

Is your present machine good at grooving operation?

A special side cutter developed by SHIBAURA MACHINE allows efficient and accurate grooving operation, aided by the MPC-B series double column machining center.

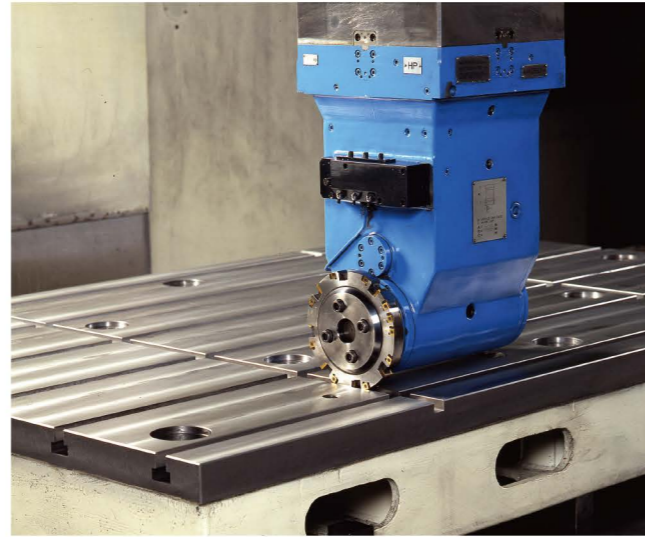
Examples of machining:
Work piece: floor plate

(1) Simultaneous finish machining of width and bottom face of 28H7 depth
15 reference slots
V=120 m/min (393.7 ft/min),
F=400 mm/min (15.7 inch/min)

(2) Finish machining only of width of 28H7 T-slots

V=120 m/min (393.7 ft/min),
F=500 mm/min (19.7 inch/min)

Material: Cast Iron (FC250)



MPC-B series

Shibaura Machine

MPC-B series

Double Column Machining Center



ISO 9001



GOTEMBA plant

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* We reserve the right to change any of specifications in this catalog without notice in order to effect improvements.

A double column machining center, meeting all the prerequisites of a production plant. Equipped with TOSNUC simplified MDI and NC operations.

Meeting all the prerequisites of a production plant. Equipped with TOSNUC simplified MDI and NC operations.



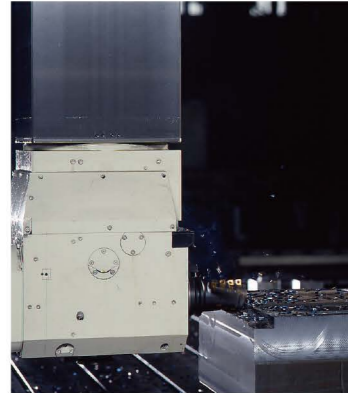
A highly productive, yet versatile, designed and engineered machine.
Double Column Machining Center

MPC-3680B

This photo shows the MPC-3680B double column machining center Equipped with such as ATC, AAC(4 stockers).

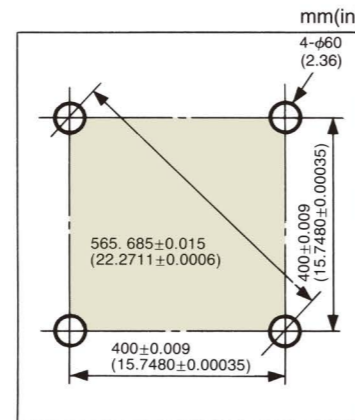
Only one double column machine needed to comprise a complete factory. The outstanding capabilities contribute largely to diversified machining operations.

Heavy cutting



Horizontal spindle
 Ram extension: 900 mm (35.4")
 End mill (WIDAXM30): $\phi 80$ mm (3.1")
 Cutting speed: 120 m/min. (394 /min)
 Feedrate: 360 mm/min. (14.2"/min)
 Width of cut: 30 mm (1.2")
 Depth of cut: 50 mm (1.97")
 Workpiece material: SS400P
 Result: excellent in any direction

High accuracy

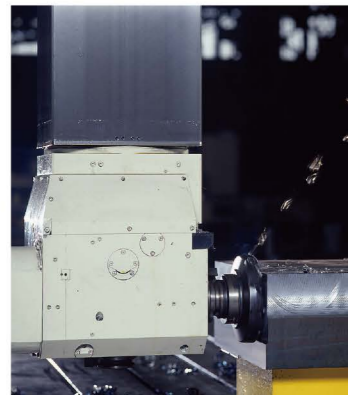


Example of actual result in accuracy test before shipment

Each machine satisfies these guaranteed values before shipment.

Remarkably high machining accuracy.

High stability



Horizontal spindle
 Ram extension: 900 mm (35.4")
 Milling cutter (TGD-5408R): $\phi 200$ mm (10 flutes) (7.9")
 Cutting speed: 150 m/min. (492 /min)
 Feedrate: 800 mm/min. (31.5")
 Width of cut: 170 mm (6.7")
 Depth of cut: 6 mm (0.236")
 Machining in any direction
 Workpiece material: SS400P

High productivity

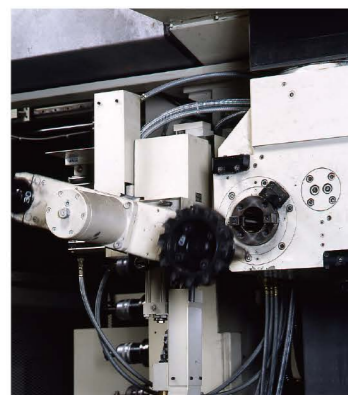
Machining Example



Complete machining in a single step-up. The lead time for the large-size component above is only two days.

- Machining Time: 17.5 hours (includes milling, drilling, tapping and spot-facing on 5-sides of workpiece)
- Straightness: 0.015 per 4000 mm (0.0006 per 157.5 inch)
- Parallelism: 0.01 per 4000 mm (0.0004 inch/157.5 inch)

Quick movements



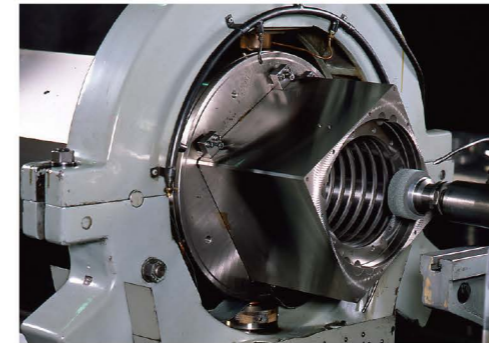
Speedy machining by quick movements
 ATC
 Vertical spindle tool-to-tool: 16 sec.
 Horizontal spindle tool-to-tool: 14 sec.
 AAI
 180° swivel: 9 sec.
 X,Y rapid traverse rate: 20 m/min. (66' /min)

Construction of main components assure quality performance.

Design and manufacture of main components based on SHIBAURA MACHINE's advanced technologies.

Ram

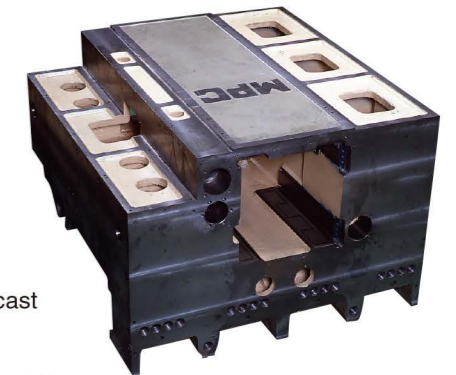
- The thick, 380 mm-square (14.96"-square), ram is hardened and ground with high accuracy on straightness, squareness and parallelism.



Material: High-grade cast iron

Saddle

- The saddle, a basic component supporting the ram, is of a mono-block type construction with a square through hole to enhance its rigidity and accuracy.



Material: High-grade cast iron

Crossrail

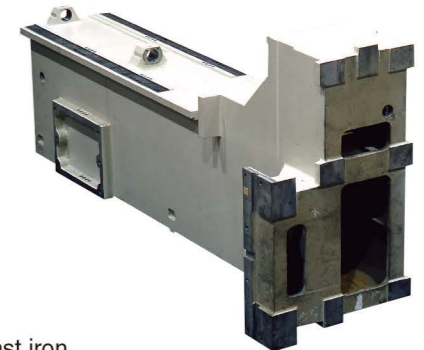
- The crossrail has a large sectional dimension and is one of the decisive factors for the double column machine.



Material: High-grade cast iron

Columns

- Two highly rigid columns support the crossrail and are both linked together solidly by a brace.



Material: High-grade cast iron

Bed

- A highly rigid bed assures stabilized accuracy during life of the machine.



Material: High-grade cast iron

The MPC-B Series double column machining center allows automatic machining of the top and all side faces of a cubic work

ing center allows automatic machining of piece in a single setup.

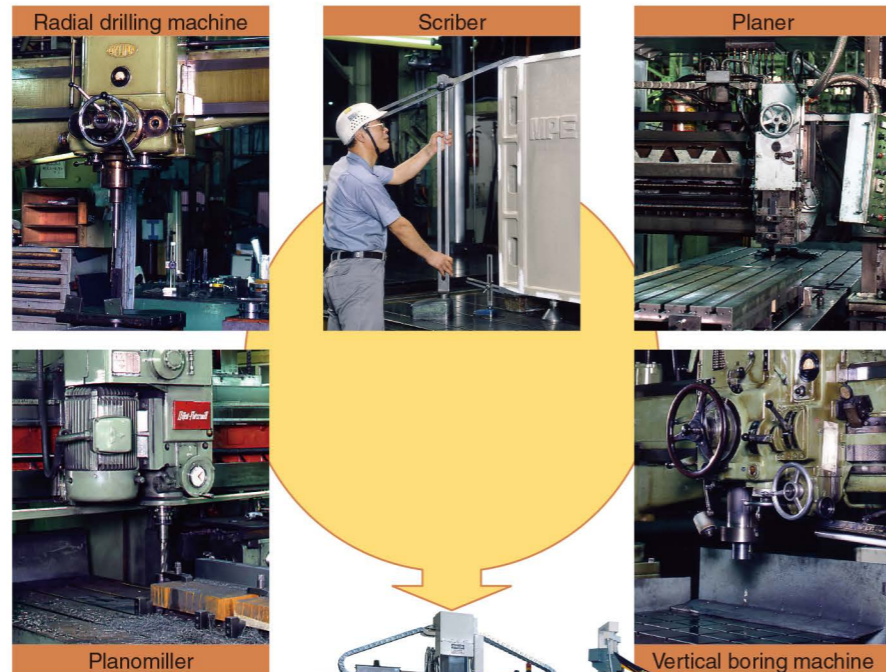
1 Improvement on productivity

Reduction in production cost. The production efficiency can be increased dramatically by fully utilizing the machine characteristics. As a result, the initial cost of the machine can be depreciated easily resulting in reduced production costs.



2 Intensified process

Advantage of 5 machines in 1. One double column machining center constitutes a complete factory compared to the time and cost consuming conventional-type system in which workpieces must be transferred to different machines for various work processes.



3 Reduction in through put time

Our MPC-B series machines eliminates unnecessary and expensive processes and enhances the production efficiency by its superior machine characteristics and a wide variety of peripheral equipment.

4 Sharp reduction in workpiece transfer and setup time

The setup time can be reduced by 80%. The scope of machining applications can be increased five times and the number of setups can be reduced to one, compared to conventional type machines. Also, angle plates and other special-type fixtures are not required. **Crane use also reduced by 80%.** As the number of setups is few, workpiece transfer is rarely performed.

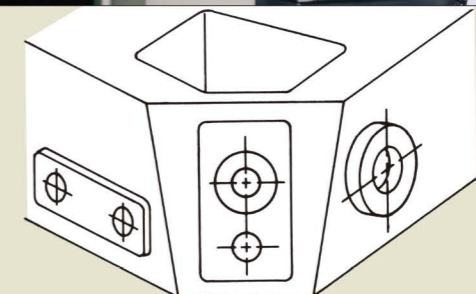


5 Decrease in non-machining time due to a variety of automated functions

Quality machining assured. A broad range of high speed operations with both high rigidity and accuracy is possible. **Making use of various functions, any required operation can be executed.** Such functions as AAI, ATC, AAC and AWC which are necessary for unmanned operation are available.



6 The CNC unit, TOSNUC 999 has available such unique functions as the three-dimensional coordinate conversion for 5-face machining



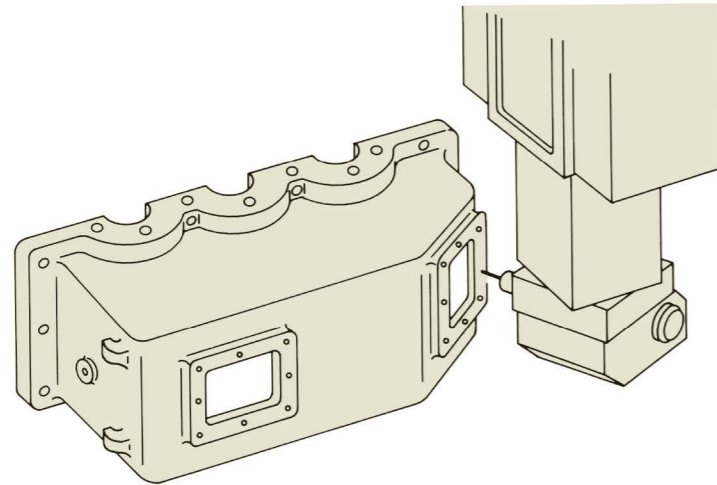
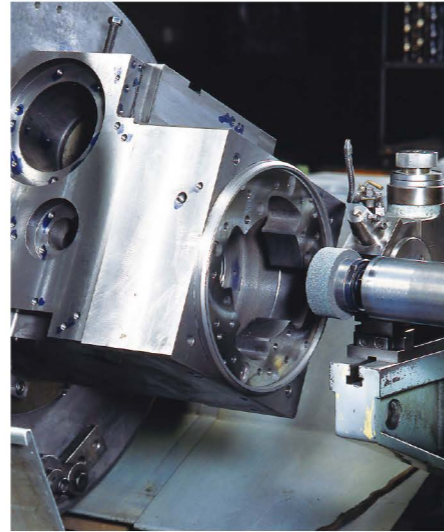
MPC-B series features high productivity and quality machining in less time and with less labor

The high-performance 5-face cutter head is equipped as standard.

- Designed for easy access to the workpiece.
- Allows heavy-duty machining operations.
- Machining on an inclined plane is easily programmable using the optional 5° incremental indexing and the 3° dimensional coordinate conversion function.

The 5-face Cutter Head

The 5-face cutter head plays a key role in determining quality of the machine by combining its rigid construction with features that cannot be duplicated.



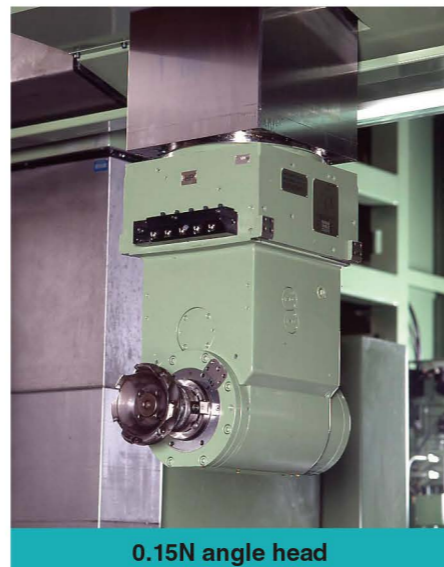
Automatic changer for special-purpose attachments (Option)



Snout 190



45° angle head



0.15N angle head

Quick movements

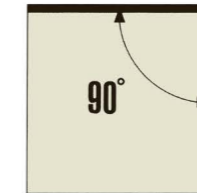
- The working time can be reduced remarkably by shortening the following auxiliary times.
 - ① Positioning of X, Y, Z and W axes
 - ② Tool change (ATC)
 - ③ Indexing of 5-face cutter head (AAI)
 - ④ Set-up of workpiece
- Preloaded rolling guides employed for the X, Y and W axes, assures high accuracy and high feedrate.

X and Y Rapid traverse rate of:	20 m/min. (65.6 ft/min)
Z Rapid traverse rate of:	10 m/min. (32.8 ft/min)
ATC Time (Tool-to-tool)	
Vertical spindle:	16 sec.
Horizontal spindle:	14 sec.
AAI Swivel by 180°:	9 sec.
Spindle speed:	5-3000 min. ⁻¹



Machining with accuracy

- In addition to positioning accuracy, dimensional, surface finish and profile accuracy are prerequisites for quality machining.

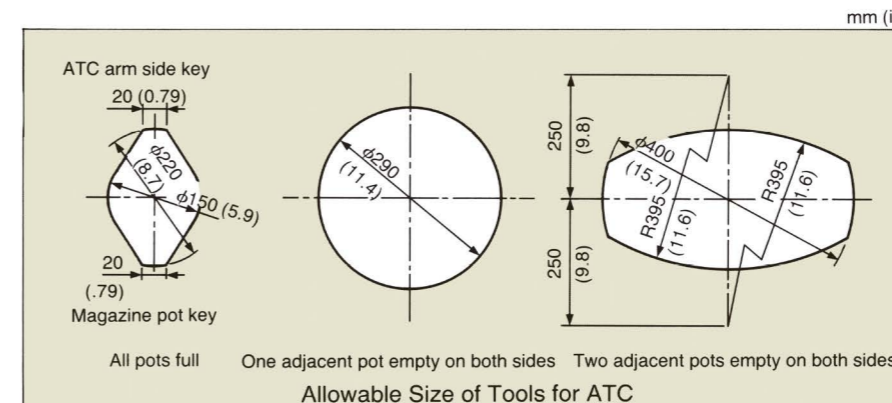


	mm(in)	
	Tolerance	Actual result
Squareness on cubic box	0.015/300 (0.0006/11.8)	0.008/300 (0.00031/11.8)
Squareness of Y axis movement and Z axis movement	0.015/900 (0.0006/35.4)	0.011/900 (0.00043/35.4)

Easy and convenient operation

- An easy-to-operate pendant makes both automatic and manual operations easy.
- Use of ATC for large-size tools is possible, thus expanding the scope of unmanned operation and liberating the operator from conventional heavy-load operations.

Maximum tool length: 600 mm (23.6 inch)
 Maximum tool mass: 25 kg (55 lbs)
 Maximum allowable moment around gage plane:
 52.9 N · m {5.4 kgf · m} (39 ft-lbs)

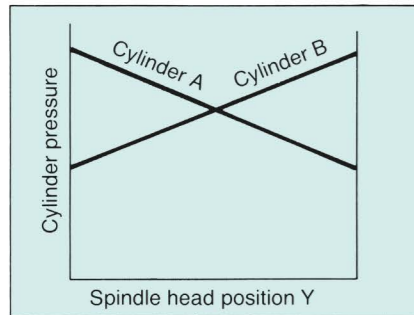
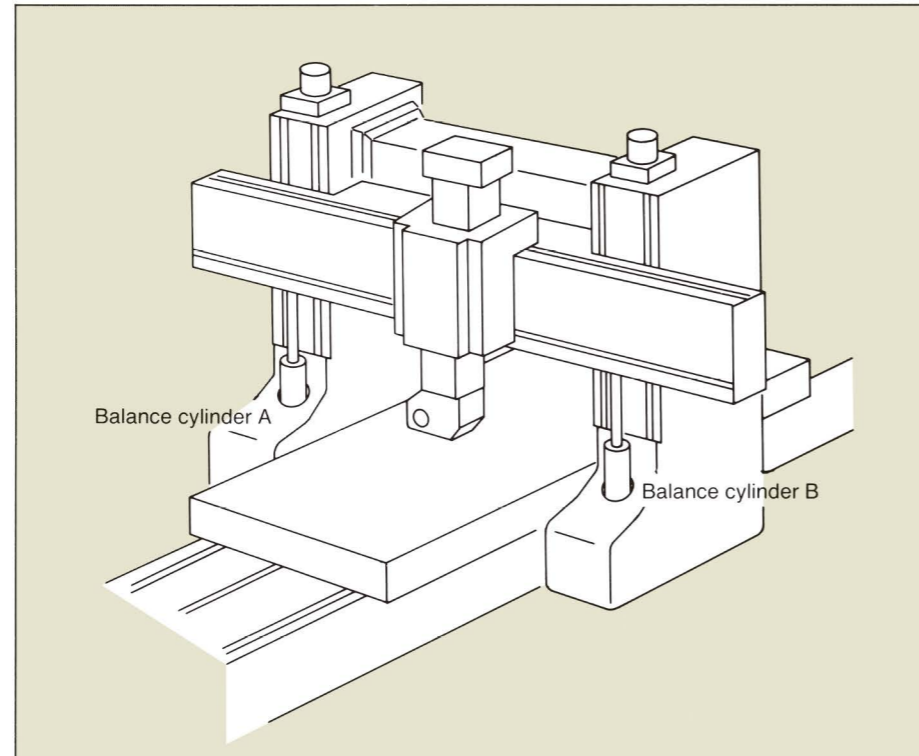


MPC-B series features: high quality and high performance

Rigid but simple.

Refreshing in appearance, strongly built and reliable

- The W axis (vertical movement of crossrail) is synchronously controlled by twin motors with independent backlash and pitch error compensation for the right and left ball screws.
- Linear scale feedback can be set separately for the left and right W axis. (option)
- The crossrail is stabilized by the hydraulic servo balancing system in order to achieve straight horizontal movement of spindle head in Y direction.



- Each balance cylinder is compensated at the foundation so that the bending moment caused by balance force is not exerted on the column.

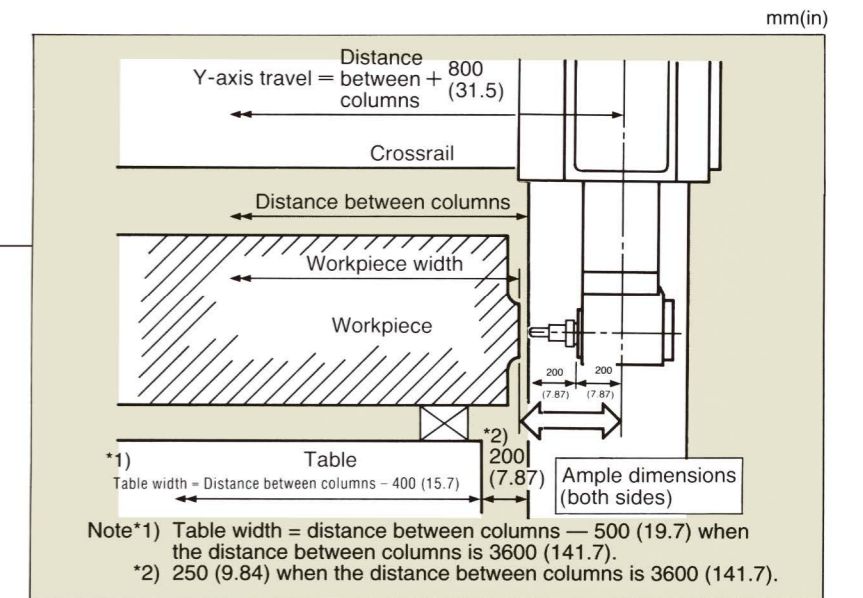
Advanced design of cutter head

- Thick and large ram bolstered by a long support
- Closed type saddle (Turcite Z axis slideways.)
- Fully rigid type crossrail



Designed and engineered for any size workpiece.

- Very useful for machining of multiple workpieces on a single table.
- A wide bridge clearance for the machining of large-sized workpieces.



Easy maintenance

- The Z axis guideways employ an oil change type lubrication system, and the X, Y and W axes rolling guides are lubricated only once every six months.

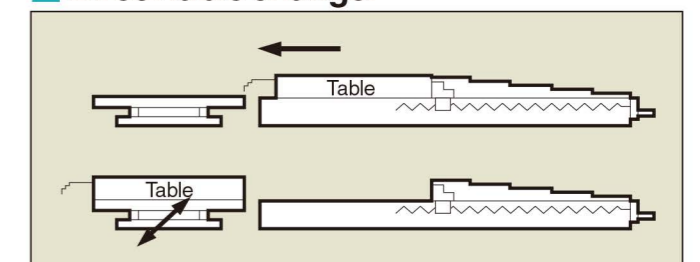
Direct table changer system (DTC) (option)

- For the conventional APC (pallet changer), pallet loaded in layers on the pallet base were transferred. This MPC-B series machine allows the table to directly ride on the machine bed to increase the machine

rigidity and accuracy. Additionally, the distance from the table top to the vertical spindle nose of cutter head and overall machine height are unchanged irrespective of presence or absence of AWC.



Direct table changer



Highly efficient CNC system TOSNUC 999 makes the machine reach its full capacity.

In machining, various capabilities of the machine are required at all times.

Not to mention the machining ability of the machine, the man-machine interface which controls the machine as the operator desires is also important.

TOSNUC999 is the easy-to-operate CNC system developed for high speed and high precision machining based on the unique NC technique being integrated both mechanically and electrically and accumulated for years.

TOSNUC999 has various functions supportive of operators.

Easily viewable display screen designed by considering from operator's point of view.

Simple and easy-to-use feed rate and spindle operation dials

User media slots (compatible with Memory (USB-Type) and CF card)

Manual pulse generator in consideration of safety and operability

Manual operation buttons capable of operating peripheral equipment such as conveyors or coolant units efficiently.

The machine operation panel is mounted on the balance type pendant operation box with a high motion degree of freedom.

The compact operation box enhances operation efficiency.



Outstanding operability derived from our experience

Display and status change-over independent keys

A display shown while machining or the contents of editing operation can be selected instantly by means of the independent keys without using the software menu.



Pop-up menu for loading and dumping data

A full-fledged multi-tasking and multi-window system allows such operation as loading, dumping, comparing, deleting, and copying of programs or other data by opening a file window from any mode or screen. For example, in automatic operation, while editing a program in a background, it is also possible to load another program into memory from the outside.



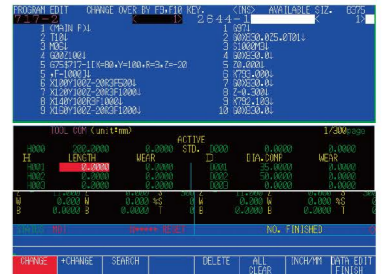
Pop-up menu

When a function key is pressed for selecting the desired function, a window containing the menu corresponding to the function will appear or pop up. Thus, any desired function can be selected without depending on a menu hierarchy or a complicated operation.



Multi-window and multi-editing

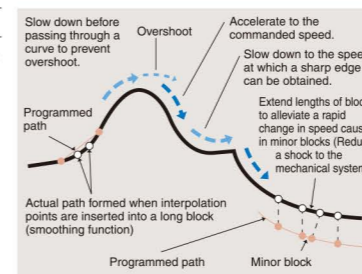
The display screen can be split in three to simultaneously display two programs and another data such as compensation values required for machining. As it is possible to load or edit each data independently on these split screens, a new program can be created easily with reference to the already created program as if operating a word processor.



Function capable of high-speed and high-accuracy machining

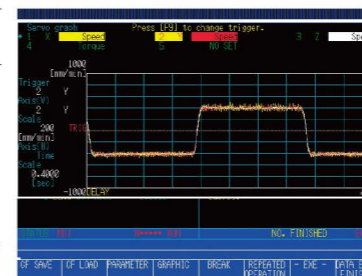
Preview control function

Generally, a contouring error decreases along with the increase of the servo gain. However, when the gain is increased, an overshoot of an axial position and vibrations caused by the increased acceleration applied to the machine adversely affect the cutting surface. To prevent these phenomena, the preview control function has been developed based on the optimal control theory thus minimizing the contouring error without increasing the gain.



Graphic function for servo adjustments

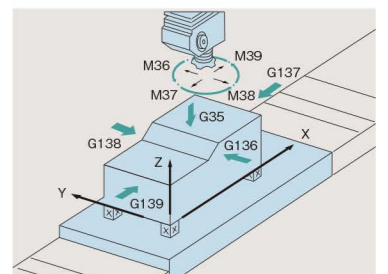
In adjusting the servo system for the machine equipped with CNC system, no conventional measurement instrument is required. Each axis speed and torque characteristics or the like can be checked using the graphic function for servo adjustments. Further, with the use of this function, load fluctuations of the spindle can also be detected, and parameters used for tool breakage detection can be set appropriately.



Programming support function

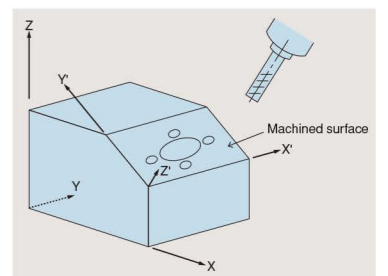
Plane conversion for 5-face machining

In machining the five faces of a box-like workpiece, an NC program on each face can be prepared based on the right-hand orthogonal coordinate system. Further, each axis address (X, Y, and Z), sign (+/-) and offset (V and H spindle) are also changed automatically based on the indexing position of the attachment in use.



Three-dimensional-coordinates conversion

Beside orthogonal five faces, programming is easy even when the attachment is inclined at any angle. For the inclined surface, various functions such as canned cycle, circular interpolation, tool length offset and cutter compensation can be also used.



Functions and optional accessories of MPC -B series

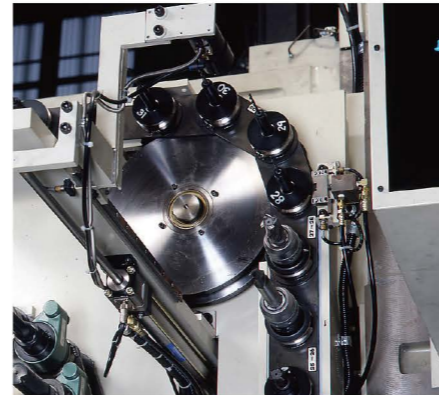
Optional accessories contribute to improving the overall efficiency of the factory.

ATC

- Automatic tool change is possible for both vertical and horizontal spindles of the 5-face cutter head.

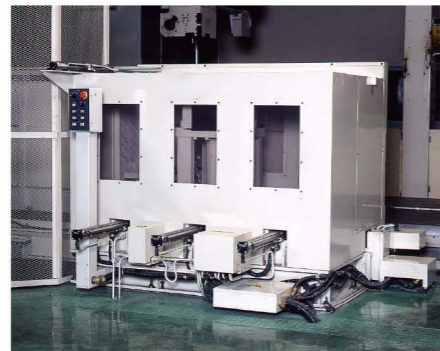


- Small diameter tool breakage detector



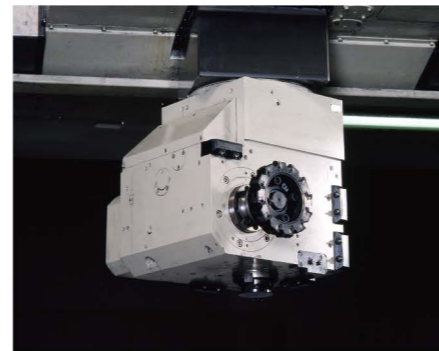
AAC

- Various attachments such as angle head and snout can be automatically mounted and dismantled to the ram.



AAI

- A spindle mounted on the 5-face cutter head or angle head is automatically indexed every 5°.



AWC (DTC)

- The next workpiece is set up during machining of the present workpiece. The table can be changed automatically.



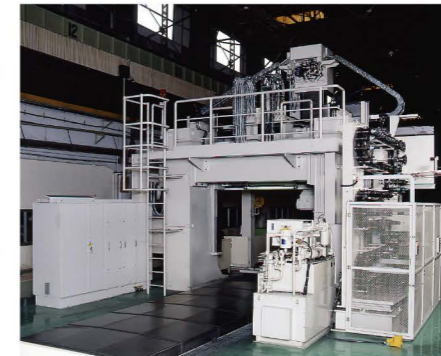
Touch probe



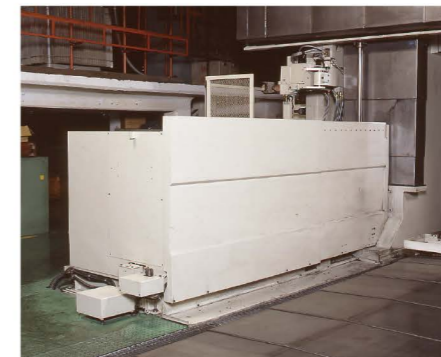
Coolant unit



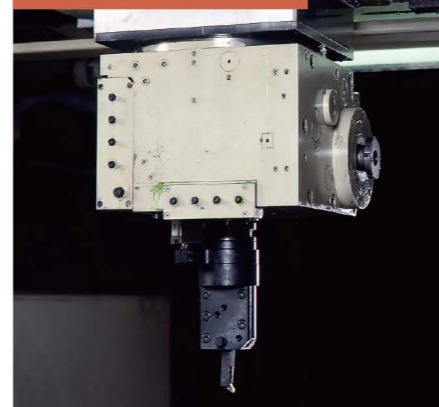
Peripheral Equipment



Splash guard cover on ATC side

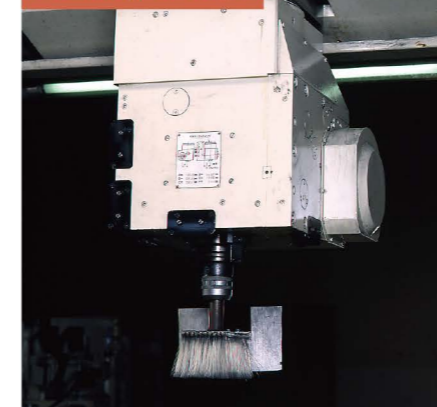


Planing holder



Auxiliary tools

Cleaning of chips



Chip cleaner to be provided by customer (For reference only)

Pneumatic tool



Pneumatic tool to be provided by customer (For reference only)

Optional specifications

(Items marked ☆ are included in the pack specification.)

- ☆ 1. Auto power OFF device
- ☆ 2. Work light
- ☆ 3. 3 colored operator call lamp
4. Automatic tool changer (ATC)
 - Tool storage capacity: Select either 60, 90, 120, 180 or 240 tools.
5. Small diameter tool (tap, drill) breakage detector
6. Retention knob: MAS P50T-2 (30°)
7. Automatic workpiece changer (AWC)
 - Direct table changing system (DTC system)
 - Maximum table loading capacity: 20000 kg (44000 lb)
 - Number of tables: 2
8. External program number search function
 - Automatic search of part program number (4-digit) and cycle start after AWC
9. Automatic attachment changer (AAC)
 - Attachment storage capacity: 3 or 5
10. Attachments and their cases
 - 0.1N angle head (AATC)
 - 0.15N angle head (AATC)
 - Snout 190 (AATC)
 - 45° angle head (manual tool change)
 - Universal head (manual tool change)
 - Other special attachments (available depending on customer's requirements)
11. 72-position (every 5°) automatic indexing for 5-face cutter head/attachment
12. Installation parts for machine and options
 - Column: Leveling blocks and clamps
 - Bed: Jack bolts and clamps
13. Chip conveyor (curving type)
14. Coolant unit
 - Coolant tank capacity: 1200ℓ (381 gal)
15. Air blower function
16. Mist coolant unit
17. Splash guard cover on ATC side
18. Automatic measuring system
 - This unit consists of a radio touch probe, standard measuring software and a calibration block for checking compensation values of touch probe. (Printer is not included)
19. Inductosyn scales for closed-loop feedback system
 - For X, Y, Z or W axis
20. Portable external input/output device
21. Air compressor
 - Screw type
 - Without air blower: 11 kW (15 HP)
 - With air blower: 15 kW (20 HP)
22. Air dryer
23. Planing holder
 - Used for recess grooving and chamfering.
24. Customer painting color
25. Spindle drive motor AC37 kW (50% ED) / 30 kW (cont.)

Standard machine specifications

Specifications of MPC-B Series Machines			Model	2640B	2650B	2665B	3150B	3165B	3180B	3665B	3680B	
Travel	X-axis travel (Longitudinal movement to table)	mm (ft)		5000 (16.4)	6000 (19.7)	7500 (24.6)	6000 (19.7)	7500 (24.6)	9000 (29.5)	7500 (24.6)	9000 (29.5)	
	Y-axis travel (Crosswise movement of spindle head)	mm (ft)		3400 (11.2)			3900 (12.8)			4400 (14.4)		
	Z-axis travel (Vertical movement of ram)	mm (in)		900 (35.4)								
	W-axis travel (Vertical movement of crossrail)	*Height: 1750 (68.9)	mm (in)	900 (35.4)								
		*Height: 2450 (96.5)	mm (in)	1600 (63.0)								
		*Height: 3150 (124)	mm (in)	2300 (90.6)								
Height (Distance from table top to vertical spindle nose of 5-face cutter head)	mm (in)		Select either 1750, 2450 or 3150 (68.9, 96.5 or 124)									
Distance between columns (maximum width between columns through which workpiece goes through)	mm (in)		2600 (102.4)			3100 (122.0)			3600 (141.7)			
Table	Table working surface	mm (in)	2200 × 4000 (86.6 × 157.5)	2200 × 5000 (86.6 × 196.8)	2200 × 6500 (86.6 × 255.9)	2700 × 5000 (106.3 × 196.8)	2700 × 6500 (106.3 × 255.9)	2700 × 8000 (106.3 × 314.9)	3100 × 6500 (122.4 × 255.9)	3100 × 8000 (122.4 × 314.9)		
	Table loading capacity	kg (lbs)	30000 (66000)	35000 (77000)	40000 (88000)	35000 (77000)	40000 (88000)					
Spindle	Spindle speed range	min ⁻¹ (rpm)	5~3000									
	Type of spindle taper hole		7/24 taper No.50									
	Maximum spindle torque	N · m	2170 (221 kgf · m) (1600 ft-lbs)									
	Spindle bearing inner diameter	mm (in)	Vertical spindle 100, horizontal spindle 120 (4.724) (5-face cutter head)									
Spindle ram	Section	mm (in)	380 × 380 (14.96 × 14.96)									
Feedrate	Rapid traverse rate	mm/min (ft/min)	X, Y: 20000 (65.6)(stroke center)/9000 (29.5) (stroke end) Z: 10000 (32.8), W: 3000 (9.8)									
	Feedrate	mm/min (ipm)	X, Y, Z: 1~6000 (0.1~236) W: 1~3000 (0.1~118)									
Motors	Spindle drive motor		AC 30 kW (50% ED)/22 kW (continuous rating) (*50% ED" means the maximum output when the motor revolves for 5 minutes and stops for 5 minutes at a rate of 10 minutes/1 cycle.)									
Power sources	Electrical power supply		AC 200/220 V ±10%, 50/60 Hz ± 1 Hz									
	Power capacity (including capacity for options)		120 kVA (Power supply for air compressor should be provided separately.)									
	Compressed air to be supplied (Compressed air supply for air blower is excluded.)		0.5~0.8 MPa [5~8 kgf/cm²] (71~114 psi) 1200 normal liters/min (42.4 ft³/min) Compressed air must not contain oil, moisture and/or dust.									
Machine size	Machine height	*Height: 1750 (68.9)	mm (ft)	6560 (21.5)								
		*Height: 2450 (96.5)	mm (ft)	7260 (23.8)								
		*Height: 3150 (124)	mm (ft)	7960 (26.1)								
	Floor space	Plain table type	mm (ft)	7900 × 13400 (25.9 × 44)	7900 × 15400 (25.9 × 50.5)	7900 × 18500 (25.9 × 60.7)	8400 × 15400 (27.6 × 50.5)	8400 × 18500 (27.6 × 60.7)	8400 × 21600 (27.6 × 70.9)	8900 × 18500 (29.2 × 60.7)	8900 × 21600 (29.2 × 70.9)	
		AWC type	mm (ft)	8400 × 17700 (27.6 × 58.1)	8400 × 20800 (27.6 × 68.2)	8400 × 25500 (27.6 × 83.7)	9900 × 20800 (32.5 × 68.2)	9900 × 25500 (32.5 × 83.7)	9900 × 30200 (32.5 × 99.1)	11400 × 25500 (37.4 × 83.7)	11400 × 30200 (37.4 × 99.1)	
	Mass of machine * (height 1750 mm [68.9])	Plain table type (with 60-tool ATC, chip conveyor and coolant unit)	kg (lbs)	60000 (132000)	65000 (143000)	73000 (160600)	72000 (158400)	80000 (176000)	90000 (198000)	87000 (191400)	97000 (213400)	
Accuracy	Positioning accuracy	mm (in)	±0.007 per 1000 (0.0003 per 40)									
	Repeatability	mm (in)	±0.003 (±0.00012)									
	Other accuracies		per standard test chart (testing method & tolerances).									
Painting color	Standard paint color (Urethane painting)		Munsell 5Y7.5/1 (Ivory white) (excluding machine name/model indication on the saddle front, pendant operation box, company nameplate and equipment purchased from other manufacturers)									

* Distance from table top to vertical spindle nose of 5-face cutter head.

Standard accessories

- 5-face cutter head
- Automatic attachment indexing (AAI) for 5-face cutter head or other attachments (4-position 90° indexing)
Head index time: Approximately 9 sec/180°
- Automatic tool loading/unloading device for vertical spindle and horizontal spindle
- Pendant operation box with electrically-driven free arm

- Hydraulic unit
- Hydraulic crossrail servo balancing system (proportional to spindle head position)
- Hydraulic ram balancing cylinder
- Oil mist lubrication unit for gears and bearings
- Telescopic bed steel cover
- Telescopic column steel cover
- Telescopic crossrail steel cover
- Service (or maintenance) tools
- Spare parts (fuses and lamps)

- Plug socket for connecting an external device
A plug socket (AC 100 V, 3A) is provided on the machine control unit (front side of NC panel) to connect an external device.

CNC System Specifications TOSNUC999

Standard Specifications including pack specifications (Items marked with ☆ are included in the pack specifications.)

A. Controlled axes

- ☆Number of controlled axes 4 axes (X, Y, Z and W)
Simultaneously controllable axes 4 axes for positioning (G00) and linear interpolation (G01) 2 axes [X-Y, Y-Z (W), and Z (W)-X] for circular interpolation (G02, G03)
- ☆Synchronized operation WM and WS axes

B. Programming Methods

- Programming resolution Linear axes: 0.001 mm
- Maximum programmable dimension Linear axes ±99999.999 mm (±9999.9999 in.)

- Data code Automatic recognition of ISO/EIA
JIS B6311 ISO 6983/1
EIA RS-358-B EIA RS-244-B

- Data format Variable block with decimal point programming
Word address format

- Absolute/incremental programming G90/G91
- Decimal point input Calculator type/programming resolution type

C. Interpolation

- Positioning A positioning operation is performed at a rapid traverse rate by executing G00 command.

- Linear interpolation A linear interpolation is performed by executing G01 command.

- Circular interpolation A circular interpolation is performed by executing G02/G03 command.

D. Feed

- Rapid traverse rate (See the section of machine specifications for numerical values)

- Feedrate F 5-digit direct programming in mm per minute
- Dwell G04 Dwell time can be specified in the range of 0 to 999.99 seconds with F (or P) code.

- Continuous jog feed A selected axis is continuously moved at a rapid traverse rate or cutting feedrate by manual operation.

- Rapid traverse override Rapid traverse can be overridden in the range of 0 to 100 % in 10 % increments.

- Feedrate override Specified feedrate can be overridden in the range of 0 to 200 % (stepless).

- Automatic acceleration or deceleration Linear acceleration or deceleration can be effective on rapid traverse rate and jog feedrate.

- Automatic acceleration or deceleration for cutting feed Linear acceleration or deceleration can be effected on feedrate by executing G08/G09 or G50/G51 command.

- S-type acceleration or deceleration for rapid traverse S-type acceleration or deceleration can be effected on rapid traverse.

- ☆Thread cutting Thread cutting synchronized with spindle revolution can be performed by executing G33 command.

- ☆Feed per revolution/feed per minute Feed per minute or feed per revolution can be selected for the feedrate specified by F code by executing G94/G95 command.

- ☆Dwell per revolution Dwell per revolution can be performed by executing G05 command.

- ☆Spindle inertia thread-cutting
- ☆Handwheel feed with portable type box 0.001, 0.01 or 0.1 mm/division

- ☆Thread-cutting initiation at optional angle Thread cutting is initiated at the optional angle of Spindle.

E. Part Program Storage and Edit

- ☆The part program storage capacity of 600 m [1970 ft/approx. 285 kB] (the numbers of registrable programs: 512) (The customer's storage capacity is decreased by approximately 100 to 200 m which is used for the selected optional functions by manufacturer.)

- Program edit (Background edit) Various editing operations are possible for programs memorized.

- Program delete, program copy, program rename, search, jump, cancel, deletion and copy by designating range, replace, program insertion, register in abbreviation, line mark designation, sequence number change, space insertion between words, program input in S, F, auto mode, simultaneous opening of two programs, editing of various data during program editing, undo of deleted program, English comment

- Program name A program name is specified with the alphanumeric characters up to eight characters following address \$ or O.

- Program comment of maximum 32 characters can be included.

- Sequence number A sequence number is specified with a 5-digit number following address N.

- Sequence number search A block containing specified sequence number can be searched.

- Programs nesting list A list of program nesting is displayed.

- Program offset list List of the following data is displayed after searching from the head of program.

- Fixture offset
- Syntax check The format of a program is checked.

F. Operation and Display

- ☆Operation panel 10.4 in. color TFT liquid crystal display
- Keyboard with membrane switches (80 keys)

- Customized key Registering a series of key-in operations to be performed very often into a key, the operation can be performed quickly, thus improving efficiency of the operation.

- Tool file Tool data such as tool length, cutter diameter and tool offset can be collectively displayed in a unified manner and edited.

- Display capabilities Commanded values, current positions, compensation values or the like are displayed on the main screen, window screen and sub screen respectively.

- Screen erasing function A screen is erased when a key-in operation is not performed in specified time or more.

- Operation Automatic operation, MDI operation, and manual numerical command are possible.

- SF manual setting S and F codes can be set in the manual mode.

- SF automatic setting S and F codes are set automatically in the manual mode.

- Spindle motor load display The power consumption of spindle drive motor is displayed.

- Run hours display The NC working time is displayed.

- Machined workpiece counting The number of machined workpiece is counted when the M code specified in the parameter is executed.

- Calendar timer A calendar and time are displayed on the run hour display screen. Program creation dates and time are displayed in the program list.

- Machining record A history such as machining start time, actual machining time or the like which is recorded after operating a machine in the automatic mode by executing a program are displayed.

- User name registration A user name is displayed at the time of a system startup.

- Memory operation A program in the NC memory is executed in an automatic mode.

- MDI operation In MDI mode, a program constituted of a plurality of blocks can be inputted and executed.

G. I/O Function and Device

- RS232C interface port A NC programs, tool offset data or the like can be inputted and outputted via the EIA RS232C interface.

- ☆User media Various data such as NC programs or tool offset data can be input and output via a USB memory or a CF card slot. Memory slots are arranged on the right side of the pendant operation box.

- ☆User media Various data such as NC programs or tool offset data can be input and output via a USB memory or a CF card slot. Memory slots are arranged on the right side of the pendant operation box.

H. S, T and M functions

- Spindle-speed function (S function) Spindle speed can be specified with a five (5)-digits integer following address S.

- Spindle speed override 50 to 150 % in 10 % increments.
- Tool function (T function) Tool number can be specified with a six(6)-digits integer following address T.

- Miscellaneous function (M function) Miscellaneous function can be specified with a four (4)-digits integer following address M.

- Miscellaneous function (M function) Miscellaneous function can be specified with a four (4)-digits integer following address M.

I. Tool Offset

- Tool length offset Tool length offset can be set to an axis perpendicular to the selected plane by executing G43/G44/(G49) command.

- Tool offset Tool extension or contraction is effected on an axis in selected plane by executing G45/G46/G47/G48 command.

- Cutter compensation type C Cutter compensation is effected on an axis in selected plane by executing G40/G41/G42 command.

- ☆Number of tool offsets The number of tool length offsets: 899 sets
The number of cutter compensations: 899 sets

J. Coordinate System	
Automatic reference point return	G28: Automatic return to a reference point G29: Return from a reference point G20: Reference point return check

Coordinate system setting	
A coordinate system can be set so that the current positions of axes constitute commanded coordinate values by executing G92 command.	
☆Fixture offset	99 sets (H901-H999)
Fixture offset becomes effective by executing G53/G57 command.	
Fixture offset 2	
Fixture offset becomes effective by executing G54/G55/G56 command.	
2nd to 4th reference point return	
Axes are returned to the 2nd to 4th reference points automatically by executing G21 command.	

K. Operation Support Function

Control in/out	
Information inserted in the section between control out and control in codes can be neglected.	
Single block	
A program can be executed block by block during automatic or MDI operation.	
Optional stop	M01
A program is stopped at a block containing M01 code in a state that M01 push button switch is ON.	
☆Optional block skip	
A block containing a slash (/) code at the top there of can be skipped.	

Dry run	3 pcs
Axes moves at the feedrate set to the parameter in place of the programmed feedrate.	
Machine lock	
Output of axis command pulse to the machine side is suspended.	
Auxiliary function lock	M, S, and T commands are not outputted to the machine side.

Z-axis feed cancel	
Output of Z-axis command pulse to the machine side is suspended.	

Manual absolute ON/OFF	
Whether a travel of an axis moved by manual operation is added to the current coordinate value is selected according to the status of the absolute ON/OFF switch.	
Override cancel	
An override for a feedrate and spindle speed is ignored to clamp the feedrate and spindle speed at 100 % by executing M48 or M49 command.	

Mirror image	
Each axis is moved in the direction opposite to the programmed direction in automatic and MDI operation in response to an external signal.	

All clear	
The NC internal memory can be initialized by pressing the ALL CLEAR push-button switch.	
Reset	A command currently executed can be reset.

Feed hold	
Axis travel can be suspended by pressing the FEED HOLD push-button switch in automatic and MDI operation.	

Cycle stop	
Axis travel and spindle rotation can be suspended by pressing CYCLE STOP push-button switch in automatic and MDI operation.	

Restart	
When machining is interrupted in automatic operation, the operation can be resumed from the specified block after taking required steps such as tool changing.	

Sequence number collation and stop	
Operation can be stopped after executing the block preceding a block with the specified sequence number.	

Manual numerical command	
Data can be inputted and executed in manual-operation mode.	
Data that can be inputted : G00/01, F, M, S, T, axis data (incremental)	

Single block cancel	
Single block ON or OFF in the single operating mode can be selected by executing G990/G991 command.	

Feed hold cancel	
Feed hold ON or OFF can be selected by executing G992/G993 command.	

Override cancel	
Feedrate override ON or OFF can be selected by executing G994/G995 command.	

Handwheel feed interruption cancel	
Handwheel feed interruption ON or OFF can be selected by executing G996/G997 command.	

Manual interruption and manual return	
A function for interposing manual operations in automatic operation.	
After each axis is moved in a manual interruption mode, the axis is automatically returned to the position before interrupting by pressing manual return push-button switch.	

☆Handwheel feed interruption	
Interruption by means of a MPG handwheel is permitted in cutting feed operation.	
☆Manual tool length and tool diameter measurement	
An offset value of a tool to be measured from the calibration tool is measured and memorized as the data of specified offset number.	

L. Programming Support Function

Plane selection	
A machined plane can be selected by executing G17/G18/G19 command.	

Circular interpolation by radius programming	
Radius of an arc can be specified directly by R command.	

Circle cutting	G12, G22: Inner circle cutting CW G13, G23: Inner circle cutting CCW G222: Outer circle cutting CW G223: Outer circle cutting CCW
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Machine coordinate system positioning command	
Axes can be moved to a position on the coordinates unique to the machine by executing G73 command.	
Subprogram call	
A subprogram stored in the memory can be called and executed by commanding G72. The subprogram name should be specified with eight (8) alphanumeric characters following address \$ or O.	

Arbitrary angle chamfering/corner R	
Arbitrary angle chamfering or corner R can be inserted between two (2) consecutive blocks including cutting feed commands.	

Canned cycle	
A drilling canned cycle can be executed by commanding each of G77 to G89.	

Automatic corner override	
Automatic override for inside corner/Change of inside arc cutting speed	
☆Programmable mirror image	
Mirror image can be set for each axis by executing G62 or G66 command.	
☆Plane conversion	
A NC program based on G17 plane can be executed on the other planes by executing each of G35 to G39 commands.	

☆Macro program	
A macro program can be called and runs by executing a command such as G72, G74, G75 or G76.	

☆Pattern cycle	
Regularly arranged hole position pattern cycle and milling pattern cycle can be executed by commanding each of G109 to G119 or G121 to G132.	

☆Coordinate conversion	
A parallel shift and rotation of a coordinate system can be made by executing G10/G11 command.	

M. Mechanical error compensation

Backlash compensation	Backlash of the machine is compensated.
Pitch error compensation	Pitch error of the machine is compensated.
Unidirectional positioning	
Final positioning of axes can always be performed from one direction by executing G60 command.	
☆Pitch-error gradient compensation	
Pitch error of each axis feed screw of mechanical system can be compensated linearly by approximating with up to thirty (30) straight lines per axis.	

N. Machine Control Support Function

Axis interlock	
Feed of each axis can be prohibited or permitted in response to the external signal.	
☆External deceleration	
Feedrate is slowed down in response to the external signal.	

O. Safety and maintenance

Emergency stop	
The machine comes to an emergency stop by pressing the EMERGENCY STOP push-button switch. Emergency stop can be canceled by pressing the EMG RESET push-button switch.	
Overtravel check	
The machine comes to an emergency stop in response to the external overtravel signal.	
Stroke check	
Axis travel exceeding the predetermined stroke is prohibited.	
☆Interference check I	
Axis travel into the predetermined interference zone is prohibited by executing G24/G25 command.	

Interference check II	
Axis travel into the predetermined interference zone is prohibited by executing G26/G27 command.	
Self-diagnosis	
A malfunction of NC program, NC system, servo and mechanical system can be monitored, and relevant alarm is processed.	

Door interlock	
An interlock function which shuts off the primary power supply when the control-cabinet door is opened.	

P. Installation requirements

Power source	AC 200/220 V +10 % ~ -15 % 50/60 Hz±1 Hz, Three (3) phases
Environmental conditions	Temperature: 0 to 45 °C Relative humidity: 75 % or less (no condensation)

Q. Servo system

Servo motor	AC servo motor
Position detector	X, Y, Z and W axis: Absolute encoders (Absolute position detection)

Optional specifications

A. Controlled axes

Additional controlled axes	
Select this function when using a NC rotary table to be controlled by TOSNUC999. Detailed specifications and scope of work shall be discussed as required.	

B. Programming Methods

Inch/metric selection	
Programming in inch or metric system can be selected by executing G70/G71 command.	

C. Interpolation

Helical interpolation	
The helical interpolation becomes effective by executing G02/G03 command and a linear interpolation command simultaneously.	

Parabolic interpolation	G06
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Hypothetical axis interpolation	
Setting and cancel of a hypothetical axis can be commanded by “G07 <i>α</i> 0/1” (<i>α</i> : axis address). An axis specified as the hypothetical axis does not move.	

Cylindrical interpolation	
When G67 command is executed, the cylindrical interpolation becomes effective by combining a linear axis with a rotation axis (additional axis) for operations such as grooving of a cylindrical cam.	

Archimedes interpolation	
The Archimedes interpolation (spiral interpolation) by means of orthogonal 2 axes or three (3) axes including orthogonal 2 axes and a normal axis becomes effective by executing G102/103 command.	

Spindle normal direction control	
Spindle normal direction control becomes effective for operation such as a grooving with the spring-necked turning tool by executing G140/G141/G142 command.	

D. Feed

Synchronous tapping	
Tapping can be performed by controlling a feed axis in synchronization with Spindle rotation. M843/M844/M845	Spindle speed for synchronous tapping : 20 - 750 min ⁻¹

E. Part program storage and edit

Part program storage capacity	
Part program storage capacity of 1,200 m [3,900 ft] (approx. 538 KB)	(the number of registrable programs: 1,024)
Part program storage capacity of 3,000 m [9,800 ft] (approx. 1.3 MB)	(the number of registrable programs: 1,024)
Part program storage capacity of 5,400 m [17,700 ft] (approx. 2.2 MB)	(the number of registrable programs: 1,024)
Part program storage capacity of 7,800 m [25,500 ft] (approx. 3.3 MB)	(the number of registrable programs: 1,536)
Part program storage capacity of 10,200 m [33,400 ft] (approx. 4.2 MB)	(the number of registrable programs: 1,536)
(Part program storage capacity includes a capacity of 600 m as the pack specification.)	

*Large capacity memory (CF card)	2GB
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F. Operation and Display

Display language selection (standard: Japanese)	English or Chinese
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G. I/O Function and Devices

RS-232C interface port B	
Loading and dumping of programs and tool offset data are possible.	
**DNC I/F	
DNC interface function compatible with EIA SP1292	

Remote operation	
Automatic operation is performed based on a NC program sent from the host computer in accordance with the transmission protocol.	
Protocol A (handshaking system)	
Protocol B (DC control-code system)	

Binary operation	
Automatic operation is performed based on the binary data sent from the host computer in accordance with the transmission protocol.	

*High-speed LAN-LINKAGE	
Host	FTP Server
Protocol	TCP/IP
LAN cable	10 base-T
Maximum capacity of internal memory	
2GB (including a capacity of 30MB for storing the operation system)	
Note) The following facilities shall be provided by the customer.	
1) Construction and set-up for network	
2) 10 base-T cables for connecting the LAN system with a machine	

I. Tool Offset

Wear offset memory	
The Wear offset memory can be added to the tool offset memory.	
Three-dimensional tool compensation	
A tool path can be offset in three dimensions by executing G30/G31 command.	
Tool length offset in tool axial direction	(Designed for the 5-axis control machine.)

K. Operation Support Function

Addition of optional block skips	3 in total.
Handwheel feed interruption in tool axial direction	(Designed for the 5-axis control machine.)

L. Programming Support Function

Teaching	
A program is automatically created based on a block executed by MDI operation, axis travel operated manually or the like.	

Programmable data input	
The data in the tool offset memory or the fixture offset memory can be updated by executing G58/G59 command.	

Programmable parameter input	
Retrieving and rewriting of the data of setting parameter and system parameter can be performed by executing G58/G59 command. (To use this function, "programmable data input" is also required.)	

Scaling	
Reducing or enlarging of a profile based on a tool locus specified by a NC program can be performed by executing G64/G65 command.	

Scaling unit 1/100000	Select together with Item (22) above.
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Coordinate conversion unit	1/100000
Three-dimensional coordinate conversion	G14

Figure copy function	
A subprogram can be entirely executed on the coordinate system which is rotated or shifted by executing G721/G722 command.	

Circle cutting compensation	
In executing the circle cutting command, the circle cutting is performed while compensating the roundness of machine motion by changing the radius of the circle in the longitudinal direction.	

Fixture offset data input	
The programmed offset value for each axis can be added to the registered offset value by executing G158 command.	

Machining time estimation and NC plotting function	
Background processing such as program syntax check, machining time estimation, and plotting of a tool path can be performed in a state that the program is not executed.	

M. Accuracy Compensation for Mechanical System

Straightness compensation	
Straightness of the mechanical system can be compensated linearly by approximating with up to nine (9) straight lines per axis.	

Z-axis thermal displacement compensation	
The error of the mechanical system caused by thermal displacement of Spindle in the Z-axis direction is compensated.	

O. Automation Support Function

Skip function	
The processing of axis travel in execution is stopped and skipped to the following block in response to a skip signal inputted from the outside. (This function is automatically included in the specifications when the "automatic measuring system" and "automatic tool length measuring system" of machine optional accessories are selected.)	

Tool breakage and tool wear detection	
Cutting load condition can be monitored to detect tool breakage and tool wear.	

Counting of tool working time	
The tool working time is counted and an alarm is generated when the time has reached a specified tool life. (tool-life management)	

Feedrate regulation	
A feedrate is controlled so that a cutting load (load on the spindle motor) assumes a predetermined value.	

Spare tool selection	
The specified spare tool is selected in place of a tool that cannot be used due to tool life, breakage, or wear based on the result of tool breakage and tool wear detection.	

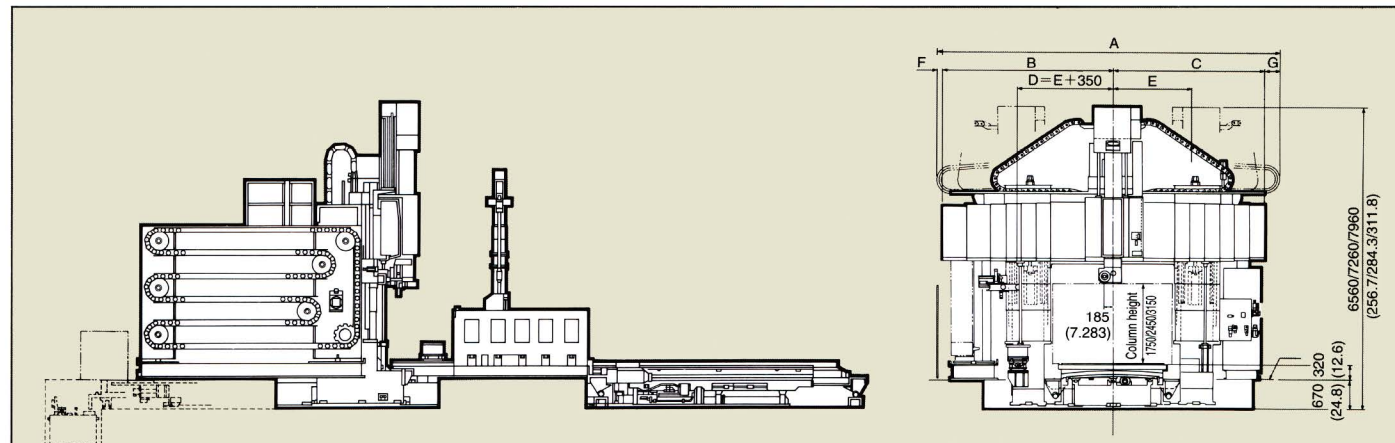
Tool wear coefficient function	
The tool-life time and the tool working time can be counted by multiplying the predetermined tool wear coefficient. (M-code output only)	
Two (2) external M codes	M192, M193 (M-code output only)

Q. Servo system

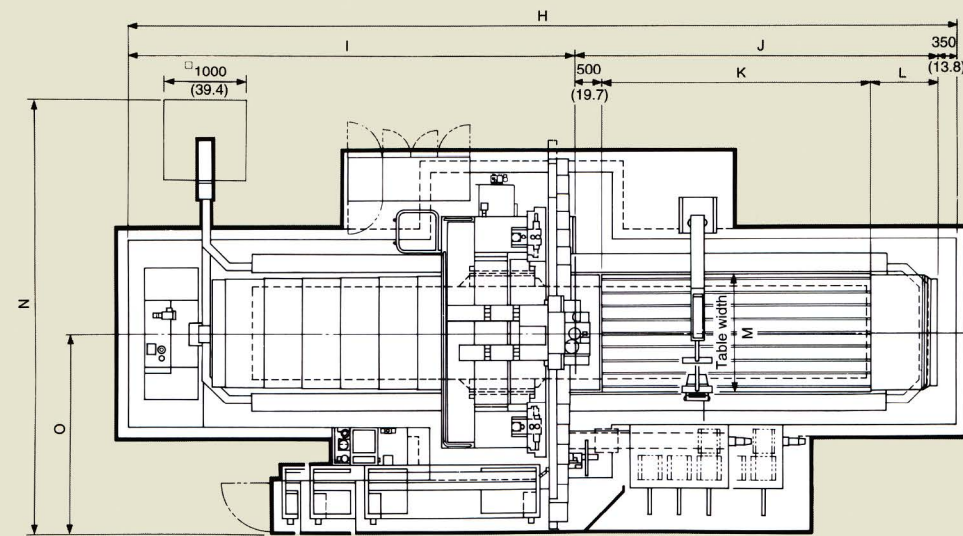
Shape recognition preview control (including preview control)	
When machining along the tool path programmed including the successive short line segment block at high speed, the impact at a corner or an error such as delay in the servo system can be prevented, thus performing highly accurate machining at high speed.	

Note) Consult with us regarding the DNC interface marked with **.
Note) Marked with *, selectable between two options.

Machine general views and floor plan



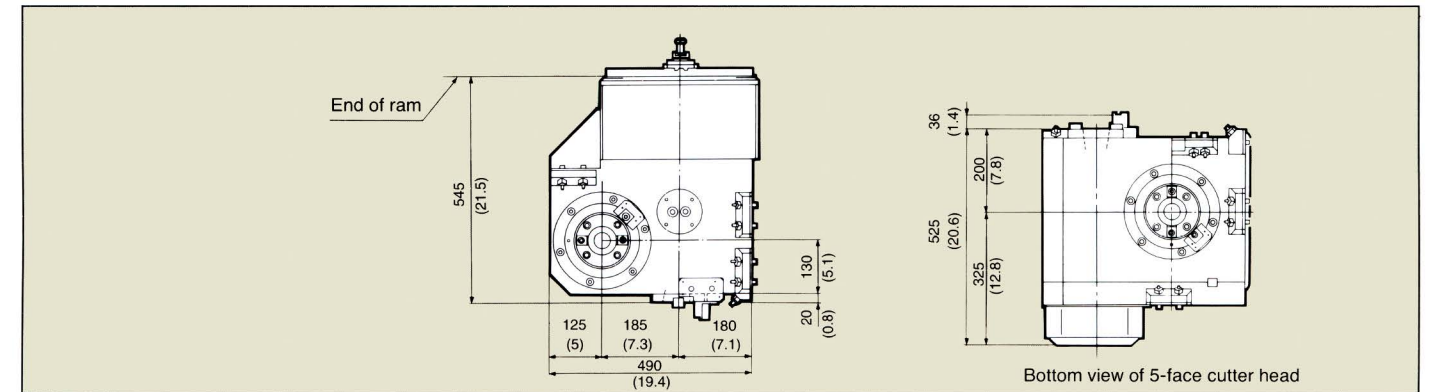
Note: Spindle drive motor AC37 kW by machine height +135 mm (5.3)



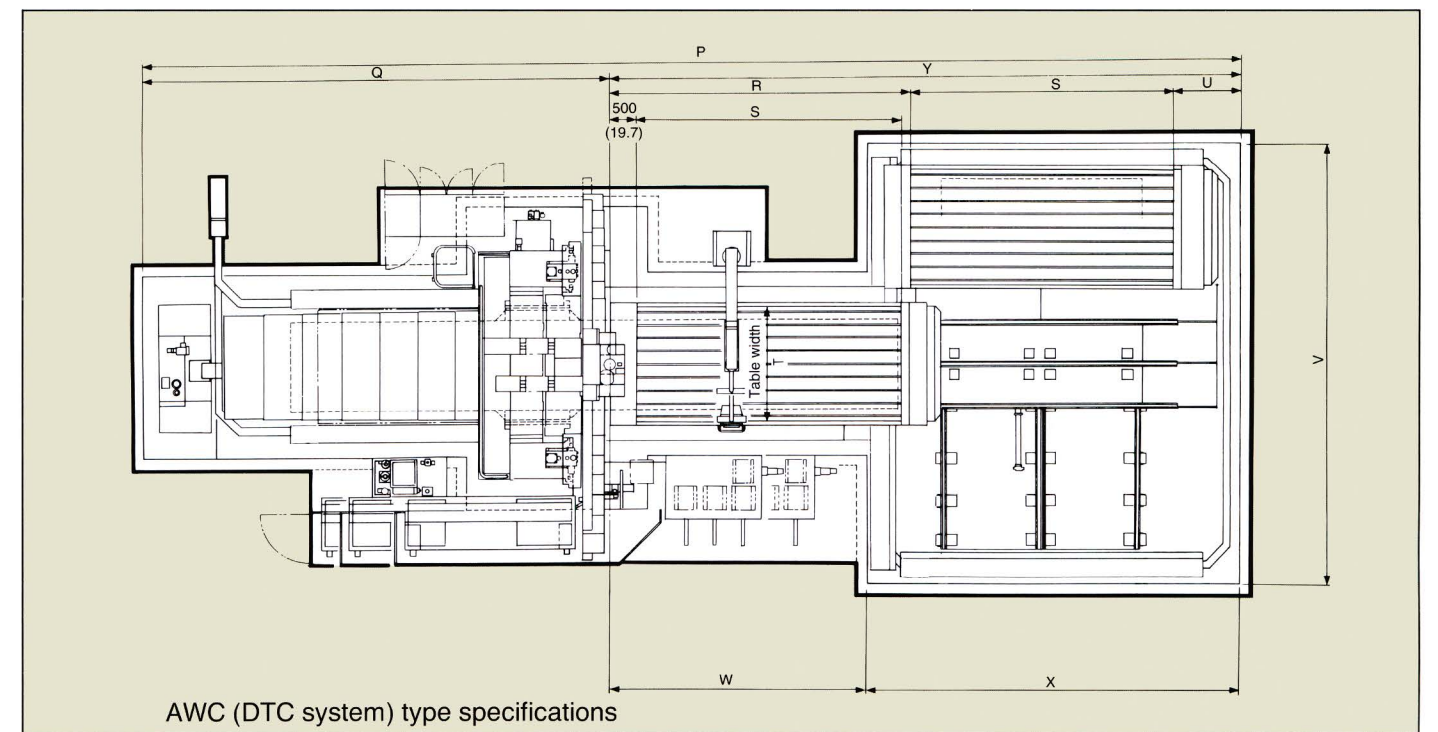
Plane table type specifications

mm(in)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2640								13350 (526)	7300 (287)	5700 (224)	4000 (157.5)	1200 (47.3)			
2650	7314 (288.0)	3620 (142.5)	3270 (128.7)	2050 (80.7)	1700 (66.9)	124 (4.9)	300 (11.8)	15400 (606)	8300 (327)	6750 (266)	5000 (197)	1250 (49.2)	2200 (87)	7900 (311)	3810 (150)
2665								18500 (728)	9800 (386)	8350 (329)	6500 (256)	1350 (53.1)			
3150								15400 (606)	8300 (327)	6750 (266)	5000 (197)	1250 (49.2)			
3165	7825 (308.0)	3870 (152.4)	3520 (138.6)	2300 (90.6)	1950 (76.8)	130 (5.1)	305 (12.0)	18500 (728)	9800 (386)	8350 (329)	6500 (256)	1350 (53.1)	2700 (106)	8400 (331)	4060 (160)
3180								21600 (850)	11350 (447)	9900 (354)	8000 (315)	1400 (55.1)			
3665	8490 (344.3)	4120 (162.2)	3770 (148.4)	2550 (100.4)	2200 (86.8)	215 (8.5)	385 (11.2)	18500 (728)	9800 (386)	8350 (329)	6500 (256)	1350 (53.1)	3100 (122)	8900 (350)	4310 (170)
3680								21600 (850)	11350 (447)	9900 (354)	8000 (315)	1400 (55.1)			



Bottom view of 5-face cutter head



AWC (DTC system) type specifications

mm(in)

Model	P	Q	R	S	T	U	V	W	X	Y
2640	17670 (696)	7800 (307)	4670 (184)	4000 (157)		1200 (47.3)		3870 (152)	6000 (236)	9870 (389)
2650	20770 (818)	8800 (346)	5670 (223)	5000 (197)	2200 (87)	1300 (51.2)	8400 (331)	4870 (192)	7100 (280)	11970 (471)
2665	25470 (1003)	10400 (409)	7170 (282)	6500 (256)		1400 (55.1)		6370 (251)	8700 (343)	15070 (593)
3150	20770 (818)	8800 (346)	5670 (223)	5000 (197)		1550 (51.2)		4870 (192)	7100 (280)	11970 (471)
3165	25470 (1003)	10400 (409)	7170 (282)	6500 (256)	2700 (106)	1400 (55.1)	9900 (390)	6370 (251)	8700 (343)	15070 (593)
3180	30170 (1188)	11950 (470)	8670 (341)	8000 (315)		1550 (61.0)		7870 (310)	10350 (408)	18220 (717)
3665	25470 (1003)	10400 (409)	7170 (282)	6500 (256)	3100 (122)	1400 (55.1)	11300 (445)	6370 (251)	8700 (343)	15070 (593)
3680	30170 (1188)	11950 (470)	8670 (341)	8000 (315)		1550 (61.1)		7870 (310)	10350 (408)	18220 (717)