OKUMA

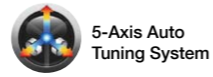**5-Axis Vertical Machining Center**

UNIVERSAL CENTER MU-400V II

5-Axis Vertical Machining Center

UNIVERSAL CENTER
MU-400V II

Intelligent Technology

- Thermo-Friendly Concept
- Collision Avoidance System
- Machining Navi
- 5-Axis Auto Tuning System
- SERVONAVI

Okuma's 5-axis vertical—superb, multi-sided applications in one-chucking—when you also need fast and efficient parts production with high accuracies

The MU-400V II 5-axis vertical machining center is based on the ACE CENTER MB-V, which boasts exceptional thermal stability with the Thermo-Friendly Concept to control thermal deformation using the unique concept of accepting temperature changes. With a trunnion structure rotary table, the MU-400V II achieves high speed, high accuracy 5-axis machining. —Quick positioning, swift ATC, and other standard features give the base machine outstanding performance. Okuma just added a trunnion with superb positioning accuracy, rigidity, and top-of-the-class table rotation speed.

From aerospace components that require simultaneous 5-axis machining to one-chuck multi-sided operations (vastly reduced setups), the Universal Center is the right tool for a wide variety of workpieces.

Hypoid gears provide fast and accurate machining with 2-axis trunnion table

- Rotation
  - C axis: 50 min⁻¹ (300 deg/sec)
  - A axis: 40 min⁻¹ (240 deg/sec)
- Indexing   A/C axes: ±4 sec*
- Repeatability   A/C axes: ±1 sec*
- Minimum indexing angle   0.0001°   *Actual data

One-chucking multi-sided machining

- Eliminates extra clamps
- Improves machined workpiece accuracies
- Eliminates setup changes
  Keeps costs down, provides highly efficient production

Superb thermostability

- Thermo-Friendly Concept

Photos shown in this brochure may also show optional equipment.

Reliable technology that supports fast, high-quality machining

Solid trunnion construction permits fast and accurate machining

- **Rotation range**
  - C axis: 360 degrees
  - Axis: +20 to -110 degrees
- **Maximum workpiece size**
  - ø600 x h400 mm (ø23.62 x ø15.75 in.) [See details on page 8.]
- **Maximum load**
  - 300 kg (660 lb)
- **High accuracies**
  - Indexing: ±4 sec (A/C axes)*
  - Repeatability: ±1 sec (A/C axes)*
    High-precision ground gears used (heat-treated steel—excellent durability)
    With high-precision DD encoders.

    * Actual data
- **High speeds**
  - C axis: 50 min^{-1} (300 deg/sec)
  - A axis: 40 min^{-1} (240 deg/sec)
    Driven by hypoid gears

C-axis
A-axis
Hypoid gears
Hypoid gears
Hypoid gears
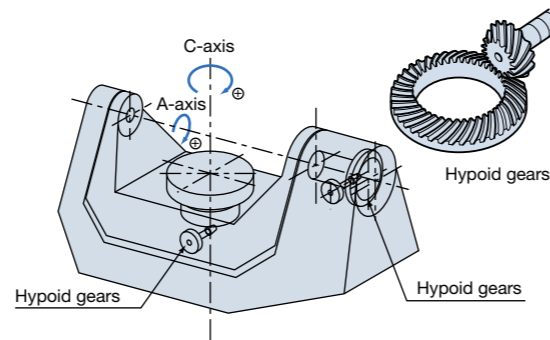
Spindle specs available to match your application requirements

- **For general applications**
  - Standard Spindle 8,000 min^{-1}, 11/7.5 kW (15/10 hp) (10 min/cont) 198 N-m (146 ft-lbf) (BT40)

- **Fast/efficient aluminum and light alloy applications**
  - Wide-Range Spindle (Optional) 15,000 min^{-1}, 22/18.5 kW (30/25 hp) (10 min/cont) 199 N-m (146 ft-lbf) (BT40)
  - High-Speed Spindle (Optional) 20,000 min^{-1}, 30/22 kW (40/30 hp) (10 min/cont) 57 N-m (42 ft-lbf) (HSK-A63)

- **High-speed machining of die/molds and small precision parts**
  - High-Speed Spindle (Optional) 25,000 min^{-1}, 15/11 kW (20/15 hp) (10 min/cont) 29 N-m (21 ft-lbf) (HSK-A63)
    35,000 min^{-1}, 15 kW (20 hp)(cont) 4 N-m (3 ft-lbf) (HSK-F63)
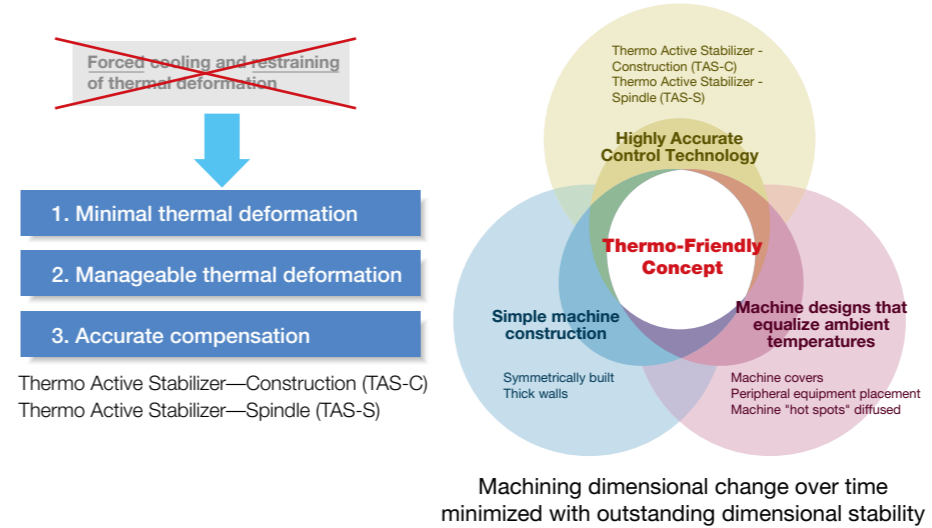
Superior machine structure

- **Thermo-Friendly Construction**
  - Thermally symmetric and with "box-build" structure
  - Cooling unit and NC control box designed to dissipate heat
  - Thermally balanced structure
  - Structure that isolates heat from coolant and chips

- **Extremely rigid machine construction**
  - From extended use of the advanced 3D-CAD and FEM analysis
  - With ram-saddle feed
- **Easy to use**
  - Good visibility of the machining process
  - Good table access
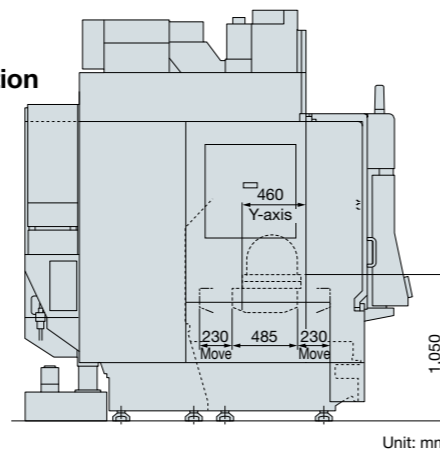
460
Y-axis
230 Move 485 230 Move
1,050
Unit: mm

The unique approach of "accepting temperature changes"
Thermo-Friendly Concept

Thermo-friendly structure gives outstanding thermal stability

Forced cooling and restraining of thermal deformation

1. Minimal thermal deformation
2. Manageable thermal deformation
3. Accurate compensation

Thermo Active Stabilizer—Construction (TAS-C)
Thermo Active Stabilizer—Spindle (TAS-S)

Thermo Active Stabilizer - Construction (TAS-C)
Thermo Active Stabilizer - Spindle (TAS-S)

Highly Accurate Control Technology

Thermo-Friendly Concept

Simple machine construction
Symmetrically built
Thick walls

Machine designs that equalize ambient temperatures
Machine covers
Peripheral equipment placement
Machine "hot spots" diffused

Machining dimensional change over time minimized with outstanding dimensional stability

Eliminate waste with the Thermo-Friendly Concept

In addition to maintaining high dimensional accuracy when room temperature changes, Okuma's Thermo— Friendly Concept provides high dimensional accuracy during machine startup and machining restart.
To stabilize thermal deformation, warming-up time is shortened and the burden of dimensional correction during machining restart is reduced.

Machine startup
Machining restart
Room temp change
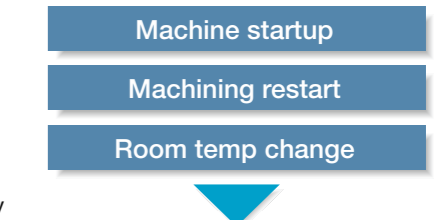
High dimensional stability

TAS-C (Thermo Active Stabilizer—Construction)
[Optional]
The TAS-C environmental thermal deformation control accurately controls the machine's structural thermal deformation; by taking into consideration the machine's thermal deformation characteristics, temperature data from properly placed sensors, and feed axis positioning information.

TAS-S (Thermo Active Stabilizer—Spindle)
[Optional]
The TAS-S spindle thermal deformation control takes into account various conditional changes such as the spindle's temperature data, modification of the spindle rotation and speed, as well as spindle stoppage. The spindle's thermal deformation will be accurately controlled, even when the rotating speed changes frequently.

Machine tool idling stop
ECO Idling Stop

ECO suite

Only the necessary units run

Accuracy ensured, cooler off
ECO Idling Stop

Intelligent energy-saving function with the Thermo-Friendly Concept.
The machine itself determines whether or not cooling is needed and cooler idling is stopped with no loss to accuracy. (Standard application on machines with Thermo-Active Stabilizer—Spindle)

On-the-spot check of energy savings
ECO Power Monitor

Power is shown individually for spindle, feed axes, and auxiliaries on the OSP operation screen. The energy-saving benefits from auxiliary equipment stopped with ECO Idling Stop can be confirmed on the spot.

ECO suite benefits

Electricity consumption during non-machining time greatly reduced with "ECO Idling Stop", which shuts down each piece of auxiliary equipment not in use.

ECO suite provides a suite of energy-saving functions that can be used on machines
- **"ECO Idling Stop"** for operation of necessary units only
- **"ECO Power Monitor"** for visual graphics of power
- Intermittent/continuous operation of chip conveyor and mist collector during operation — **"ECO Operation"** (Optional)
- Energy-saving hydraulic unit using servo control technology — **"ECO Hydraulics"** (Optional)

Highly efficient 5-axis machining of complex-shaped parts

602 cm³/min (actual data*)

ø20 roughing end mill, workpiece material: S45C
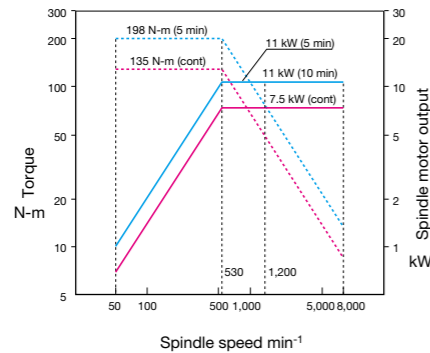Wide range spindle (Optional) 15,000min⁻¹ (No. 40 22/18.5 kW 199/146 N-m)

Cutting Tool	Spindle min⁻¹	Cutting m/min	Feed mm/min	Width mm	Depth mm	Removed cm³/min
ø80 (ø3.15) face mill 8 blades (cermet)	895	225	3,000	56	3	**504**
ø20 (ø0.79) roughing end mill 7 flutes (carbide)	4,000	251	4,300	7	20	**602**
ø63 (ø2.48) insert drill (carbide)	606	120	91	—	—	—
M30 P3.5 tap	318	30	1,113	—	—	66% (Spindle load)

* Note: The "actual data" referred to above for this brochure represent examples, and may not be obtained due to differences in specifications, tooling, and cutting conditions.
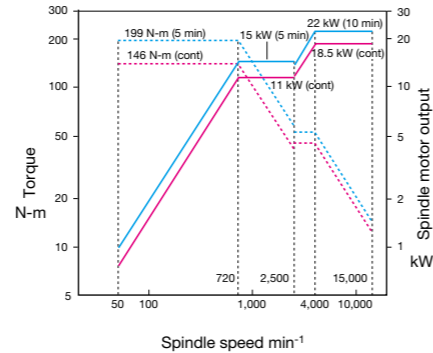
■ Standard spindle
For general applications
- Speed . . . . 8,000 min⁻¹
- Max output . . . . 11/7.5 kW (10 min/cont)
- Max torque . . . . 198/135 N-m (5 min/cont)

■ Wide-range spindle (Optional)
Highly efficient light alloys (Al)
- Speed . . . . 15,000 min⁻¹
- Max output . . . 22/18.5 kW (10 min/cont)
- Max torque . . . 199/146 N-m (5 min/cont)

Quick machine components reduce non-cutting times

- Rapid traverse . . . . X-Y: 40 m/min (1,575 ipm)
- Rapid accel/decel spindle . . . 1.2 sec (0↔8,000 min⁻¹)
- Rapid ATC . . . . 1.2 sec (T-T)

Hi-G Control (Standard)
During positioning, this function controls the acceleration/deceleration speed according to the speed- torque characteristics of the BL motor, resulting in fast and highly stable positioning. The Hi-G control function reduces positioning time and greatly reduces non-cutting time.
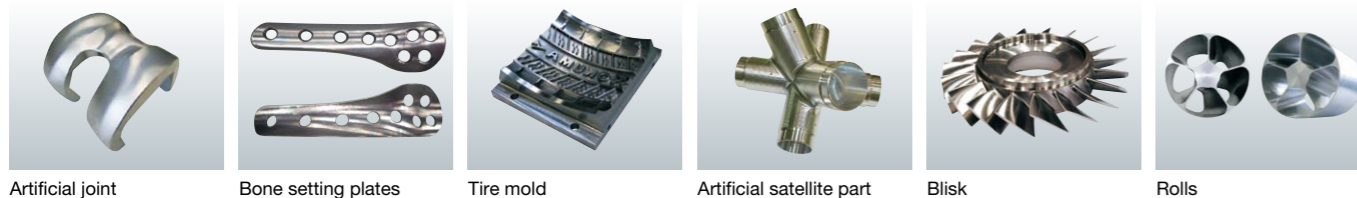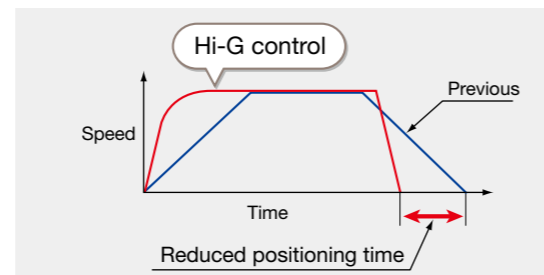
Artificial joint   Bone setting plates   Tire mold   Artificial satellite part   Blisk   Rolls

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Power displayed in indexing and simultaneous 5-axis machining

■ 3-axis vs 5-axis machining
☐ : 3-axis   ☐ : 5-axis
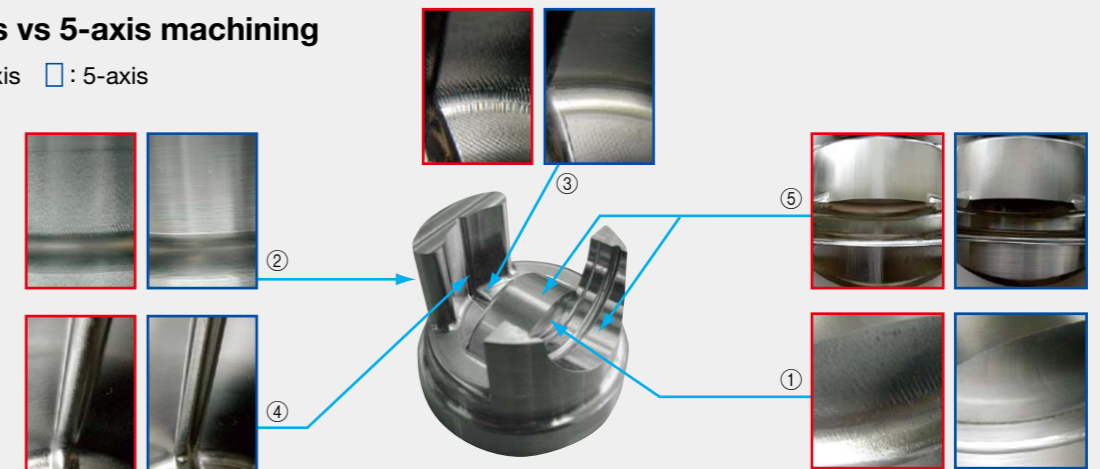
- Machine   MU-400V Ⅱ 15,000 min⁻¹
- Workpiece   Rubber mold
- Material   NAK80
- Work size   ø100 × 75
- Data   Unigraphics

Advantages	Application Used
① Can cut pin corners	Workpiece oriented (positioned) to ideal cutting conditions
② Perpendicular wall (H45 mm) vibration eliminated	Shorter tool lengths for tools with higher rigidity
③ Corner R vibration eliminated	
④ Can use smaller-dia tools (ø6 → ø3 mm)	
⑤ Higher quality cuts; concave bottom (convex top)	Tip-clear* ball-nose end milling

* 0 peripheral speed

■ Cutting condtions

Area machined	Tool	Spindle speed min⁻¹	Cutting speed m/min	Feedrate mm/min
Half cylinder	ø16 end mill	4,000	215	400
Center cylinder	ø4 ball end mill	10,000	125	1,500
All corners	ø3 ball end mill	8,000	75	1,000
Cylinder groove	ø1.5 ball end mill	12,000	55	1,500

■ Intensive machining—in one chucking

- Machine   MU-400V Ⅱ 15,000 min⁻¹
- Workpiece   Bone setting plate
- Material   Ti-6AI-4V (titanium alloy)
- Work size   117 × 30 × 3
- Cycle time   9 hr 5 min (machining from block material)

■ Cutting condtions

Area machined	Tool	Spindle speed min⁻¹	Cutting speed m/min	Feedrate mm/min
Roughing (all surfaces)	ø20 R2 corner radius end mill	954	60	763
Both surfaces	R5 ball end mill	3,180	100	318
ø7 hole	ø7 drill	909	20	64

■ Machine specifications

	Item	Unit	MU-400V Ⅱ
Travels	X-axis (saddle left/right)	mm (in.)	762 (30.00)
	Y-axis (pallet front/back)	mm (in.)	460 (18.11)
	Z-axis (spindle up/down)	mm (in.)	460 (18.11)
	A-axis	deg	+20 to -110
	C-axis	deg	360
	Table surface to spindle nose	mm (in.)	100 to 560 (3.94 to 22.05)
Table	Table size	mm (in.)	ø400 (ø15.75)
	Max work size	mm (in.)	ø600 x h400 (ø23.62 x h15.75) *For details see p.8
	Floor to table top	mm (in.)	1,050 (41.34)
	Max load capacity	kg (lb)	300 (660)
Spindle	Spindle speed	min⁻¹	8,000 [15,000, 20,000, 25,000, 35,000]
	No. of spindle ranges		Infinitely variable
	Tapered bore		7/24 taper No. 40 [HSK-A63, HSK-F63]
	Bearing dia	mm	ø70 [ø70, ø60]
Feed	Rapid traverse	m/min (ipm)	X-Y: 40 (1,575) Z: 32 (1,260)
	Rapid traverse (A-C)	deg/min	A: 14,400 C: 18,000
	Cutting feedrate	mm/min (ipm)	X-Y-Z: 32,000 (1,260)
Motors	Spindle (10 min/cont)	kW (hp)	11/7.5 (15/10) [22/18.5, 30/22, 15/11, 15]
	Feed axes	kW	X-Y-Z: 3.5 A: 4.2 C: 3.0
ATC	Tool shank		MAS BT40 [HSK]
	Pull stud		MAS 2 [-]
	Tool capacity	tools	20 [32, 48, 64, 98, 132, 166, 200, 234, 268]*
	Max tool dia (w/ adjacent tool)	mm (in.)	ø90 (ø3.54)
	Max tool dia (w/o adjacent tool)	mm (in.)	ø125 (ø4.92)
	Max tool length	mm (in.)	240 (9.45)
	Max tool weight	kg (lb)	8 (18)
	Max tool moment	N-m (ft-lbf)	7.8 [8 kg x 100 mm] (5.7 [17.6 lb x 3.94 in.])
	Tool selection		Memory random [fixed address for matrix type for ≥64 tools]
Machine size	Height	mm (in.)	2,946 (115.98)
	Floor space W × D	mm (in.)	2,160 × 2,810 (85.04 × 110.63)
	Weight	kg (lb)	8,300 (18,260)

* Matrix type for ≥64 tools   [   ] Optional

■ Standard specifications / accessories

Item	Remarks	Item	Remarks
Spindle speed 50 to 8,000 min⁻¹	7/24 taper No. 40, 11/7.5 kW (15/10 hp)	Chip pan	Effective capacity: 60 L
Rapids X-Y: 40, Z: 32 m/min	(X-Y: 1,575, Z: 1,260 ipm)	ATC air blower (blast)	
Spindle/Spindlehead cooling system	Oil controller	Chip air blower (blast)	Nozzle type
		Foundation blocks (with jack bolts)	8 pcs (with jack bolts)
Air cleaner (filter)	Including regulator	3-lamp status indicator	Type C (LED signal tower)
Spindle oil-air lubrication system		Work lamp	LED
A/C axis rotary table	0.0001 deg, includes DD encoders	Full enclosure shielding	With ceiling
C axis table	ø400, T groove 18H7 6-tool	Tapered bore cleaning bar	
Auto tool changer	20-tool	Hand tools	
ATC magazine shutter		Tool box	
Coolant supply system*¹	Tank: 170 L [Effective: 100 L], pump: 250W	CNC	OSP-P300M
Coolant nozzle	Flexible nozzle 5-tool	Operation panel with color LCD	
Chip flusher system*²	Table left/right	Pulse handle	

*1. 800-W pump required with oil-based coolant.
*2. Use an in-machine coil type chip conveyor when using an oil-based coolant.
Note: Oil-based coolants are highly flammable, so fire prevention measures must always be taken when using these coolants. Do not operate unattended.

■ Working range

Unit : mm (in.)

■ Table dimensions
(A axis at –90° swing)

Max workpiece size that allows swing

(▨ Workpiece max swing
area restricted per A-axis angle)

Unit : mm (in.)

■ Max workpiece dimensions

Bolt holes (8 places) to mount table to machine.
Not for workpiece fixtures.

T-slot detail (6)

Unit : mm
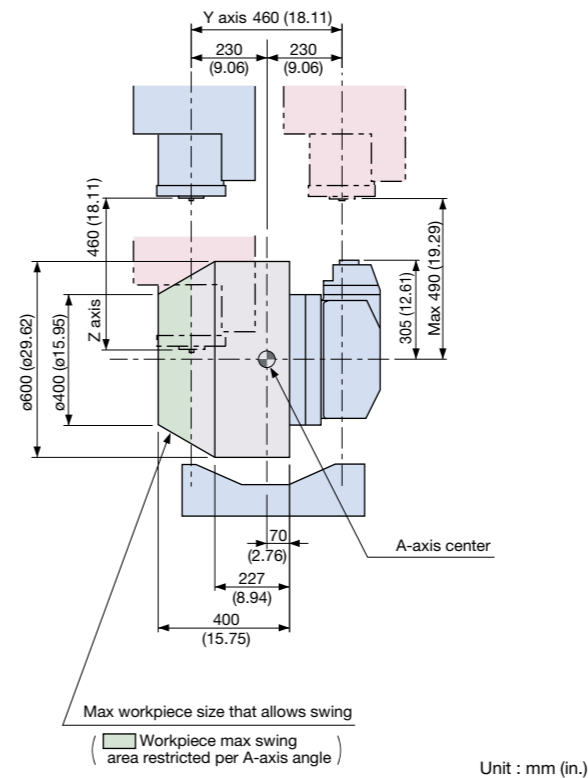
■ Maximum tool dimensions

● **Maximum tool size (adjacent tools)**
Maximum tool dimension that can be used alongside the magazine.
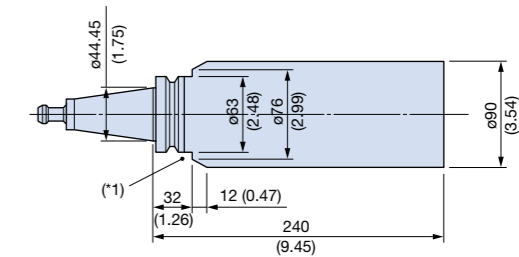
● **Max single tool size**
Maximum tool size that can be used when there are no adjacent tools on either side in the ATC magazine
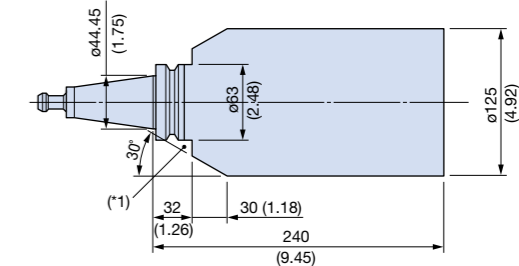
*1. With commercially available milling chucks, interference between the ATC arm and milling outer diameter may occur. Always be sure to check the dimensions in the catalog or other data sources from the tool manufacturer before use.

● **ATC maximum tool mass moment**
Mass including shank may be up to 78.4 N (8 kg), and the center of gravity position at that time up to 100 mm from gauge line.

78.4 N (8 kg) (17.6 lb) (57.65 ft-lbf)

Unit : mm (in.)
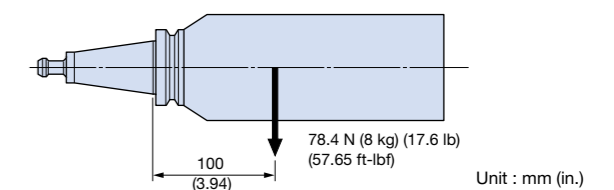
■ Optional specifications / accessories

Item	Remarks	Item	Remarks
Optional spindle speeds		Mist collector	
Wide-range spindle 50 to 15,000 min⁻¹ *	22/18.5 kW (30/25 hp) [10 min/cont]*1	Semi-dry machining	
High-speed spindle 50 to 20,000 min⁻¹ *	30/22 kW (40/30 hp) [10 min/cont]*2	Shower coolant	
High-speed spindle 50 to 25,000 min⁻¹ *	15/11 kW (20/15 hp) [10 min/cont]*2	Workpiece washing gun	
High-speed spindle 35,000 min⁻¹	15 kW (20 hp) [cont], HSK-F63	In-machine chip conveyor (coil) *	Table left/right
Dual contact spindle *	HSK, BIG-PLUS®, Super BT	Lift-up chip conveyor *	With reference to recommended chip discharge on p. 10, right side discharge (rear discharge also possible)
Special ATC capacities	* 32-tool, 48-tool (chain system)		
	64, 98, 132, 166, 200, 234, 268-tool		
	(matrix system)	Chip bucket for above *	
Special pull studs *	MAS 1 · JIS · CAT · DIN	Dust collector	
Attachment preps	Accelerator attachment	Tool breakage detection/Auto tool length compensation	Touch sensor (Metrol)
	Anglehead attachment		
	Oil hole supply	Auto zero offset/Auto gauging	Touch probe (Renishaw)
AbsoScale	X-Y-Z	5-Axis Auto Tuning System	Gauging compensation of geometric error
Die/mold & fine-feed specs	Rapid traverse X-Y-Z: 20 m/min		
Thru-spindle coolant	** Specify 1.5 MPa or 7.0 MPa	Chemical anchor specs	
	25,000 min⁻¹ specs for HSK-A63 only	Hydraulic fixture preps*3	Hydraulic: 2 tools, air: 2 tools
	35,000 min⁻¹ specs for HSK-F63 only	Work lamp	LED Left side mount
APC		TAS-S	Thermo Active Stabilizer–Spindle
Chip air blower (adapter)		TAS-C	Thermo Active Stabilizer–Construction
Oil mist coolant			

* Corresponding standard specifications are deleted.   ** Okuma pull studs required. (End-face grinding, O-ring, and through-hole diameter differ from those of commercial pull studs.)
*1. Spindle taper (7/24 No. 40) accepts (BT40, BIG-PLUS®, SuperBT, CAT 40, DIN 40) or HSK-A63.   *2. Spindle taper accepts BIG-PLUS®, SuperBT or HSK-A63.
*3. Cannot accommodate auto pallet changer

■ High-speed spindle (Optional)

Die/mold and aluminum applications
● Speed . . . . 20,000 min⁻¹
● Max output . . . 30/22 kW (10 min/cont)
● Max torque . . . 57/42 N-m (10 min/cont)
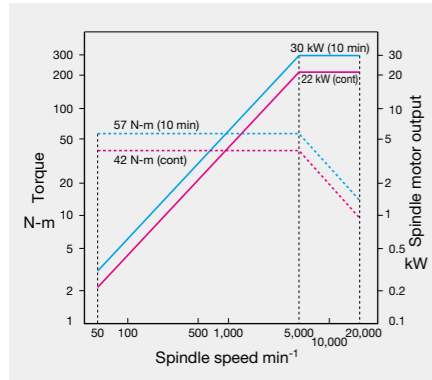
Die/mold and small precision parts
● Speed . . . . 25,000 min⁻¹
● Max output . . . 15/11 kW (10 min/cont)
● Max torque . . . 29.1/19.9 N-m (10 min/cont)
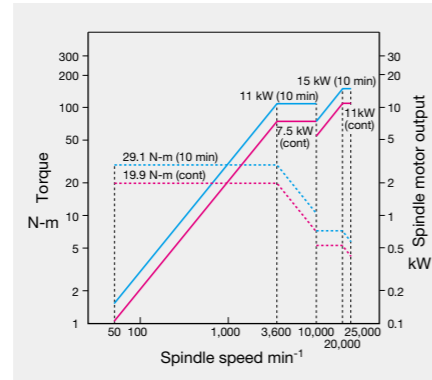
● Speed . . . . 35,000 min⁻¹
● Max output . . . 15 kW (cont)
● Max torque . . . 4 N-m
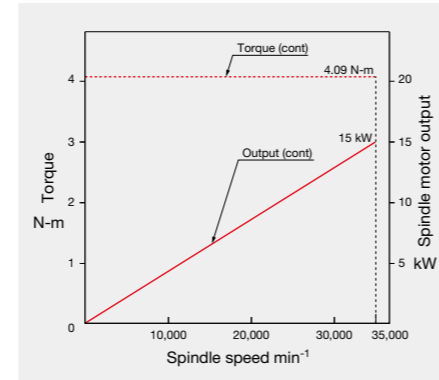
■ Major options

● Shower coolant/ Coolant nozzle

● Tool breakage detection/ Auto tool length compensation

● Auto zero offset/Auto gauging (optical transmission)

Receiver (touch probe signals transmitted and received)

Touch probe

■ In-machine chip discharge (coil type: Optional)

Table
Coil type chip conveyor
Chip pan
Coolant tank
Bed
(Machine front)
(Machine rear)
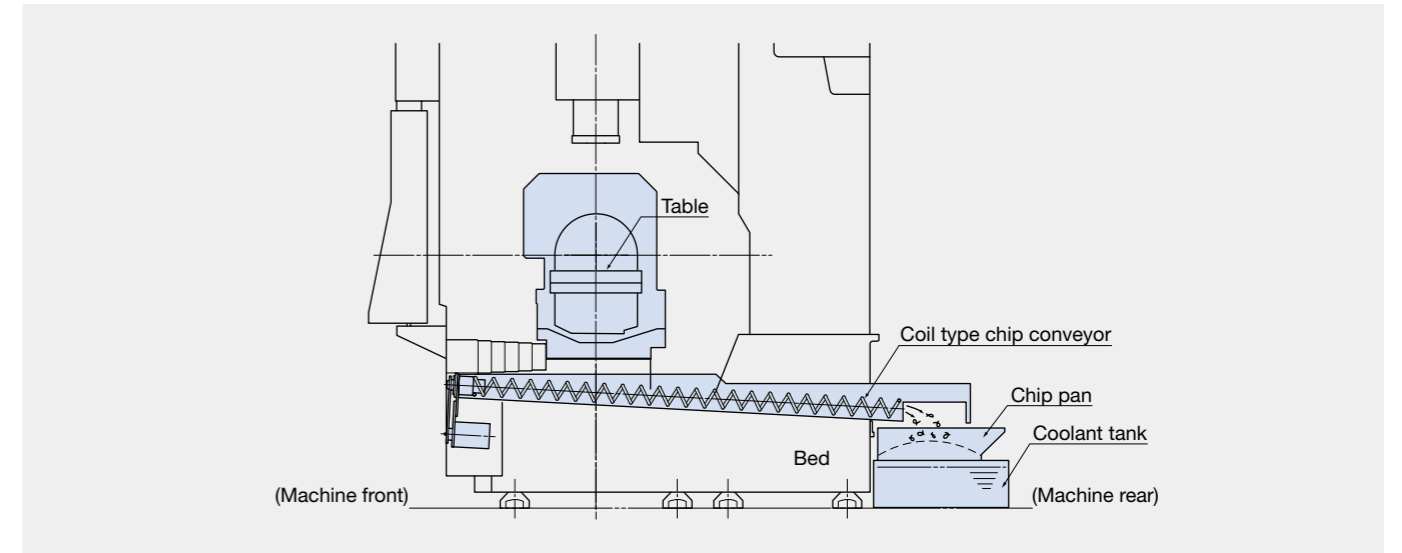
■ Recommended Chip Conveyors
(Please contact an Okuma sales representative for details.)

○: Recommended
△: Recommended with conditions

Workpiece material		Steel	FC	Aluminum / Nonferrous	Mixed (general use)
Chip shape					
In-machine	Screw (Standard)	—	○ (Wet)	○	—
	Coil (Optional)	○	○ (Dry·Wet)	—	○
Off-machine (Optional)	Hinge	○	—	—	△ (*4)
	Scraper	—	○ (Dry)	—	—
	Scraper (with drum filter)	—	○ (Wet) with magnet	△ (*3)	—
	Hinge + scraper (with drum filter)	△ (*1)	△ (Wet) (*2)	○	○

*1. When there are many fine chips   *2. When chips are longer than 100 mm   *3. When chips are shorter than 100 mm   *4. When there are few fine chips
Note: Use of oil-based coolant may cause fires; fire prevention measures are necessary.

■ Off-machine lift-up chip conveyors

Name	Hinge	Scraper	Scraper (with drum filter)	Hinge + scraper (with drum filter)
Shape				

MU-400VII
Dimensional and Installation Drawings

Dimensional and installation drawing labels:

- 20-tool ATC
- 32-tool ATC (Optional)
- Spindlehead cooler
- Spindle center
- Signal tower
- Spindle tool manual change button (In machine)
- ATC magazine door
- ATC operation panel
- X travel 762
- Lift-up chip conveyor (Optional)
- Y travel 460
- Op panel
- 381 Move / 381 Move
- 700 *827 / 140 *313
- Z travel 460
- 560
- 100 / 61 / 33
- ø400 Table dia
- 230 Move / 485 / 230 Move
- 750
- 980 / 700 *1,000 / 70
- Chip bucket (Optional)
- 2,946 (115.98)
- 2,237 (88.07) [15,000/20,000/25,000/35,000 min⁻¹ spindle]
- 2,137 (84.13) [8,000 min⁻¹ spindle]
- 1,400 (NC control box height)
- 2,202 (86.69) / 2,800 (110.24)
- 146 (5.75)
- Air unit
- Coolant tank
- Tank removal
- FL
- Hydraulic unit
- Pulse handle
- 1,800 (70.87) / 708 (27.87)
- 2,508 (98.74) / 302 (11.89)
- 2,810 (110.63)
- 380 / 420 / 440 (17.32) / 240 (9.45) / 600 (23.62)
- 460 (18.11) / 120 (4.72) / 920 (36.22) / 800 (31.5)(door open) / *340 (13.39) / *800 (31.5)
- 3,580 (140.94) *3,880 (152.76)

Plan view labels:

- 500 (17.69) (Margin)
- 3,580 (140.94) *3,880 (152.76)
- 500 (17.69) (Margin)
- 580 (22.83) / 550 (21.65) / 1,500 (Bed bottom width)
- 350 (13.78) / 600 (23.62)
- 380 / 200 / 850 / 1,200 / 450 (17.72) / *800 (31.50)
- 500 (17.69) (Margin)
- 100
- Tank removal
- 182 / 117
- 1,330 (52.36)
- NC cabinet
- 100
- 600 (23.62)
- 551
- 610
- 59
- Air inlet Height 748 Rc3/8 female
  Required capacity 500 N/min (ANR)
  0.5 MPa or more
  Supplied air humidity within +5℃
  of room temperature
- Lift-up chip conveyor (Optional)
- 1,190 / 1,640 (Bed bottom length)
- 2,810 (110.63) / 3,580 (140.94)
- 354
- Spindle coolant unit (Optional)
- Bed bottom line
- 32-tool ATC (Optional)
- Hydraulic unit
- 910 / 450 / 240
- Chip bucket (Optional)
- 20-tool ATC
- 170 (6.69)
- 500 (17.69) (Margin)
- 430 / 430 / 430 (16.96)
- 870 (34.25) / 860 (33.86) (Bed bottom width)
- Spindle center
- 2,160 (85.04) / 76 (2.99)
- 2,236 (88.03)

Power inlet
25kVA □30 mm² 4C (8,000 min⁻¹ spindle)
40kVA □50 mm² 4C (15,000 min⁻¹ spindle)*
44kVA □60 mm² 4C (20,000 min⁻¹ spindle)*
30kVA □38 mm² 4C (25,000 min⁻¹ spindle)*
35kVA □38 mm² 4C (35,000 min⁻¹ spindle)*
Height from floor 750mm or 2,250mm
* Options

· Lift-up chip conveyor .... Height: 750 mm
　　　　　　　　　　 * Height: 1,000 mm
· Thru-spindle coolant .... 1.5 MPa

Unit: mm (in.)

Gauging and compensation of geometric error
5-Axis Auto Tuning System (Optional)

■ Higher accuracies in 5-axis machining
5-axis machining accuracy is greatly affected by misalignment and other "geometric errors" on the rotary axis. The 5-Axis Auto Tuning System measures geometric error using a touch probe and datum sphere, and performs compensation using measurement results to tune the movement accuracy on 5-axis machines. In this way 5-axis machining accuracy on a higher level is achieved.

■ Quick and easy tuning by anyone
Previously, manual measurements of the indexing center were bothersome and time-consuming, but with the 5-Axis Auto Tuning System the measurements are made autom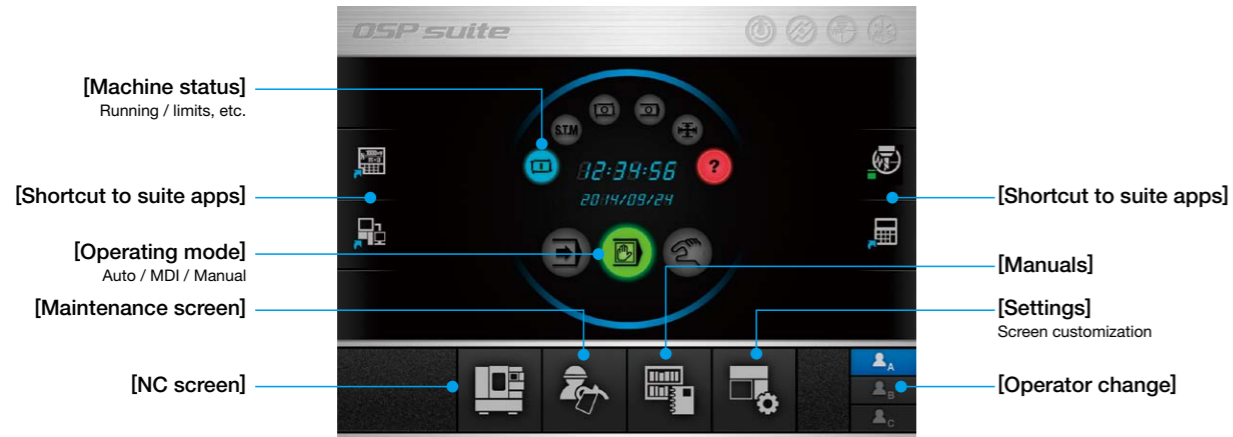atically by the machine. Measurements can therefore be done with stable accuracy in a short time by anyone. (Up to 11 geometric errors turnd automatically.) In addition, the results of tuning are applied regardless of whether the operation in auto, manual, or MDI and whether Tool Center Point Control is on or off. Setup and machining can therefore be done with the same operations as before.

Work effciency / Time reduction / Accuracy improvement / Accuracy
General auto comp / Manual / 4 types / With 5-Axis Auto Turning System / 11 types

Optimized Servo Control
SERVONAVI

Achieves long term accuracy and surface quality

| SERVONAVI AI (Automatic Identification)
Optimum settings automatically identified

On table travel type machining centers, the table feed acceleration with the previous system was the same regardless of weight, such as workpieces and fixtures loaded on the table.
　Work Weight Auto Setting estimates the weight of the workpiece and fixture on the table and automatically sets servo parameters, including acceleration, to the optimum values. Cycle times are shortened with no changes to machining accuracy.

Tool Tilt Compensation (Optional)

(Included in Tool Center Point Contor II)

The tool angle on a workpiece (tool tilt) in 5-axis machining will change on a waving surface. CAM processing errors will cause the tool to stagger with unnecessary accel/decel and reverse angles during axis feed. Simul 5-Axis TTC will keep feedrates steady with a smooth sequence of commands to automatically correct tool tilt angles–resulting in shorter cycle times and smoother surface finishes

Collision prevention
Collision Avoidance System (Optional)

■ World's first "Collision-Free Machine"
CAS prevents collisions in automatic or manual mode, providing risk-free protection for the machine and great confidence for the operator.

Cutting condition search for milling
Machining Navi M-*i*, M-*g*II+ (Optional)

■ Search for optimum cutting conditions
● Machining Navi M-*i* changes automatically to optimum spindle speed
● Machining Navi M-*g*II+ displays several spindle speed possibilities

Machining Navi (OSP) provides the answer!

| SERVONAVI SF (Surface Fine-tuning)
Enables longer machine use

When decreased machining accuracy is recognized to have occurred with many years of use, SERVONAVI restores machined surface accuracy. It can improve crease marks in machined surfaces that occur where the feed axis reverses with worn ball-screws or guideways.
　Even noise or vibration that occurs when there are large changes in the machine state can be immediately eliminated.

Staggered tool angles
With TTC
No change in tool tilt　　Gradual change in tool tilt

The Next-Generation Intelligent CNC **OSP suite OSP-P300M**

It is a suite of premium applications to increase the efficiency of each manufacturing process by increasing status visibility and digitizing shop floor production instructions, setup information, machining and utilization, machine maintenance information and more. Intelligent, fast machining and efficient "monozukuri" (craftsmanship-based manufacturing) achieved with a control interface that can be operated on a new dimension.
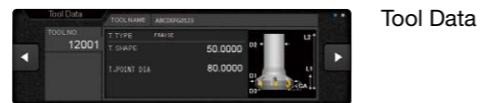
[Machine status]
Running / limits, etc.

[Shortcut to suite apps]

[Operating mode]
Auto / MDI / Manual

[Maintenance screen]

[NC screen]

[Shortcut to suite apps]

[Manuals]

[Settings]
Screen customization

[Operator change]

■ suite apps

In addition to Okuma's Intelligent Technology, a rich array of applications is available for visualization and digitization of information needed on shop floors to support high-level "monozukuri".

Actual Load

MacMan Monitor

Tool Data

Maintenance Monitor that displays daily and regular check items

■ suite operation

A highly reliable touch panel suited to shop floors is used. Suite apps can be started by touching a function key icon on the right side of the screen. They are then displayed in a pop-up window. The icon layout is customizable. Suite apps can be accessed with one touch according to the desired phase of operation.

■ Standard Specifications

Basic Specs	Control	X, Y, Z, A, C simultaneous 5-axis, spindle control (1 axis)
	Position feedback	OSP full range absolute position feedback (zero point return not required)
	Coordinate functions	Machine coordinate system (1 set), work coordinate system (20 sets)
	Min / Max inputs	8-digit decimal, ±99999.999 to 0.001 mm (3937.0078 to 0.0001 in.), 0.001°
		Decimals: 1 μm, 10 μm, 1 mm (0.0001,1 in.) (1°, 0.01°, 0.001°)
	Feed	Override: 0 to 200%
	Spindle control	Direct spindle speed commands override 30 to 300%, multi-point indexing
	Tool compensation	No. of registered tools: Max 999 sets, tool length/radius compensation: 3 sets per tool
	Display	15-inch color LCD + touch panel operations
	Self-diagnostics	Automatic diagnostics and display of program, operation, machine, and NC system faults
Programming	Program capacity	Program storage capacity: 4 GB; operation backup capacity: 2 MB
	Program operations	Program management, editing, multitasking, scheduled program, fixed cycle, G-/M-code macros, arithmetic, logic statements, math functions, variables, branch commands, coordinate calculate, area calculate, coordinate convert, programming help, fixture offset II
Operations	suite apps	Applications to graphically visualize and digitize information needed on the shop floor
	suite operation	Highly reliable touch panel suited to shop floors. One-touch access to suite apps.
	Easy Operation	"Single-mode operation" to complete a series of operations , Advanced operation panel/graphics facilitate smooth machine control
	Machine operations	MDI, manual (rapid traverse, manual cutting feed, pulse handle), load meter, operation help, alarm help, sequence return, manual interrupt/auto return, pulse handle overlap, parameter I/O, PLC monitor, alignment compensation
	MacMan	Machining management: machining results, machine utilization, fault data compile & report, external output
Communications / Networking		USB (2 ports), Ethernet, RS-232-C interface (1 channel)
High speed/accuracy specs		Hi-Cut Pro, pitch error compensation, Hi-G Control, SᴇʀᴠᴏNᴀᴠɪ, Machining Time Shortening Function
Energy-saving	ECO suite	ECO Idling Stop*1, ECO Power Monitor*2

*1. Spindle cooler Idling Stop is used on TAS-S machines.
*2. The power display shows estimated values. When precise electrical values are needed, select the on-machine wattmeter option.

■ Optional Specifications

Item	Kit Specs*1	NML E	NML D	3D E	3D D	AOT E	AOT D
Interactive functions							
Advanced One-Touch IGF-M (Real 3D simulation)						●	●
Interactive MAP (I-MAP)				●	●		
Programming							
Auto scheduled program update		●	●	●	●	●	●
Common variables	1,000 pts						
(Std: 200 pts)	2,000 pts						
Program branch; 2 sets							
Program notes (MSG)		●		●		●	
Coordinate system	100 sets	●		●		●	
select	200 sets	●		●		●	
(Std: 20 sets)	400 sets	●		●		●	
Helical cutting (within 360°)		●	●	●	●	●	●
3D circular interpolation							
Synchronized Tapping II		●	●	●	●	●	●
Arbitrary angle chamfering		●	●	●	●	●	●
Cylindrical side facing							
Slope machining							
Inverse time feed							
Tool grooving (flat-tool free-shaped grooving)							
Tool center point control II (TCP-II) (w/ tool tilt comp)							
Tool tilt command							
Tool max rotational speed setting							
F1-digit feed	4 sets, 8 sets, parameter						
Programmable travel limits (G22, G23)		●	●	●	●	●	●
Skip (G31)							
Axis naming (G14)							
Additional G/M code macros							
3D tool compensation							
Tool wear compensation		●		●		●	
Drawing conversion	Programmable mirror image (G62)	●		●		●	
	Enlarge/reduce (G50, G51)	●		●		●	
User task 2	I/O variables (16 each)						
Tape conversion★							
Monitoring							
Real 3D simulation				●	●	●	●
Simple load monitor	Spindle overload monitor	●	●	●	●	●	●
NC operation monitor	Hour meter, work counter	●	●	●	●	●	●
Hour meters	Power, spindle, NC, cutting						
Operation end buzzer	M02, M30, and END commands						
Work counter	With M02 and M30 commands						
MOP-TOOL	Adaptive control, overload monitor						
Tool life management	Hour meter, No. of workpieces	●	●	●	●	●	●
Gauging							
Auto gauging	Touch probe (G31)	Included in machine specs					
Auto zero offset	Includes auto gauging	Included in machine specs					
Tool breakage detection	(touch sensor) (G31)	Included in machine specs					
	Includes auto tool offset						
Gauging data printout	File output						
Manual gauging (w/o sensor)		●	●	●	●	●	●
Interactive gauging (touch sensor, touch probe required)							

*1. NML: Normal, 3D: Real 3D simulation, E: Economy, D: Deluxe, AOT: Advanced One-Touch IGF-M
*2. ★Technical consultation needed for specifications

Item	Kit Specs*1	NML E	NML D	3D E	3D D	AOT E	AOT D
External I/O communication							
Additional RS-232-C channel (Std specs include 1 channel)							
DNC-T3							
DNC-B (232C-Ethernet transducer used on OSP side)							
DNC-DT							
DNC-C/Ethernet							
Additional USB (Additional 2 ports, Std: 2 ports)							
Automation / untended operation							
Auto power shut-off	M02 and END alarms, work preps done	●	●	●	●	●	●
Warm-up (calendar timer)							
External program select	Button, rotary switch, digital switch, BCD (2-digit, 4-digit)	●	●	●	●	●	●
Cycle time reduction (Ignores certain commands)							
Pallet pool control (PPC) (Required for multi-pallet APC)							
Robot, loader I/F							
High-speed, high-precision							
AbsoScale detection	X-, Y-, Z-axis						
5-Axis Auto Tuning System	Standard, high spec						
Straightness compensation							
0.1 μm control (linear axis commands)							
Super-NURBS							
Simultaneous 5-axis kit	Tool center point control II (w/tool tilt comp)						
	Tool center point control manual feed						
	Table origin coord manual feed						
	Super-NURBS (5-axis spec)						
	Slope machining						
	Inverse time feed						
	Tool tilt command						
	DNC-DT						
TAS-S (Thermo Active Stabilizer-Spindle)							
TAS-C (Thermo Active Stabilizer-Construction)							
ECO suite (energy saving functions)							
ECO Operation							
ECO Power Monitor	Wattmeter						
Energy-saving hydraulic unit	Inverter						
	ECO Hydraulics						
Other							
Control cabinet lamp (inside)							
Circuit breaker							
Sequence operation	Sequence stop	●	●	●	●	●	●
Upgraded sequence restart	Mid-block return		●		●		●
Tool point center manual feed							
Table reference coord manual feed							
Pulse handle	2 pcs, 3 pcs (Std: 1 pc)						
External M signals	4, 8 signals						
Collision Avoidance System (CAS)							
Machining Navi M-*i*, M-*g*II+ (cutting condition search)							
One-Touch Spreadsheet							
Block skip; 3 sets							
Leading edge offset							
OSP-VPS (Virus Protection System)							

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