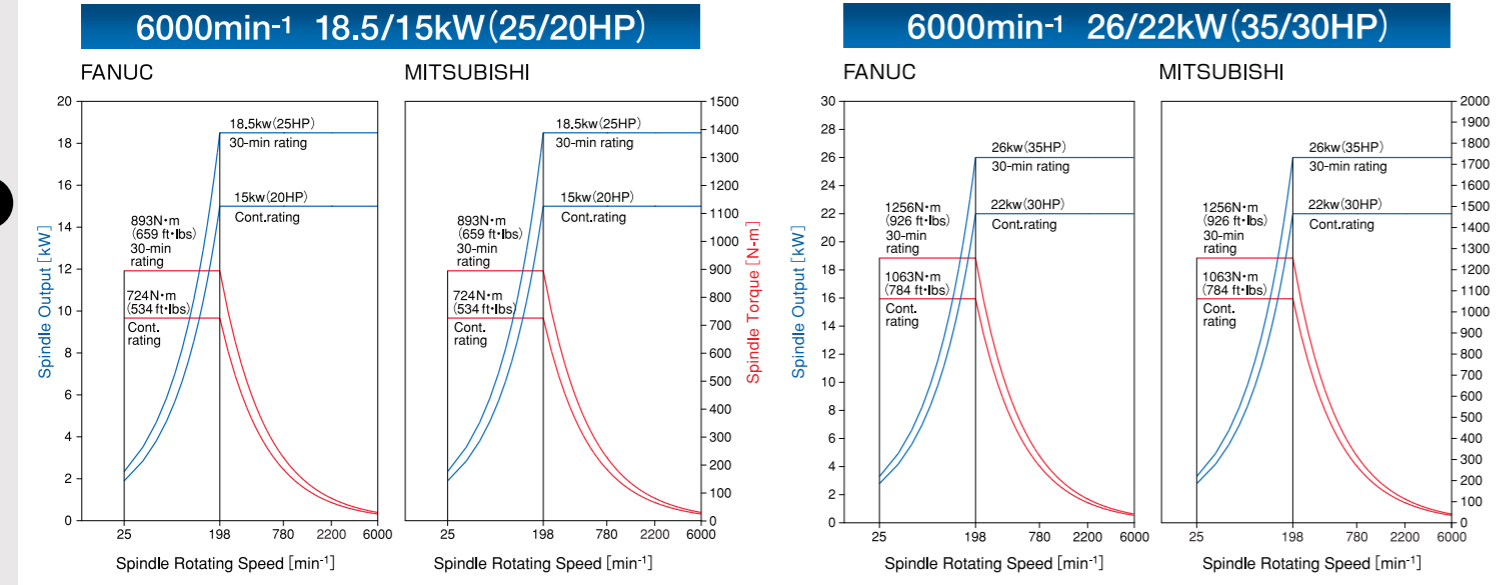
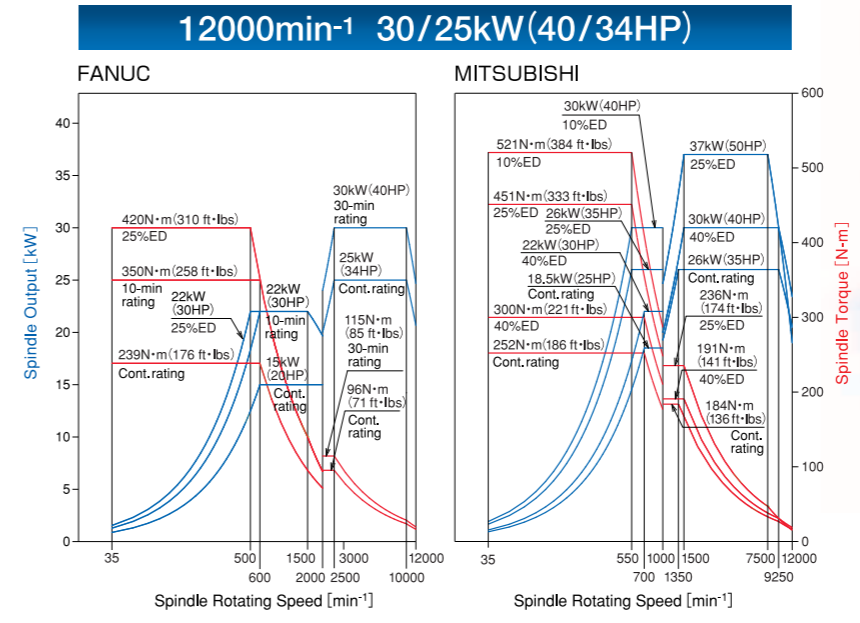
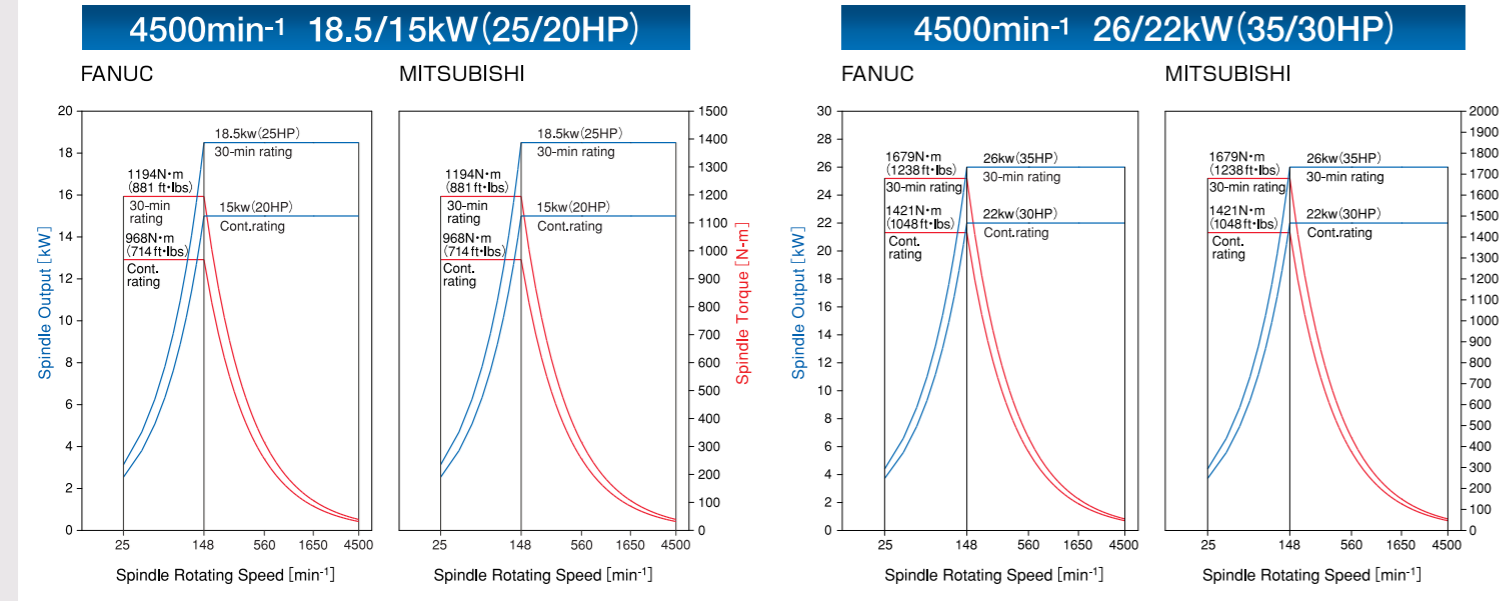


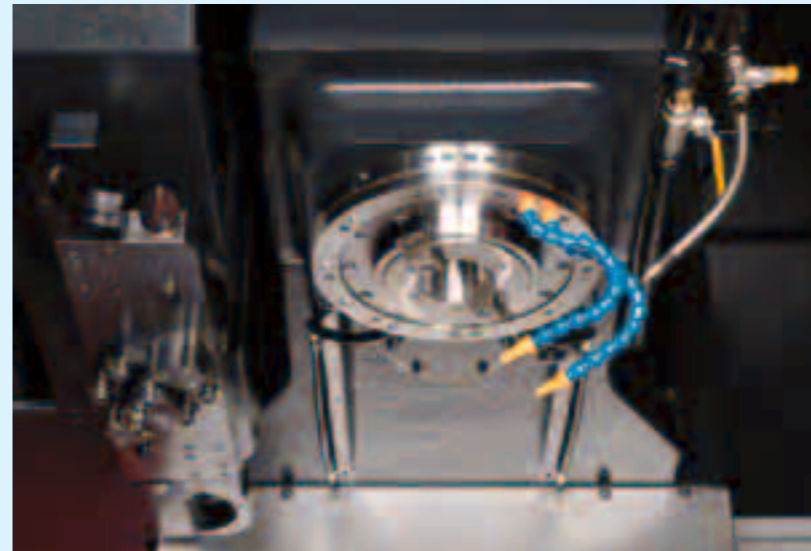
Photo is VM940R

6

- Maximum tool diameter $\phi 200\text{mm}$ (7.87")
- Maximum tool moment $25.7\text{N}\cdot\text{m}$ (19ft·lbs)
- Maximum tool length VM660R 350mm (13.78") VM940R 400mm (15.75")
- Tool exchange time (tool-to-tool) 2.9 sec
- Maximum tool mass
- VM660R Maximum 20kg (44lbs) / Average 10kg (22lbs) / Total 300kg (661 lbs)
- VM940R Maximum 20kg (44lbs) / Average 10kg (22lbs) / Total 400kg (882 lbs)

Several Spindle variations to meet your machining requirements.



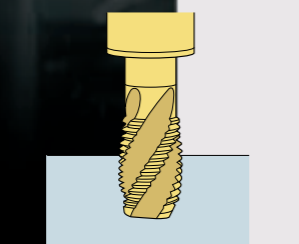
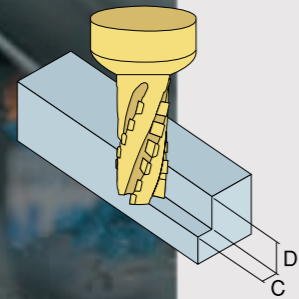
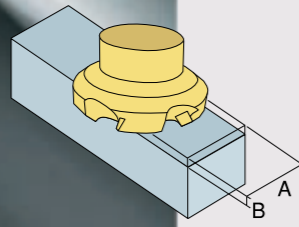


Maximum spindle torque 1679N·m (1238ft·lbs)

Torque in the low-speed range has been improved drastically by the use of a large-diameter bearing for the gear-shift spindle and the modification to the three-stage gear shift.

	Spindle rotating speed (min ⁻¹)	Spindle motor kW (HP)	Maximum spindle torque (30-min/Cont.) N·m(ft·lbs)	
Gear drive	25~4500	18.5/15 (25/20)	1194/968 (881/714)	Standard
		26/22 (35/30)	1679/1421 (1238/1048)	
	25~6000	18.5/15 (25/20)	893/724 (659/534)	Option
		26/22 (35/30)	1256/1063 (926/784)	
25~8000	18.5/15 (25/20)	537/435 (396/321)		
	26/22 (35/30)	755/639 (557/471)		
MS drive	35~12000	MITSUBISHI: 37(50) (25%ED)/26(35) FANUC: 30(40)/25(34)	MITSUBISHI: 521(384) (10%ED)/252(186) FANUC: 420(310) (25%ED)/239(176)	

Heavy cutting capacity
and high-accuracies
produces the highest
quality machining.



Cutting capability

Cutting data Workpiece material : S45C

VM660R : No.50 4500min⁻¹
26/22kW (35/30HP)
VM940R : No.50 6000min⁻¹
22/18.5kW (30/25HP)

	VM660R	VM940R
Type of machining	Face milling	
	φ160 (6.30") × 7T	φ160 (6.30") × 7T
Spindle rotating speed min ⁻¹	400	400
Width of cut (A) mm	120 (4.72")	120 (4.72")
Depth of cut (B) mm	6 (0.24")	6 (0.24")
Feed rate mm/min	960 (38ipm)	864 (34ipm)
Cutting rate cm ³ /min	691.2 (42.2in ³ /min)	622 (38in ³ /min)
Spindle motor load %	101	105

	VM660R	VM940R
Type of machining	Side milling	
	φ80 (3.15") × 4T [Chip type]	φ80 (3.15") × 4T [Chip type]
Spindle rotating speed min ⁻¹	500	500
Width of cut (C) mm	40 (1.57")	40 (1.57")
Depth of cut (D) mm	60 (2.36")	60 (2.36")
Feed rate mm/min	350 (14ipm)	244 (10ipm)
Cutting rate cm ³ /min	840 (51.3in ³ /min)	585.6 (35.7in ³ /min)
Spindle motor load %	119	107

	VM660R	VM940R
Type of machining	Drill milling	
	φ68 (") [Chip type]	φ63 (2.48") [Chip type]
Spindle rotating speed min ⁻¹	900	760
Feed rate mm/min	90 (ipm)	91 (4 ipm)
Feed mm/rev	0.10 (in/rev)	0.12 (0.005 in/rev)
Cutting rate cm ³ /min	326.8 (in ³ /min)	283.5 (17.3 in ³ /min)
Spindle motor load %	65	58

	VM940R
Type of machining	Tap milling
	M48 × P5
Spindle rotating speed min ⁻¹	47
Feed rate mm/min	235 (9 ipm)
Spindle motor load %	21

Values shown here are for reference to provide an indication of cutting capability.

Highly reliable structure
realizes the high-accuracy
and high-quality machining



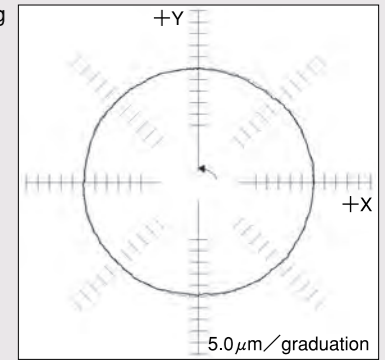
Soft Scale III

Three functions for improving
and retaining accuracy

- 1 Variable backlash compensation II**
Backlash changes with speed/position. It minimizes the backlash by compensating it according to the slideway's characteristics (Patent No.4750496)
- 2 Ball screw elongation compensation**
Reduces any error generated by repeated feeding and positioning.
- 3 Spindle's thermal displacement compensation**
It compensates the thermal displacement generated by rotation of the spindle.

Circularity measurement

VM660R : 3.9 μm
VM940R : 4.4 μm



Circularity measurement sample

*The above data show the actual values. The results may vary with the conditions.



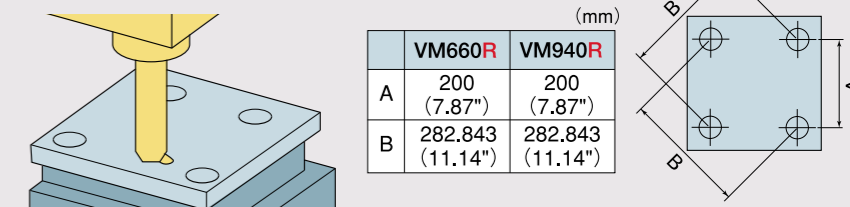
Diagram of the 1-μm step-feed measurement

Accuracy

Positioning accuracy (mm) (Nidec OKK tolerance)

Item	VM660R	VM940R
Positioning accuracy	X/Y/Z : ±0.0030 (±0.00012") full stroke	X : ±0.0050 (±0.00020") full stroke Y/Z : ±0.0030 (±0.00012") full stroke
Repeated positioning accuracy	X/Y/Z : ±0.0020 (±0.00008") full stroke	X/Y/Z : ±0.0020 (±0.00008") full stroke

Positioning Machining Accuracy



Example record (mm)

Item	VM660R	VM940R
Axial direction	-0.004 (-0.00016")	0.005 (0.00020")
Diagonal direction	-0.003 (-0.00012")	0.004 (0.00016")
Difference in diameter	0.003 (0.00012")	0.005 (0.00020")

Notes

- The data shown above is an example and is based on short-time machining. The values may vary in during continuous machining.
- The data shown above as an example were obtained under Nidec OKK's in-house cutting test conditions. The values may vary with different cutting tools and fixtures.
- The above accuracy data are laboratory data obtained by installing the machine according to the Nidec OKK's foundation drawing and carrying out the inspection based on Nidec OKK's inspection standard in an environment with controlled temperature.

Ergonomics and environmental friendliness in this machine.

Environmental measures

ECO sleep function (Standard)

If the machine remains idle longer than the specified time period, the machine's present mode is switched to a power-saving mode to reduce wasteful consumption of power, air and so on. When the power-saving mode is active, the equipment such as servos and chip conveyors are turned off. It is cancelled automatically when the setup operation is completed i.e. when the doors are closed.

LED lamps (Standard)

The machine incorporates LED lamps due to their low heat generation and power consumption savings.



Improvement in operability

15-inch operation panel



N730

F31i-B

- ◎The 15-inch color LCD screen increases legibility of the information on the screen and improves operability.
- ◎Construction of the operation panel is simple and ergonomic. Its keyboard adopts the QWERTY key arrangement similar to PCs.
- ◎The display incorporates Nidec OKK's original screens for setup support and operation.

Thorough chip processing measures

Coil-type chip conveyor (Standard)

Standard machine has three sets of rear discharge coil-type chip conveyors. The coil-type chip conveyors are capable of removing a large amount of chips from the machine promptly.

※VM660R: Two sets of coil-type chip conveyor (Standard)

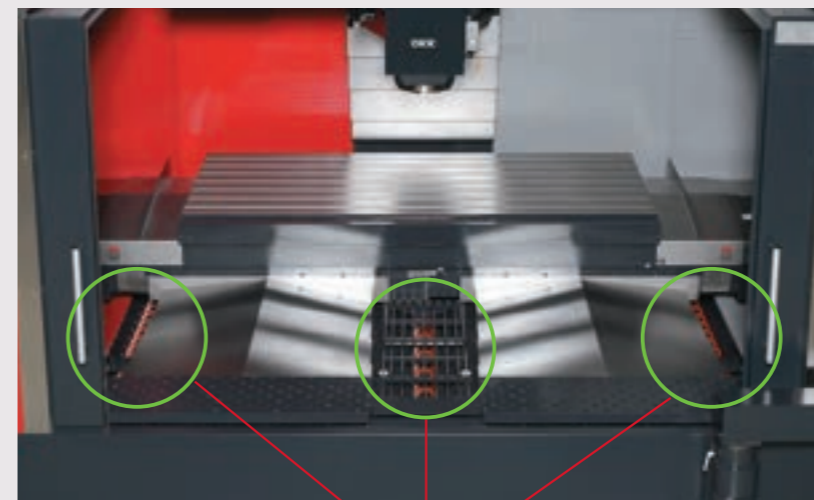


Photo is VM940R

Coil-type chip conveyor (Standard)

Photo is Hinged type.
Chip bucket is another option.
There are fixed type and swivel type.



Coil-type chip conveyor (Standard)

Maintenance

Easy to maintain

In order to improve the operating efficiency, routinely inspected air and oil-related equipments are collectively located respectively.

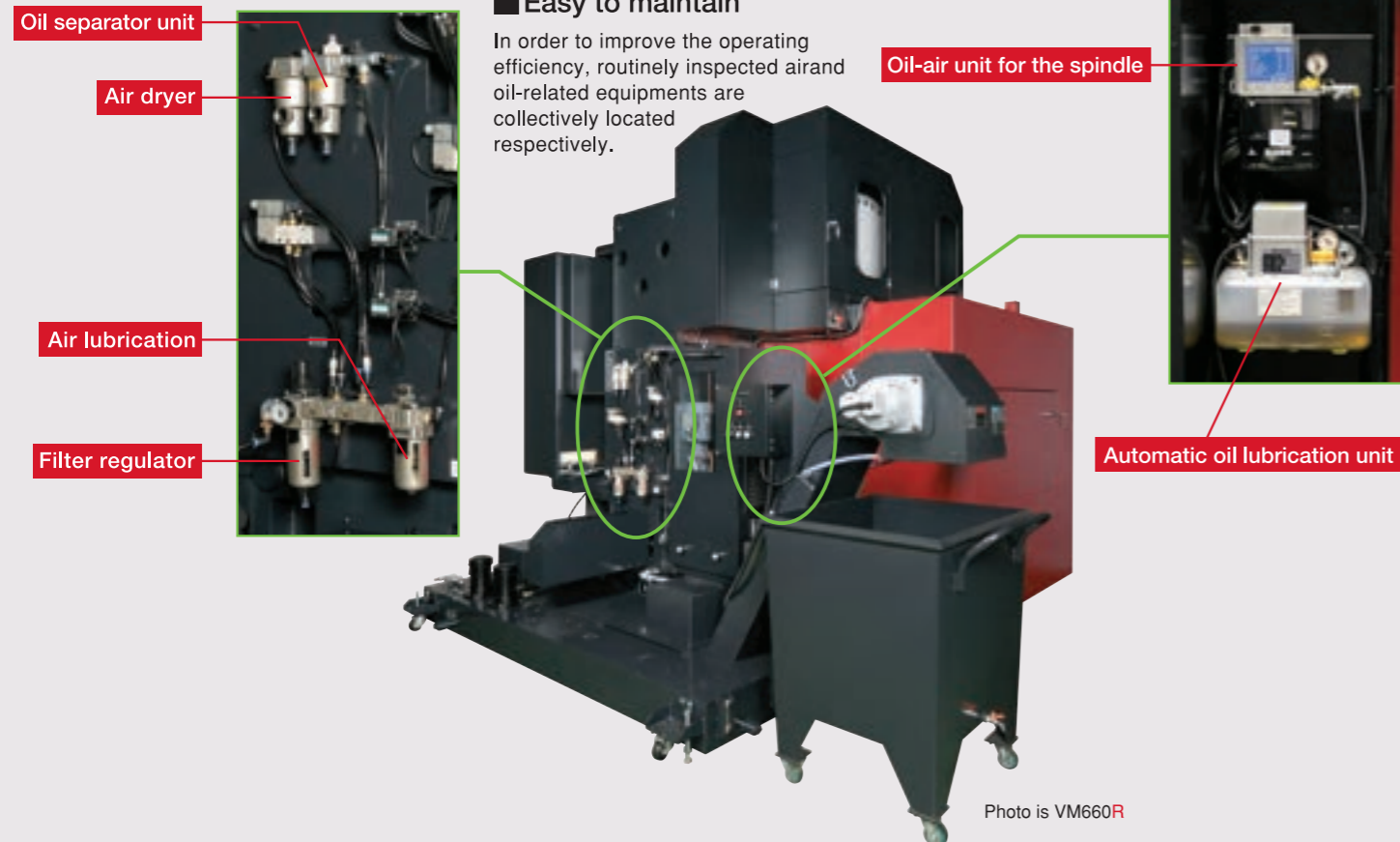


Photo is VM660R

Lift-up chip conveyor (Option)

Suitable lift-up chip conveyor according to type of chips

◎ : Most suitable; ○ : Usable; △ : Conditionally usable; × : Not usable; - : Not applicable

Type of chips	Type of chip conveyor	Use or not use of coolant oil		Hinged type		Scraper typ		Magnet scraper type		Scraper type with drum filter		Magnet scraper type with drum filter		
		Use	Not use	Use	Not use	Use	Not use	Use	Not use	Use	Not use	Use	Not use	
Magnetizable chips	Steel	Short curl	◎	◎	○	○	◎	◎	○	-	◎	-		
		Spiral	◎	◎	△*2	△*2	△*2	△*2	×	-	×	-		
		Long	◎	◎	×	×	×	×	×	-	×	-		
	Cast iron	Needle shape	×	△*1	×	○	○*3	○	○	-	◎	-		
		Powder or small lump	×	△*1	×	○	○*3	○	○	-	◎	-		
		Needle shape	×	△*1	×	○	○*3	○	○	-	◎	-		
Non-magnetizable chips	Aluminum	Short curl	×	◎	△*4	○	-	-	◎	-	◎	-		
		Spiral	○	◎	○	○	-	-	△*5	-	△*5	-		
		Long	○	◎	○	○	-	-	△*5	-	△*5	-		
		Needle shape	×	△*1	×	○	-	-	◎	-	◎	-		
		Powder or small lump	×	△*1	×	○	-	-	◎	-	◎	-		

*1: Minute chips can enter the conveyor casing through a gap between hinged plates. Therefore, cleaning inside the conveyor frequently is needed.

*2: Long chips can easily be caught by a scraper. Therefore, measures for shortening the chips such as the step feed and removing the caught chips are needed.

*3: If the coolant flow rate is large, chips can flow out of the conveyor casing and cause clogging of filters. Therefore, combined use of a magnet plate is recommended.

*4: If the coolant flow rate is large, chips can flow out of the conveyor casing and cause clogging of filters. Therefore, cleaning filters frequently is needed.

*5: Long chips can easily be caught by a scraper. Therefore, removing them regularly is needed. Drum filters are damaged if they are not removed.

Machine Main Body's Main Specification

Machine Body's Specification

Item	Unit	Specification
		4500min ⁻¹ (Gear-drive spindle)
Travel on X axis (Table right / left)	mm	1300 (51.18")
Travel on Y axis (Saddle back / forth)	mm	660 (25.98")
Travel on Z axis (Spindle head up / down)	mm	660 (25.98")
Distance from table top surface to spindle nose	mm	150 (5.91") ~ 810 (31.89")
Distance from column front to spindle center	mm	685 (26.97")
Table work surface area (X-axis direction × Y-axis direction)	mm	1400 (55.12") × 660 (25.98")
Max. workpiece weight loadable on table	kg	2000
Table work surface configuration (T-slot nominal dimension × spacing × number of T slots)	mm	22 (0.87") × 125 (4.92") × 5 tools
Distance from floor to table work surface	mm	980 (38.58")
Spindle rotating speed	min ⁻¹	25~4500
Number of spindle rotating speeds		3 steps
Spindle nose (nominal number)		7/24-tapered No.50
Spindle bearing bore diameter	mm	φ120 (4.72")
Rapid traverse rate	m/min	X/Y: 24 (945 ipm) Z: 20 (787 ipm)
Cutting feed rate	mm/min	1~20000 (0.04 to 787 ipm) ※1
Jog feed rate	mm/min	2000 (79 ipm)
Type of Tool shank		JIS B 6339 BT50
Type of Pull stud		OKK only 90°
Number of stored tools	tools	30
Max. tool diameter (with tools in adjacent pots)	mm	φ103 (4.06")
Max. tool diameter (with no tools in adjacent pots)	mm	φ200 (7.87")
Max. tool length (from gauge line)	mm	350 (13.78")
Max. tool mass	kg	Max 20 (44.1 lbs) / AVERAGE 10 / Total 300
Max. tool mass [moment]	N · m	25.7
Tool selection method		Memory random method
Tool exchange time (tool-to-tool)	sec	2.9 (Speed is changeable for heavy tools)
Tool exchange time (cut-to-cut)	sec	8.9
Spindle motor (30-min/continuous rating)	MITSUBISHI / FANUC kW	18.5 (25HP) / 15 (20HP)
Feed motors	MITSUBISHI / FANUC kW	X/Y: 3.5 (5HP) Z: 4.5 (6HP) X/Y: 4.0 (5HP) Z: 6.0 (8HP)
Coolant pump motor	kW	1.1 (1.5HP)
Sideway lubrication pump motor	kW	0.017 (0.022HP)
Spindle head cooling pump motor (oil cooler)	kW	0.75 (1HP)
Spindle head cooling pump motor (oil air lubrication)	kW	0.018 (0.024HP)
Motor for tool clamp	kW	0.75 (1HP)
Motor for ATC	kW	1.1 (1.5HP)
Motor for tool magazine	kW	0.55 (0.74HP)
Motor for coil-type chip conveyor	kW	0.2 (0.27HP) × 2
Power supply	MITSUBISHI / FANUC kVA	37 / 39
Supply voltage · Supply frequency	V · Hz	200V ± 10% 50/60Hz ± 1Hz 220V ± 10% 60Hz ± 1Hz
Compressed air supply pressure ※3	MPa	0.4~0.6 (58~87 psi)
Compressed air supply flow rate ※2, ※3	L/min (ANR)	600 (159 gpm)
Coolant tank capacity	L	360 (95 gal)
Spindle cooling oil tank capacity (oil cooler)	L	70 (18 gal)
Spindle lubrication oil tank capacity (oil air)	L	2.0 (0.5 gal)
Spindle bearing lubrication oil tank capacity	L	6.0 (1.6 gal)
Machine height (from floor surface)	mm	3215 (126.57")
Required floor space under operation (width × depth)	mm	3870 (152.36") × 3655 (143.90")
Required floor space including maintenance area (width × depth)	mm	4870 (191.73") × 4505 (177.36")
Machine weight	kg	11500 (25353 lbs)
Operation environment temperature	°C	5~40
Operation environment humidity	%	10~90 (No dew)

※1 : Available with the HQ or Hyper HQ control
 ※2 : The value for the standard specification. It may vary with added options.
 ※3 : Purity of the supplied air should be equivalent to Class 3.5.4 specified in ISO 8573-1 / JIS B8392-1 or higher.

Note: Use the machine in the appropriate environment as the machine installation environment affects accuracies of the machine and the machining.

Standard Accessories

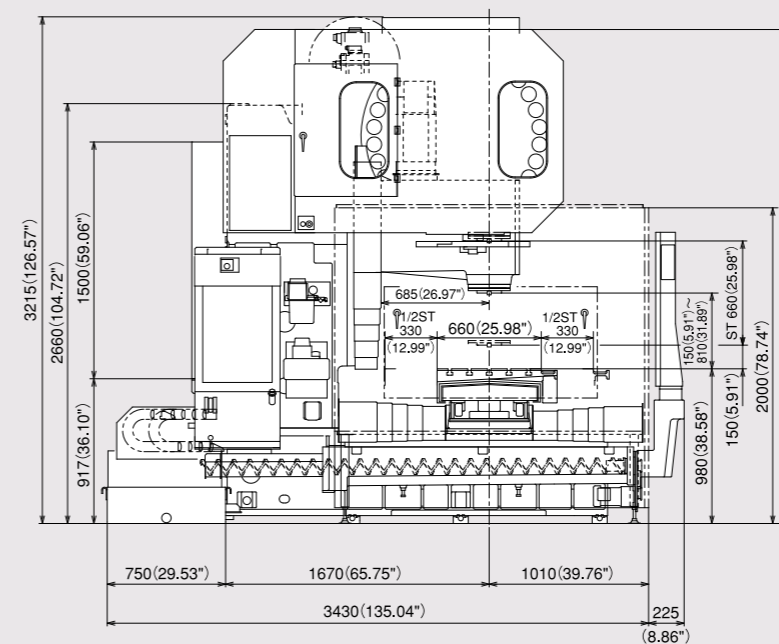
Name	Qty	Remark
Lighting system	1 set	Two LED lamps
Coolant unit (Separate coolant tank)	1 set	Tank capacity : 360L (95 gal)
Entire machine cover (Splash Guard)	1 set	Including front door and maintenance cover electromagnetic lock
Ceiling cover	1 set	
Magazine safety cover	1 set	Including
Sliding surface protection steel sliding cover for X/Y/Z axes	1 set	
Electric leakage breaker	1 set	
Automatic power-off unit	1 set	
Rear-discharging coil-type chip conveyor (Including the reverse rotation function)	1 set	1 set for each of right and left sides
Spindle & ball screw cooling oil temperature controller	1 set	
Sliding surface lubrication unit	1 set	
Oil Air unit	1 set	
Oil skimmer	1 set	Screw type
Air blower	1 set	
Signal lamp	1 set	3-lamp type including buzzer alarm
Workpiece flushing gun	1 set	Shower gun type (normal pressure)
Leveling block	1 set	
Parts for machine transfer	1 set	
Instruction manual, Soft scale II/III manual	1 set	
Instruction manual	1 set	
Electrical instruction manuals (including hardware diagram)	1 set	

Special Accessories

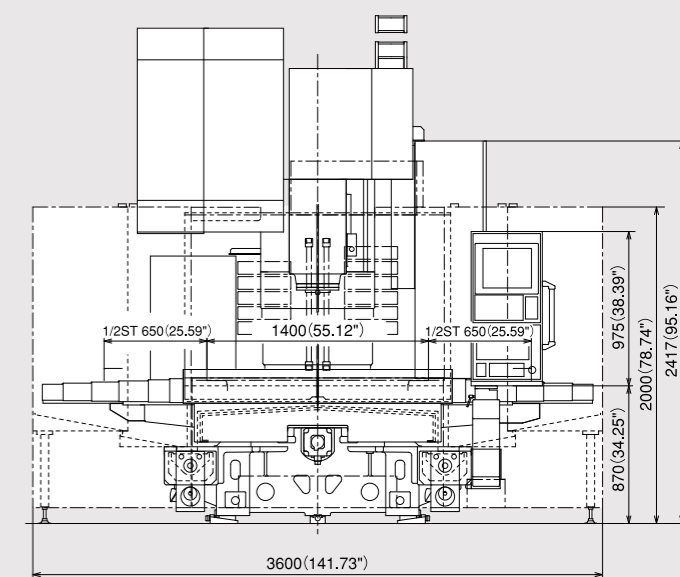
Item	Specification
Long table specification	Table width 1550mm (61.02")
Compatibility with Dual-contact tool	BT Type (with Magazine tool holder remove device)
Spindle motor	4500min ⁻¹ [26 (35HP) / 22 (30HP) kW] (No.50 Gear-drive spindle) 6000min ⁻¹ [18.5 (25HP) / 15 (20HP) kW] [26 (35HP) / 22 (30HP) kW] (No.50 Gear-drive spindle) 8000min ⁻¹ [18.5 (25HP) / 15 (20HP) kW] [26 (35HP) / 22 (30HP) kW] (No.50 Gear-drive spindle) 12000min ⁻¹ [37 (50HP) / 26 (35HP) kW] (MITSUBISHI) (No.50 MS) 12000min ⁻¹ [30 (40HP) / 25 (34HP) kW] (FANUC) (No.50 MS)
Changing the type of pull stud	No.50 : MAS1 (45°) / MAS2 (60°)
Number of stored tools	40 tools, 60 tools
Pallet changer	Shuttle type 2APC (Pallet top face specification / T-slot specification / Tap specification)
Column-UP	250mm (9.84") (Standard for the machine with APC)
Splash guard	Front door automatically open / close
Automatically opened and closed ATC cover	
Hybrid guide face	Sliding guide face & aerostatic specification
Linear scale feed back	XYZ-axis / XY-axis
Spindle through coolant	2MPa (290psi) coolant / 7MPa (1015psi) coolant / with air / Complete preparation for coolant through spindle
Coolant cooler	Separately installed type / High-pressure unit integrated type (High-pressure unit is required separately)
Oil mist blower	
Minimal quantity coolant supply equipment	External nozzle type / Spindle through type
Swirl stopper block	For high-spindle / For angle attachment
Compatibility with Oil-hole holder	Normal pressure (Increased pump output: Equivalent to 1.1kW (1.5HP)) / High pressure (2MPa (290psi))
Mist collector	Installed separately / Compatibility with supplied device (φ200)
Lift-up chip conveyor	Hinge type / Scraper type / Scraper type with floor magnet / for aluminum / for aluminum · FC Discharge: Right/Left
Chip bucket	Fixed type / Swing type
Special operation panel	Pendant-type / console type
Foundation parts	Bond anchoring method
Machine coating color	Color specified by customer
Extinguisher	
Sub table	
NC rotary table	
Motorized index table (Rotary table with controller)	
Touch sensor system T0	Workpiece measurement / Tool length / diameter measurement
Touch sensor system T1	Workpiece measurement / Tool length measurement / Tool break detection
Tool Attachment / Detachment Support	
Programmable Coolant Nozzle	
M-FLAT function	Linear Scale XY, F31IB requires 15" or larger
NET MONITOR	
NET MONITOR Remote Function	

Main Dimensions

Side View



Front View



Floor Space

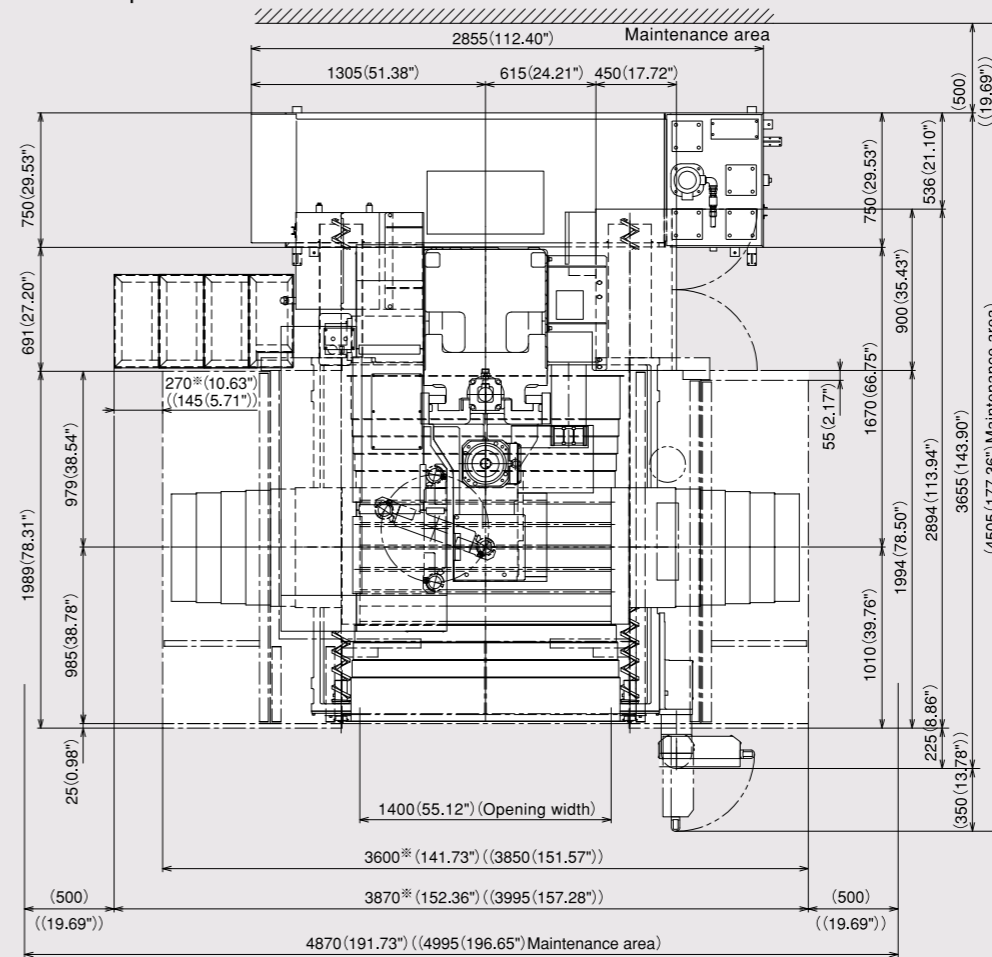
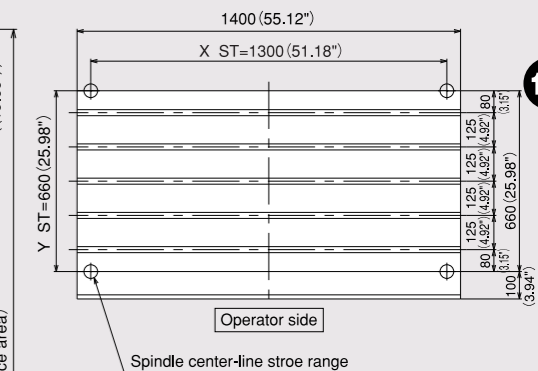
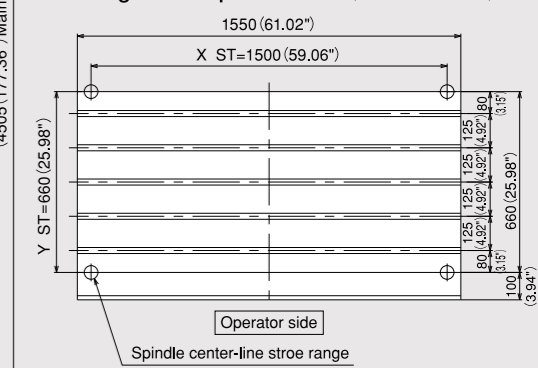


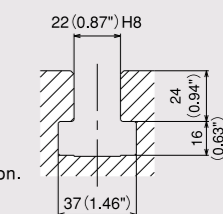
Table Dimensions



Long Table Specification (Extend X St)



T-slot dimension



Note: ※ dimension changes with the machine specification.
 ※ : Long table specification (Extend X st)
 Table width: 1550mm (61.02in) (X st 1500mm (59.06in))

Machine Main Body's Main Specification

Machine Body's Specification

Item	Unit	Specification
		4500min ⁻¹ (Gear-drive spindle)
Travel on X axis (Table right / left)	mm	2060 (81.10")
Travel on Y axis (Saddle back / forth)	mm	940 (37.01")
Travel on Z axis (Spindle head up / down)	mm	820 (32.28")
Distance from table top surface to spindle nose	mm	200 (7.87") ~ 1020 (40.16")
Distance from column front to spindle center mm	mm	1100 (43.31")
Table work surface area (X-axis direction × Y-axis direction)	mm	2300 (90.55") × 940 (37.01")
Max. workpiece weight loadable on table	kg	3000
Table work surface configuration (T-slot nominal dimension × spacing × number of T slots)	mm	22 (0.87") × 125 (4.92") × 7 tools
Distance from floor to table work surface	mm	1100 (43.31")
Spindle rotating speed	min ⁻¹	25~4500
Number of spindle rotating speeds		3 steps
Spindle nose (nominal number)		7/24-tapered No.50
Spindle bearing bore diameter	mm	φ120 (4.72")
Rapid traverse rate	m/min	X/Y : 20 (787 ipm) Z : 16 (630 ipm)
Cutting feed rate	mm/min	1~16000 (0.04 to 630 ipm) ※1
Jog feed rate	mm/min	2000 (79 ipm)
Type of Tool shank		JIS B 6339 BT50
Type of Pull stud		OKK only 90°
Number of stored tools	本	40
Max. tool diameter (with tools in adjacent pots)	mm	φ110 (4.33")
Max. tool diameter (with no tools in adjacent pots)	mm	φ200 (7.87")
Max. tool length (from gauge line)	mm	400 (15.75")
Max. tool mass	kg	Max 20 (44.1 lbs) / AVERAGE 10 / Total 400
Max. tool mass [moment]	N · m	25.7
Tool selection method		Memory random method
Tool exchange time (tool-to-tool)	sec	2.9 (Speed is changeable for heavy tools)
Tool exchange time (cut-to-cut)	sec	9.9
Spindle motor	MITSUBISHI / FANUC kW	18.5 (25HP) / 15 (20HP)
Feed motors	MITSUBISHI / FANUC kW	X/Z : 4.5 (6HP) Y : 3.5 (5HP) × 2 set X/Z : 7.0 (9HP) Y : 4.0 (5HP)
Coolant pump motor	kW	1.1 (1.5HP)
Sideway lubrication pump motor	kW	0.017 (0.022HP)
Spindle head cooling pump motor (oil cooler)	kW	0.75 (1HP)
Spindle head cooling pump motor (oil air lubrication)	kW	0.018 (0.024HP)
Motor for tool clamp	kW	0.75 (1HP)
Motor for ATC	kW	1.1 (1.5HP)
Motor for tool magazine	kW	1.1 (1.5HP)
Motor for coil-type chip conveyor kW	kW	0.2 (0.27HP) × 3
Power supply	MITSUBISHI / FANUC kVA	40 44
Supply voltage · Supply frequency	V · Hz	200V ± 10% 50/60Hz ± 1Hz 220V ± 10% 60Hz ± 1Hz
Compressed air supply pressure ※3	MPa	0.4~0.6 (58~87 psi)
Compressed air supply flow rate ※2, ※3	L/min (ANR)	1000 (264 gpm)
Coolant tank capacity	L	500 (132 gal)
Spindle cooling oil tank capacity (oil cooler)	L	70 (18 gal)
Spindle bearing lubrication oil tank capacity	L	2.0 (0.5 gal)
Sideway lubrication oil tank capacity	L	6.0 (1.6 gal)
Machine height (from floor surface)	MITSUBISHI / FANUC mm	3810 (150.00") 3920 (154.33") × 3655 (143.90")
Required floor space under operation (width × depth)	mm	5600 (220.47") × 5220 (205.51")
Required floor space including maintenance area (width × depth)	mm	6600 (259.84") × 6080 (239.37")
Machine weight	kg	23000 (50706 lbs)
Operation environment temperature	°C	5~40
Operation environment humidity	%	10~90 (No dew)

※1 : Available with the HQ or Hyper HQ control
 ※2 : The value for the standard specification It may vary with added options.
 ※3 : Purity of the supplied air should be equivalent to Class 3.5.4 specified in ISO 8573-1 / JIS B8392-1 or higher.

Note: Use the machine in the appropriate environment as the machine installation environment affects accuracies of the machine and the machining.

Standard Accessories

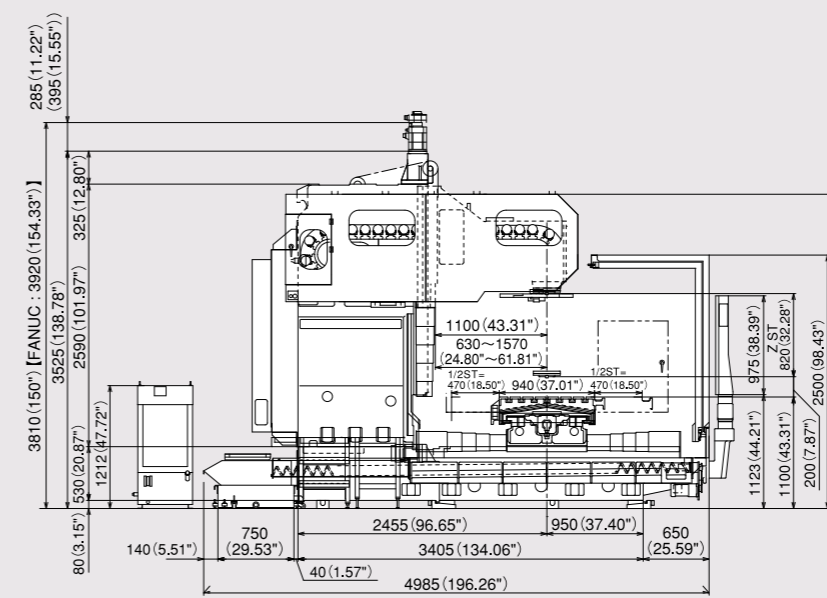
Name	Qty	Remark
Lighting system	1 set	Two LED lamps
Coolant unit (Separate coolant tank)	1 set	Tank capacity : 500L (132 gal)
Entire machine cover (Splash Guard)	1 set	Including front door and maintenance cover electromagnetic lock
Ceiling cover	1 set	
Magazine safety cover	1 set	Including
Sliding surface protection steel sliding cover for X/Y/Z axes	1 set	
Electric leakage breaker	1 set	
Automatic power-off unit	1 set	
X/Y axes hybrid (aerostatic & sliding) guide face	1 set	
Rear-discharging coil-type chip conveyor (Including the reverse rotation function)	1 set	1 set for each of right and left sides
Spindle & ball screw cooling oil temperature controller	1 set	
Sliding surface lubrication unit	1 set	
Oil Air unit	1 set	
Oil skimmer	1 set	Screw type
Air blower	1 set	
Signal lamp	1 set	3-lamp type including buzzer alarm
Workpiece flushing gun	1 set	Shower gun type (normal pressure)
Leveling block	1 set	
Parts for machine transfer	1 set	
Instruction manual, Soft scale II/III manual	1 set	
Instruction manual	1 set	
Electrical instruction manuals (including hardware diagram)	1 set	

Special Accessories

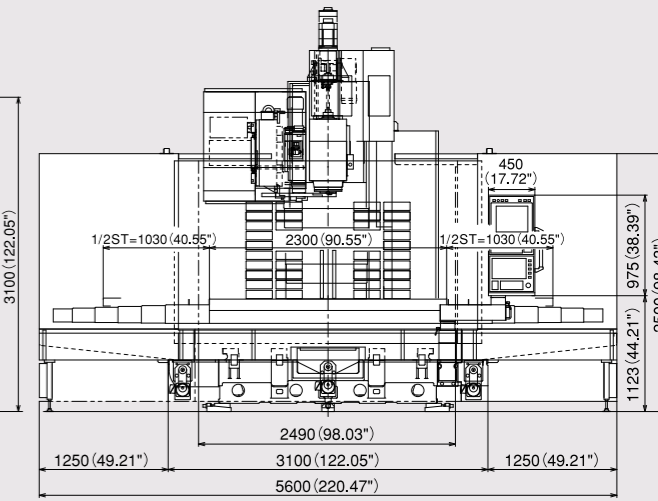
Item	Specification
Compatibility with Dual-contact tool	BT Type (with Magazine tool holder remove device)
Spindle motor	4500min ⁻¹ [26 (35HP) / 22 (30HP) kW] (No.50 Gear-drive spindle) 6000min ⁻¹ [18.5 (25HP) / 15 (20HP) kW] [26 (35HP) / 22 (30HP) kW] (No.50 Gear-drive spindle) 8000min ⁻¹ [18.5 (25HP) / 15 (20HP) kW] [26 (35HP) / 22 (30HP) kW] (No.50 Gear-drive spindle) 12000min ⁻¹ [37 (50HP) / 26 (35HP) kW] (MITSUBISHI) (No.50 MS) 12000min ⁻¹ [30 (40HP) / 25 (34HP) kW] (FANUC) (No.50 MS)
Changing the type of pull stud	No.50:MAS1 (45°) / MAS2 (60°)
Number of stored tools	60 tools
Pallet changer	Shuttle type 2APC (Pallet top face specification / T-slot specification / Tap specification)
Column-UP	200mm (7.87") (Standard for the machine with APC)
Splash guard	Front door automatically open / close
Automatically opened and closed ATC cover	
Linear scale feed back	XYZ-axis / XY-axis
Spindle through coolant	2Mpa (290psi) coolant / 7Mpa (1015psi) coolant / with air / Complete preparation for coolant through spindle
Coolant cooler	Separately installed type / High-pressure unit integrated type (High-pressure unit is required separately)
Oil mist blower	
Minimal quantity coolant supply equipment	External nozzle type / Spindle through type
Swirl stopper block	For high-spindle / For angle attachment
Compatibility with Oil-hole holder	Normal pressure (Increased pump output: Equivalent to 1.1kW (1.5HP)) / High pressure (2MPa (290psi))
Mist collector	Installed separately / Compatibility with supplied device (φ150×2)
Lift-up chip conveyor	Hinge type / Scraper type / Scraper type with floor magnet / for aluminum / for aluminum · FC Discharge: Right/Left
Chip bucket	Fixed type / Swing type
Special operation panel	Pendant-type / console type
Machine coating color	Color specified by customer
Extinguisher	
Sub table	
NC rotary table	
Motorized index table (Rotary table with controller)	
Touch sensor system T0	Workpiece measurement Tool length / diameter measurement
Touch sensor system T1	Workpiece measurement / Tool length measurement / Tool break detection
Tool Attachment / Detachment Support	
Programmable Coolant Nozzle	
NET MONITOR	
NET MONITOR Remote Function	

Main Dimensions

Side View



Front View



Floor Space

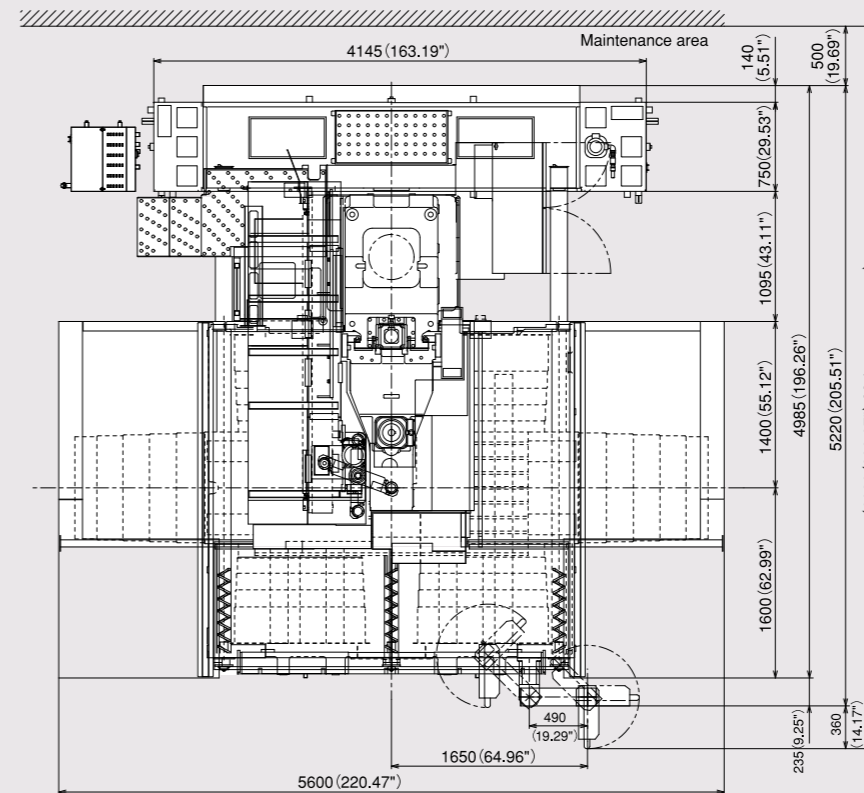
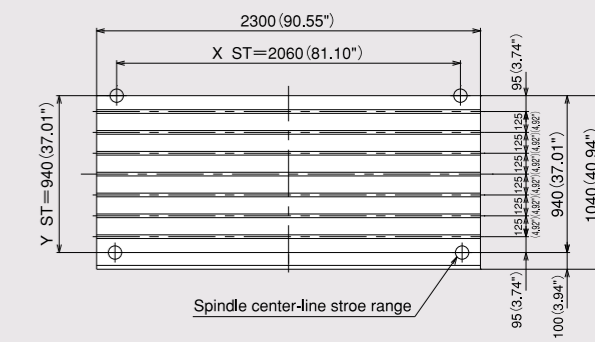
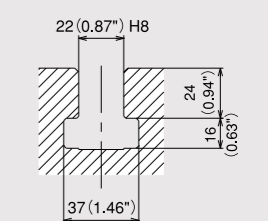


Table Dimensions



T-slot dimension



CONTROLLER

N830 (Windows 8-installed Open CNC)

Standard Specification
No. of controlled axes: 3 axes (X, Y, Z)
No. of simultaneously controlled axes: 3 axes
Least input increment: 0.001mm / 0.0001"
Max. programmable dimension: ±99999.999mm / ±9999.9999"
Inch / Metric conversion: G20 / G21
Program format: Meldas standard format (M2 / M0 format needs to be instructed separately.)
Decimal point input I / II
Absolute / Incremental programming: G90 / G91
Program code: ISO / EIA automatic discrimination
Least control increment: 1nm
Positioning: G00
Linear interpolation: G01
Circular interpolation: G02 / G03 (Including radius designation)
Unidirectional positioning
Helical interpolation
Cutting feed rate: 5.3-digit F-code, direct designation
One digit F-code feed
Rapid traverse override: 0 / 1 / 10 / 25 / 50 / 100%
Cutting feed rate override: 0 to 200% (every 10%)
Feed rate override cancel: M49 / M48 (cancel)
Rigid tap cycle: G74, G84
Manual handle feed: Least input increment ×1, ×10, ×100 / graduation
Dwell: G04
Part program storage capacity: 1280m [500KB]
No. of registered programs: 1000
Part program editing
Background editing: Possible to program or edit the machining program while NC machining is executed.
Buffer modification
Color touch-panel display (15" LCD / QWERTY key MDI)
Integrating time display
Clock function
User definable key
MDI (Manual Data Input) operation
Menu list
Parameter / Operation guidance
Alarm guidance
Ethernet interface
SD card / USB memory interface
Operation inside display unit with high-speed program server
Operation with SD card / USB memory
Spindle function: Direct designation of spindle speed with 5-digit S-code
Spindle speed override: 50 to 150% (every 5%)
Tool function: Direct designation of called tool number with 4-digit T-code
ATC tool registration
Miscellaneous function: Designation with 3-digit M-code
Multiple M-codes in 1 block: Maximum 3 codes in 1 block (Maximum 20 settings)
Tool length offset: G43, G44, G49 (cancel)
Tool position offset: G45 to G48
Cutter compensation: G38 to G42
Tool offset sets: 200 sets
Tool offset memory II: tool geometry (length/diameter) and wear offset
Machine coordinate system: G53
Coordinate system setting: G92
Automatic coordinate system setting
Workpiece coordinate system: G54 to G59
Local coordinate system: G52
Manual reference position return

Automatic reference position return
2nd to 4th reference position return: G30 P2 to P4
Reference position return check: G27
Optional block skip: / n (n:1 to 9)
Single block
Dry run
Machine lock
Z-axis feed cancel
Miscellaneous function lock
3D solid program check
Graphic display check
Program number search
Sequence number search
Sequence number comparison and stop
Program restart function
Cycle start
Feed hold
Manual absolute (ON / OFF with PLC parameter)
Auto restart
Program stop: M00
Optional stop: M01
Machining time computation
Automatic operation handle interruption
Manual numerical command
Sub program control: M98, M99
Canned cycle: G73, G74, G76, G81 to G89, G80 (cancel)
Linear angle designation
Circular cutting: G12, G13
Parameter mirror image
Programmable mirror image: G51.1, G50.1 (cancel)
User macro and user macro interruption
Variable command: total 700 sets
Programmable coordinate system rotation: G68, G69 (cancel)
Parameter coordinate system rotation
Corner chamfering / corner R: Insert between straight line-straight line / straight line-circle blocks
Programmable data input: G10 / G11 (cancel)
Automatic corner override
Exact stop check / mode
Playback
Memory pitch error compensation
Backlash compensation
Skip function: G31
Manual tool length measurement
Tool life management II: 200 sets
External search
Emergency stop
Data protection key
NC alarm display
Machine alarm message
Stored stroke limit I / II
Load monitor
Self-diagnosis
Absolute position detection

Optional Specification

Additional one axis control: name of axis (A, B, C, U, V, W)
Additional two axes control: name of axis (A, B, C, U, V, W) ^{Note}
Simultaneously controlled axes: 4 axes
Simultaneously controlled axes: 5 axes ^{Note}
Least input increment: 0.0001mm / 0.00001"

Program format: M2 / M0 format
Spiral / Conical interpolation
Cylindrical interpolation
Hypothetical axis interpolation
NURBS interpolation (Hyper HQ control mode II is required)
Handle feed 3 axes: Standard pulse handle is removed
Inverse time feed
Part program storage capacity: 2560m [1Mbyte] (No. of registered programs: 1000)
Part program storage capacity: 5120m [2Mbyte] (No. of registered programs: 1000)
Color touch-panel display (19" LCD / Software key MDI)
RS232C interface: RS232C-1CH
Computer link B: RS232C
Spindle contour control (Spindle position control)
3-dimensional cutter compensation
Tool offset sets: 400 sets
Tool offset sets: 999 sets
Addition of workpiece coordinate system (total 96): G54.1 P1 to G54.1 P96
Addition of workpiece coordinate system (total 300): G54.1 P1 to G54.1 P300
Tool retract and return
Scaling: G51, G50 (cancel)
Pattern rotation
Chopping function
Special canned cycles: G34, G35, G36, G37
Additional tool life management sets: total 400 sets
Additional tool life management sets: total 999 sets

Original Nidec OKK Software

Integrated machining support system	STD
Tool support	STD
Program Editor	STD
EasyPRO	STD
Work Manager	Opt
HQ control	STD
Hyper HQ control mode I	Opt
Hyper HQ control mode II	Opt
Soft Scale III	STD
WinGMC8 (including the option H)	STD
Cycle Mate	Opt
Touch sensor T0 software	Opt
Soft CCM (Cutting failure monitoring)	Opt
Soft AC (Adaptive control)	Opt
Automatic restart at the time of tool breakage	Opt

Note: The controller N850 (Windows 8-installed Open CNC) is used when five axes are controlled simultaneously.
STD : Standard Opt : Option

F31i-B Plus (Windows CE-installed Open CNC), OKK-FANUC Ai

Standard Specification
No. of controlled axes: 3 axes (X, Y, Z)
No. of simultaneously controlled axes: 3 axes
Least input increment: 0.001mm / 0.0001"
Max. programmable dimension: ±999999.999mm / ±39370.0787"
Absolute / Incremental programming: G90 / G91
Decimal point input / Pocket calculator type decimal point input
Inch / Metric conversion: G20 / G21
Program code: ISO / EIA automatic discrimination
Program format: FANUC standard format
FS15 tape format
Nano interpolation (internal)
Positioning: G00
Linear interpolation: G01
Circular interpolation: G02 / G03 (CW/CCW) (Including radius designation)
Helical interpolation
Unidirectional positioning: G60
Cutting feed rate: 6.3-digit F-code, direct designation
Rapid traverse override: 0 / 1 / 10 / 25 / 50 / 100%
Cutting feed rate override: 0 to 200% (every 10%)
Feed rate override cancel: M49 / M48
Rigid tapping: G84, G74 (Mode designation: M29)
Manual handle feed: Least input increment ×1, ×10, ×100/graduation
Dwell: G04
One-digit F code feed
inverse time feed
Part program storage capacity: total 10240m [4MB] (total 1000 programs)
Part program editing
Background editing: Possible to program or edit the machining program while NC machining is executed.
Extended part program editing
15-inch color LCD / QWERTY key MDI
Clock function
MDI (manual data input) operation
Run hour and parts count display
Memory card / USB interface
Spindle function: Direct designation of spindle speed with 5-digit S-code
Spindle speed override: 50 to 150% (every 5%)
Tool function: Direct designation of called tool number with 4-digit T-code
ATC tool registration
Auxiliary function: Designation with 3-digit M-code
Multiple M-codes in 1 block: Maximum 3 codes in 1 block (Maximum 20 settings)
Tool length offset: G43, G44 / G49
Tool diameter and cutting edge R compensation: G41, G42 / G40
Tool offset sets: total 400 sets
Tool offset memory C
Tool position offset
Automatic reference position return: G28 / G29
2nd reference position return: G30
Machine coordinate system: G53
Coordinate system setting: G92
Automatic coordinate system setting
Workpiece coordinate system: G54 to G59 G54.1 P1 ~ P48

Standard Specification
Local coordinate system: G52
Polar coordinate command: G15, G16
Manual reference position return
Reference position return check: G27
Optional block skip: /
Single block
Dry run
Machine lock
Z-axis feed cancel
Auxiliary function lock
Graphic function
Program number search
Sequence number search
Program restart
Cycle start
Feed hold
Manual absolute (ON / OFF with PMC parameter)
Auto restart
Program stop: M00
Optional stop: M01
Sequence number collation and stop
Sub program control
Canned cycle: G73, G74, G76, G80 to G89
Mirror image function parameter
Custom macro
Programmable mirror image
Programmable data input: G10
Automatic corner override
Manual Guide i (Basic)
Exact stop check / mode
Scaling: G50, G51
Additional custom macro common variables: 1000
Coordinate system rotation: G68, G69
Optional chamfering / corner R
Playback
Interpolation type pitch error compensation
Backlash compensation for each rapid traverse and cutting feed
Smooth backlash
Skip function
Tool life management: total 256 sets
Tool length manual measurement
Data protection key
NC alarm display / alarm history display
Machine alarm display
Stored stroke check 1
Stored stroke check 2
Load monitor
Self-diagnosis
Absolute position detection

Optional Specification

Additional one axis control: name of axis (A, B, C, U, V, W)
Additional two axes control: name of axis (A, B, C, U, V, W) ^{Note1}
No. of simultaneously controlled axes: 4 axes
No. of simultaneously controlled axes: 5 axes ^{Note1}
Least input increment: 0.0001mm / 0.00001"
Spiral / Conical interpolation
Cylindrical interpolation

Optional Specification
Hypothetical axis interpolation
Involute interpolation
NURBS interpolation
Smooth interpolation (Hyper HQ control B mode is required)
Handle feed 3 axes: Standard pulse handle is removed
Part program storage capacity: total 20480m [8MB] (1000 in total)
Machining time stamp
Data server: ATA card (1GB)
Data server: ATA card (4GB)
RS232C interface: RS232C-1CH
Spindle contour control (Cs contour control)
Tool position offset
Tool offset sets: total 499 sets
Tool offset sets: total 999 sets
Addition of workpiece coordinate system (total 300 sets): G54.1 P1 to P300
Optional block skip: Total 9
Manual handle interruption
Tool retract and return
Figure copy
Interruption type custom macro
Instruction of inclined plane indexing
Chopping
Manual Guide i (Milling cycle)
Addition of tool life management sets: total 1024 sets
High-speed skip

Original Nidec OKK Software

Integrated machining support software (incl. help guidance, etc.)	STD
Tool support	STD
Program Editor	STD
EasyPRO	STD
Work Manager	Opt
HQ control	STD
Hyper HQ control mode A	Opt
Hyper HQ control mode B	Opt
Hyper HQ varue kit ^{Note2}	Opt
Special canned cycle (including circular cutting)	Opt
Cycle Mate F	Opt
Soft Scale III	STD
Touch sensor T0 software	Opt
Soft CCM (Tool failure detection system)	Opt
Soft AC (Adaptive control unit)	Opt
Automatic restart at tool damage	Opt

Note1 : F31i-B5 Plus (Windows CE-installed Open CNC)
Note2 : Includes Data server: ATA card(1GB) and Hyper HQ control mode B
STD : Standard Opt : Option