Shibaura Machine

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ISO 9001

GOTEMBA plant

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URL : https://www.shibaura-machine.co.jp

SM19097-1100-SZ
Printed in Japan

TMD series

Shibaura Machine

TMD series

TURNING CENTER

Catalog TMD0018-CED-11

An advanced high speed, high accuracy 3-axis controlled turning center with heavy duty machining capabilities.

TMD series

Based on our TUD series general-purpose vertical turning mills, the TMD series also incorporates milling and table index functions. In addition to all turning operations, complex machining operations such as milling, boring, drilling and tapping can be all accomplished in only one workpiece setup.

■ Improved machining capabilities

- A step positioning mechanism moves the crossrail a maximum of 500mm(19.6in.) vertically in 250mm(9.84in.) steps [750mm(29.5in.) for TMD-20] for virtually all workpiece heights.
- The closed type single-block construction rail head enclose a 220×220mm(8.66×8.66in) square ram.
- Maximum cutting force of ram : 2 500kgf (5 500 lbf).
- Linear machining by the simultaneous control of X and C axes. (Polar interpolation)
- Milling spindle motor 22/15 kW [30/20]HP.

■ High speed and high accuracy

- Extremely rigid linear roller guides employed on the X axis slideway.
- Sharply reduced thermal displacement due to symmetrically positioned placement of the motor and symmetrical design of both the table and column.

■ Outstanding operability

- An easily accessible operation panel with centralized controls for all operation functions.

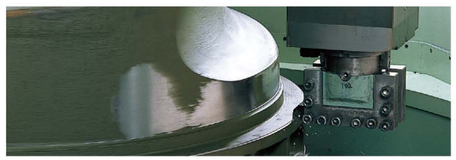
■ For even greater degrees of automaticity and labor savings

- An automatic tool changer (ATC) and an automatic pallet changer(APC) are optionally available.

■ Face milling

■ End milling

■ Drilling

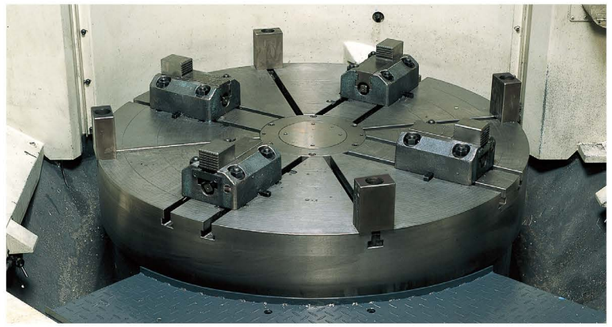


■ Turning

TMD Series TURNING CENTER

Photo:
TMD-16 with optional accessories.
(ATC, APC and chip conveyor.)

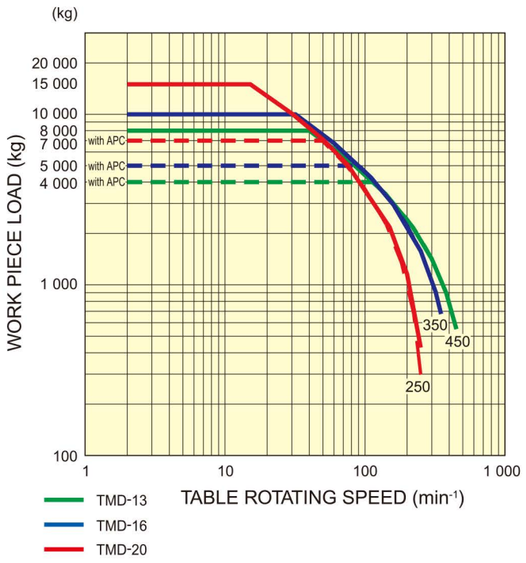
Outstanding machine features



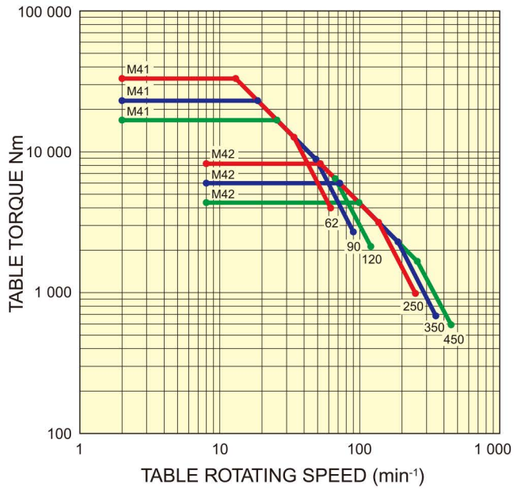
Rigid table construction for more efficient machining

All of the major machine components are constructed of high-grade castings.
The table has been provided with ample strength and size.
The table is supported on a large-diameter thrust ball bearing and tapered roller bearing arrangement. This type of arrangement assures adequate support for extremely efficient, high speed heavy machining. In addition, the table is equipped with 4 independent manually-operated jaws and T-slots that guide and hold the workpiece in the required position.

■Maximum load on table



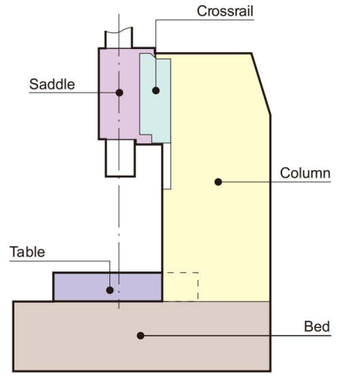
■Table-torque diagram

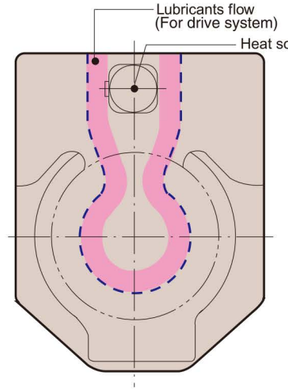


1 kgf·m = 7.23 ft·lb

TMD series

■Common bed construction





Thermally symmetrical bed design

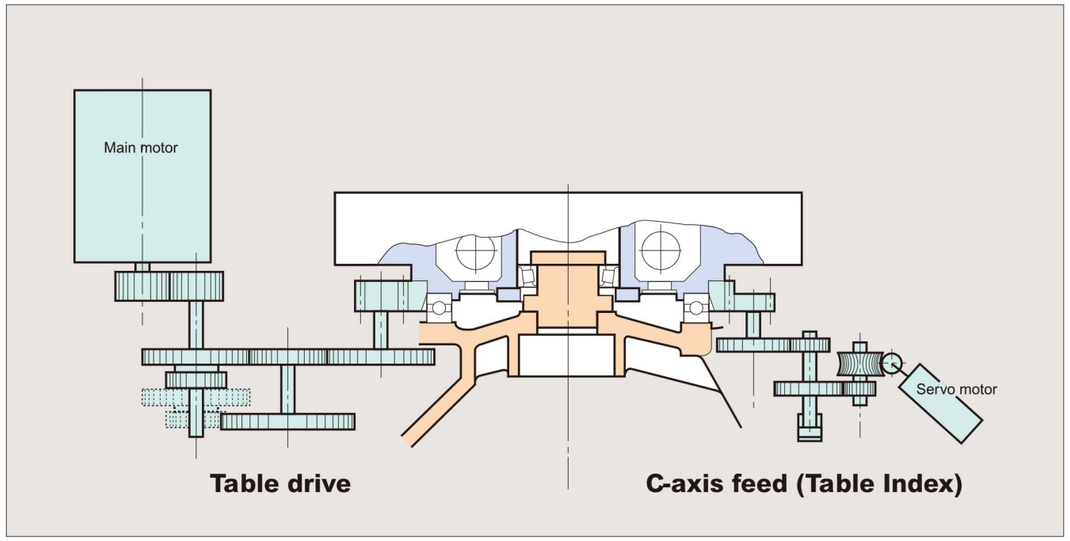
The table and column are mounted on a common bed.
Thermal distortion is minimized by a standard lubricant oil cooling system and the thermally symmetrical layout of ribs on the machine bed.
Additionally, the table driving mechanism is built into the rear side of the bed.

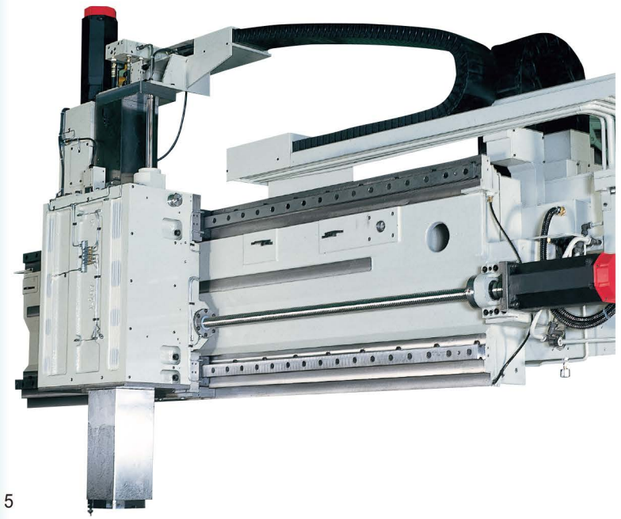
Highly rigid table driving mechanism

The main motor drives a large-diameter helical gear (ring gear) via two-range gear drive.
Table speed change is performed by a two-range hydraulic shift and VAC motor control. The simplified gear mechanism with low heat generation is arranged symmetrically to enhance thermal rigidity.

The C-axis feed pinion has a backlash eliminator for accurate table indexing. In the turning mode, this pinion is disengaged by the hydraulically shifted gear located in the C-axis feed gear box.

■Sectional view of table and bed structure



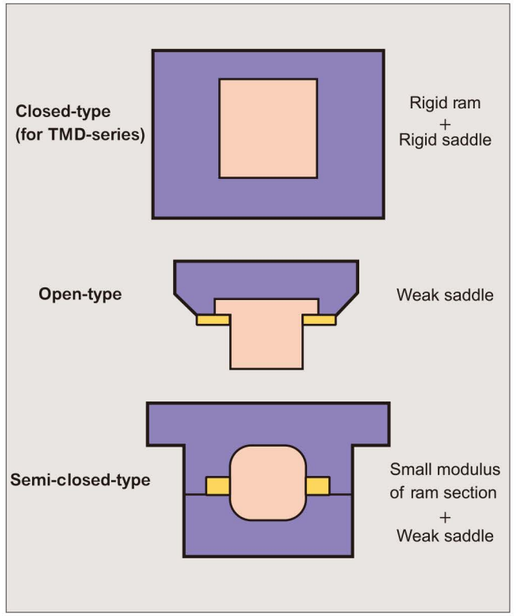


Symmetrical and highly rigid column

The extremely rigid and box-shaped symmetrical column has two guideways and the crossrail linear guides are protected from chips and coolant with telescopic steel covers. The vertical movement of the crossrail is performed by a hydraulic cylinder in 250mm (9.84in) steps for precise positioning of up to a maximum of 500mm (19.6in) [750mm(29.5in) for TMD-20] using positive stops.

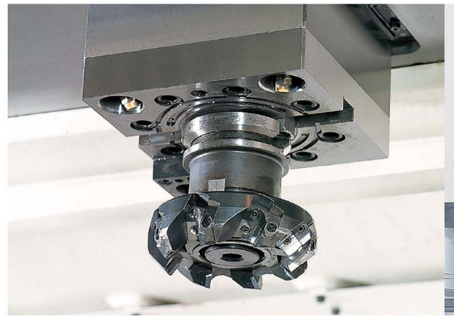
Closed type rail head for improved machining

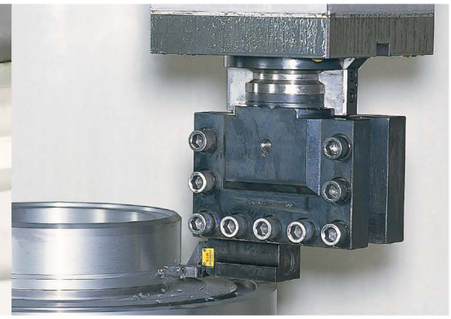
The maximum cutting force of the ram is more than twice that of our conventional machines even when the ram is extended to its maximum stroke. Linear machining by simultaneous control of the X and C axes is possible and the milling spindle motor is 20/15kW(30/20HP). The closed type single-block construction rail head encloses a 220×220mm (8.66×8.66in) square ram and other main machine components made of high-grade cast iron all assure high rigidity and quality machining.



Crossrail for stable positioning accuracy

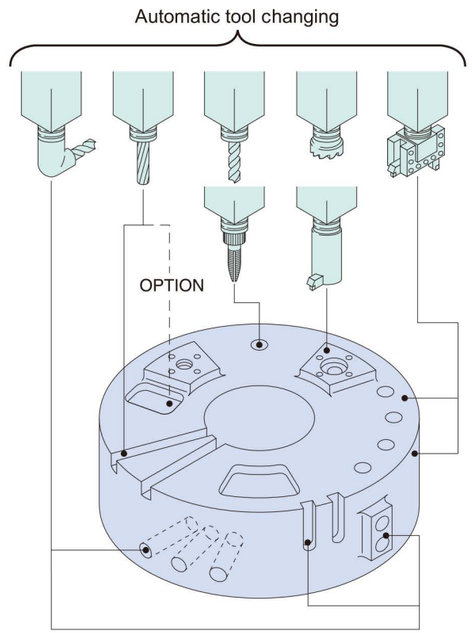
Thermal displacement is halved, compared to other machines, resulting in dramatic improvement of the rail head positioning accuracy, and a thermally designed symmetrical crossrail and motor position assure high thermal rigidity. Additionally, extremely rigid precision linear roller guides employed on the rail head (X-axis) slideways assure high-speed and high accuracy operations.



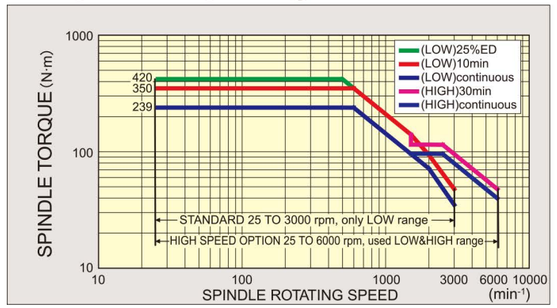


Rail head for improved machine performance

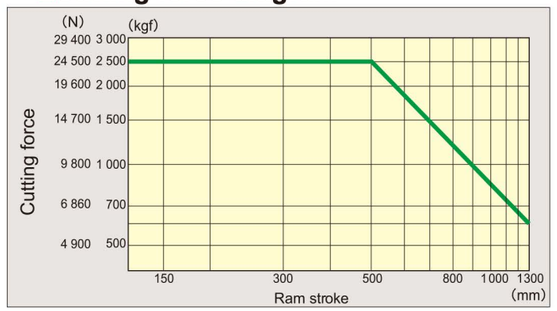
The rail head is positioned horizontally (X-axis) and the ram vertically (Z-axis) by means of large-diameter ball screws of which each is supported by special angular contact ball bearings. The X-axis slideways consists of linear guides and the Z-axis slideway is composed of non-metallic liners (Turcite B) to assure high positioning accuracy, high-speed axis feed and heavy-duty operations.
Tooling can be clamped/unclamped automatically in the spindle (ISO taper No. 50) with the collet type pull stud and the spindle is driven by the AC type motor located at the top of the ram.



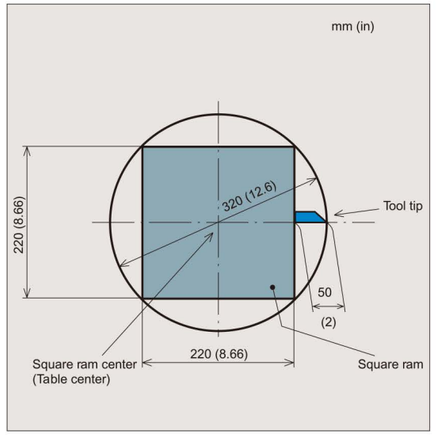
■Spindle torque diagram



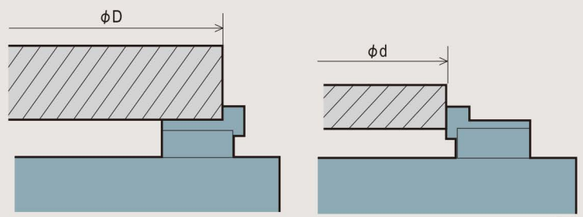
■Cutting force diagram



Minimum cutting diameter of square ram



Maximum/minimum workpiece chucking diameter

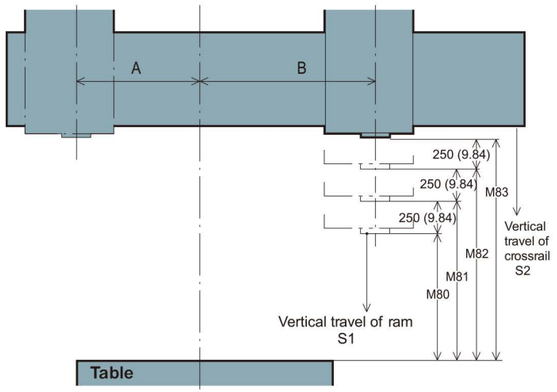


mm(in)

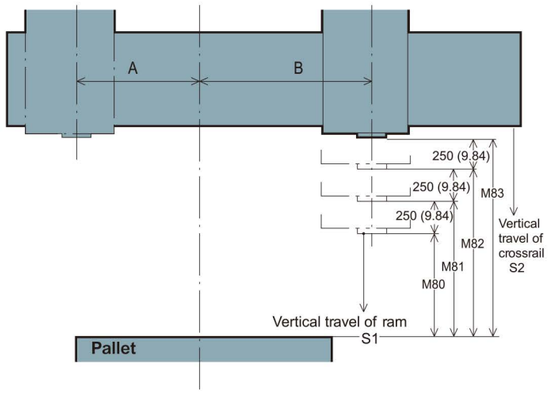
		TMD-13	TMD-16	TMD-20
Maximum workpiece chucking diameter	ϕD	1 180 (46.5)	1 550 (61.0)	1 950 (76.7)
Minimum workpiece chucking diameter	ϕd	250 (9.8)	300 (11.8)	300 (11.8)

Machining range

Without APC



With APC



Without APC

mm(in)

		TMD-13	TMD-16	TMD-20
Vertical travel of ram	S1	800 (31.4)		1 050 (41.4)
Vertical travel of crossrail	S2	500 (19.6)		750 (29.5)
Crossrail position	M80	800 (31.4)	1 050 (41.4)	1 050 (41.4)
	M81	1 050 (41.4)	1 300 (51.1)	1 300 (51.1)
	M82	1 300 (51.1)	1 550 (61.0)	1 550 (61.0)
	M83	——	——	1 800 (70.8)
A		630 (24.8)	805 (31.6)	1 005 (39.5)
B		920 (36.2)	1 120 (44.0)	1 370 (53.9)

With APC

mm(in)

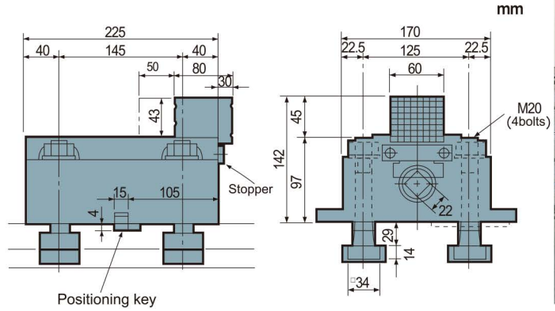
		TMD-13	TMD-16	TMD-20
Vertical travel of ram	S1	800 (31.4)		1 050 (41.4)
Vertical travel of crossrail	S2	500 (19.6)		750 (29.5)
Crossrail position	M80	600 (23.6)	850 (33.4)	850 (31.4)
	M81	850 (33.4)	1 100 (43.3)	1 050 (41.3)
	M82	1 100 (43.3)	1 350 (53.1)	1 300 (51.1)
	M83	——	——	1 550 (61.0)
A		630 (24.8)	805 (31.6)	1 005 (39.5)
B		920 (36.2)	1 120 (44.0)	1 370 (53.9)

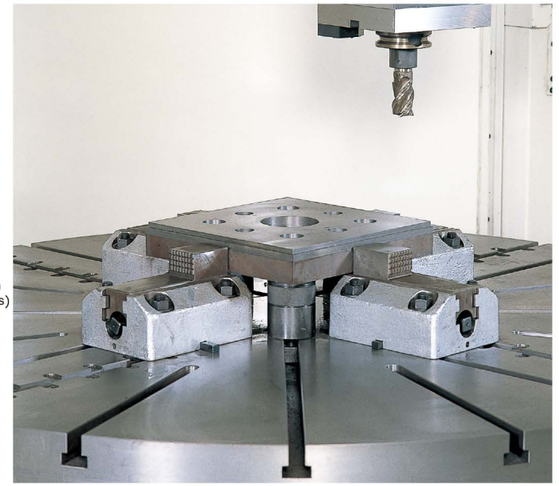
Independent manually-operated jaws

Four jaws with the following specifications are supplied as standard accessories.

- Maximum clamping force : 4 metric tons (8 800 lbs) (clamping torque 18.5 kgf-m [133ft- lbs])
- Weight (one jaw) : 28 kg. (61.6 lbs)

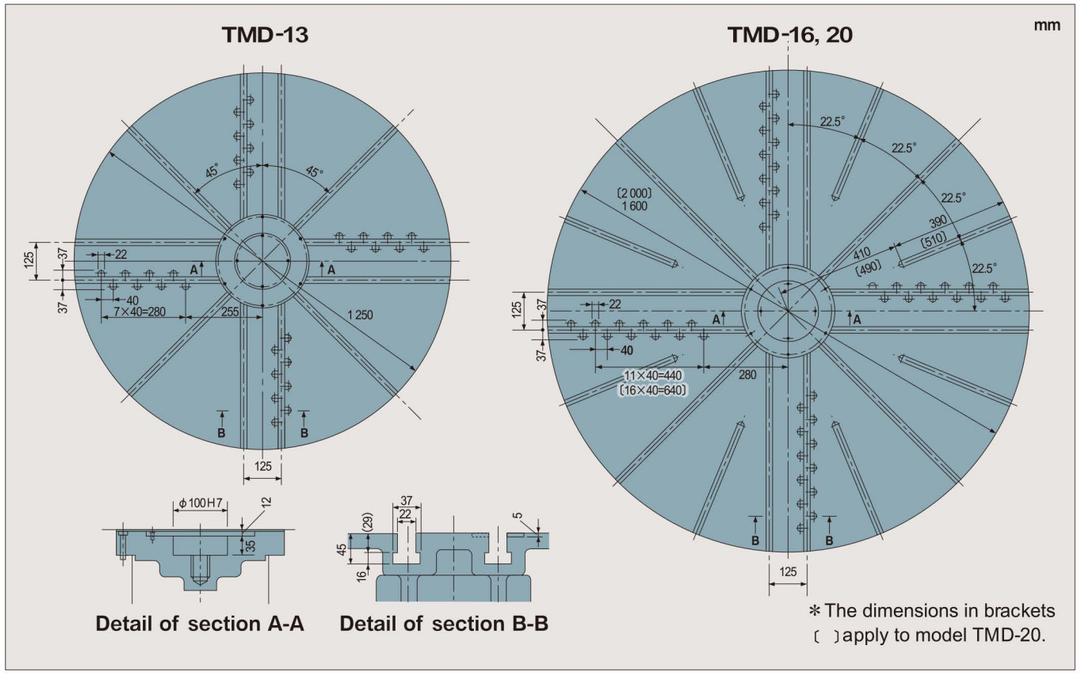
mm





Top view of table

mm



＊The dimensions in brackets [ ] apply to model TMD-20.

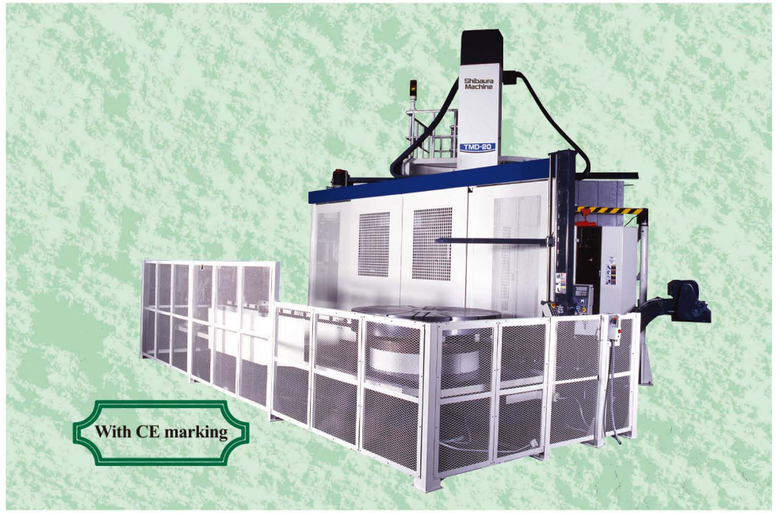
Machine Specifications

Machine Specifications				TMD-13	TMD-16	TMD-20
Capacity	Table diameter		mm(in)	1 250 (49.2)	1 600 (63.0)	2 000 (78.7)
	Maximum swing		mm(in)	1 600 (63.0)	2 000 (78.7)	2 700 (106.3)
	Maximum height from table top to ram bottom	without APC	mm(in)	1 300 (51.2)	1 550 (61.0)	1 800 (70.9)
		with APC		1 100 (43.3)	1 350 (53.1)	1 550 (61.0)
	Maximum cutting height	without APC	mm(in)	1 100 (43.3)	1 350 (53.1)	1 600 (63.0)
		with APC		900 (35.4)	1 150 (45.3)	1 350 (53.1)
	Maximum cutting diameter		mm(in)	1 600 (63.0)	2 000 (78.7)	2 500(98.4)
	Maximum cutting force of ram		N{kgf(lbf)]	24 500{2 500(5 500)}		
	Maximum load on table	on the Machine	kg(lb)	8 000 (17 600)	10 000 (22 000)	15 000 (33 000)
		on the APC		4 000 (8 800)	5 000 (11 000)	7 000 (15 400)
Travel	Horizontal travel of rail head		mm(in)	-630～920 (-24.8～36.2)	-805～1 120 (-31.7～44.1)	-1 005～1 370 (-39.6～53.9)
	Vertical travel of ram		mm(in)	800 (31.5)		1 050 (41.3)
	Vertical travel of crossrail		mm(in)	500 (19.7)		750 (29.5)
Table	Table speeds		min^{-1}	2～450	2～350	1～250
	Number of table speed ranges			2 ranges		
	Maximum table torque		N・m(ft・lbf)	16 775(12 370)	23 065(17 010)	33 100(24 410)
Spindle	Spindle speeds		min^{-1}	25～3 000		
	Maximum spindle torque		N・m(ft・lbf)	420(310)		
Feedrate	Rapid traverse rate of rail head	(X-axis)	mm/min (ipm)	12 000 (472)		10 000 (394)
	Rapid traverse rate of ram	(Z-axis)		10 000 (394)		
	Feedrate	(X-and Z-axis)		1～2 000 (0.1～78.7)		
	Rapid traverse rate of table	(C-axis)	deg/min	1 440	1 080	720
	Table feedrate	(C-axis)		1～360		
	Vertical travel speed of crossrail		mm/min(ipm)	300 (11.8)		
Ram	Type			Square, fully enclosed type		
	Guideway			4 guideways closed type		
	Section		mm(in)	220×220 (8.66×8.66)		
Tool	Type of tool shank			ISO taper No.50		
	Type of pull stud			50P		
Motors	Table drive motor	(30min/cont.)	kW(HP)	VAC 45/37 (60/50)		
	Spindle drive motor	(30min/cont.)		VAC 22/15 (30/20)		
	Feed motors	(30min/cont.)		X-,Z-,C-axis: AC1.0 (9.4)		

1N=9.8kgf

TMD series

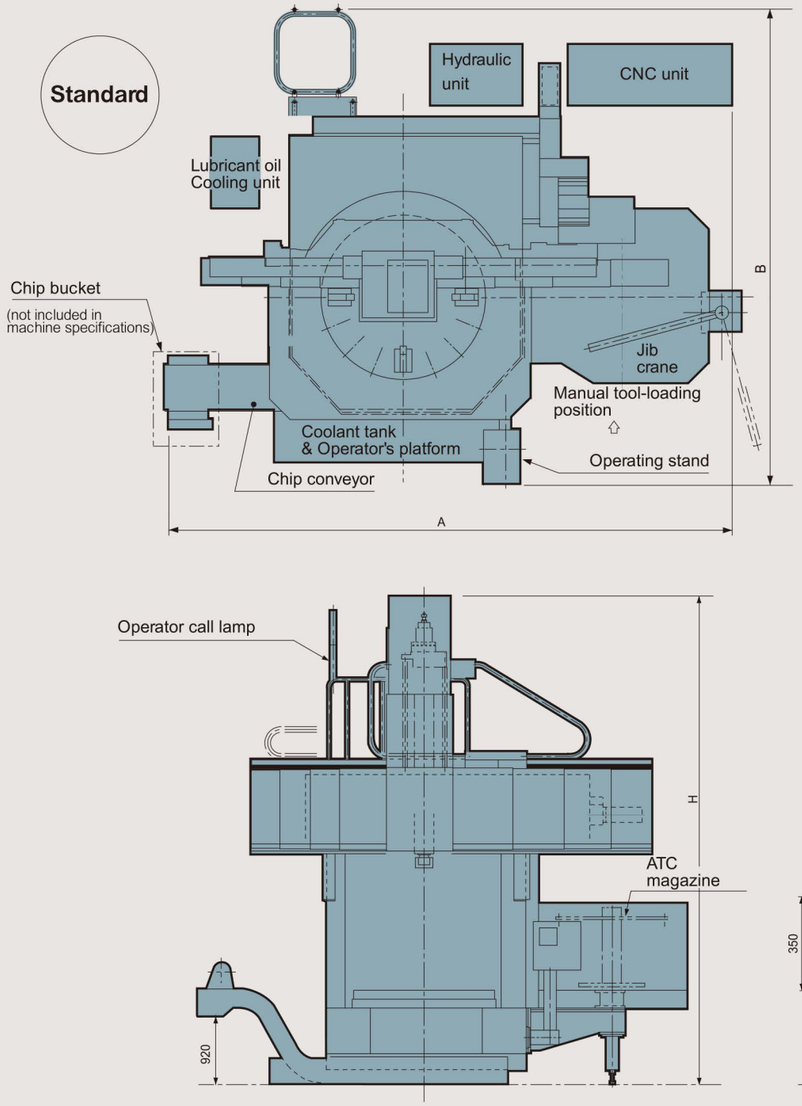
Machine Specifications				TMD-13	TMD-16	TMD-20
Power sources	Electrical power supply			AC200/220V±10%, 50/60Hz±1Hz		
	Power capacity		kVA	100		
	Compressed air supply	Pressure	MPa(psi)	0.5～0.8 (72.5～116.0)		
	Flowrate	Without APC	ℓ/min (SCFM)	300 (11) air compressor 2.2kW 〔3.0HP〕 〈with ATC〉		
		With APC		720 (25) air compressor 5.5kW 〔7.4HP〕 〈with ATC, APC〉		
Machine size	Machine height		mm(in)	5 500 (216.5)	5 750 (226.4)	6 300 (248)
	Floor space	Without APC		4 460×5 740 (176×226)	4 805×6 080 (190×240)	5 790×6 670 (228×263)
		With APC		6 520×6 620 (257×260)	7 320×7 360 (289×290)	8 885×8 400 (350×331)
	Machine weight (not include options)	Without APC	kg(lb)	20 000 (44 090)	24 000 (52 900)	34 000 (75 000)
		With APC		28 000 (61 730)	33 000 (72 750)	49 000 (108 000)
Accuracy	Positioning accuracy of linear axis		mm(in)	±0.007 / 500 (±0.0003 / 20)		
	Repeatability of linear axis			±0.003 (±0.0001)		
	Positioning accuracy of rotary axis			±10" / 360°		
	Repeatability of rotary axis			±5"		
Painting color	Standard exterior paint color			Munsell 5Y8.4 / 0.5 & N2.5		
	Standard interior paint color			Munsell 10YR8 / 4		



TMD Series

TMD series

Machine general views



without APC

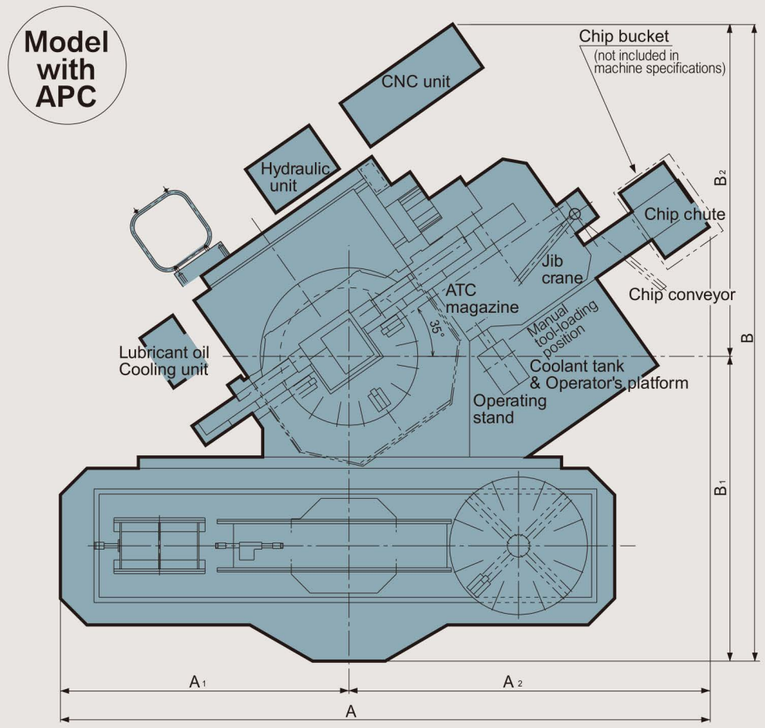
mm(in)

	TMD-13	TMD-16	TMD-20
A	5 740 (226)	6 080 (240)	6 670 (263)
B	4 460 (176)	4 805 (190)	5 790 (228)
H	5 500 (216.5)	5 750 (226.4)	6 300 (248)

with APC

mm(in)

	TMD-13	TMD-16	TMD-20
A	6 620 (260)	7 360 (290)	8 400 (331)
A_1	2 750 (109)	3 350 (132)	4 200 (166)
A_2	3 870 (152)	4 010 (158)	4 200 (166)
B	6 520 (257)	7 320 (289)	8 885 (350)
B_1	2 970 (117)	3 540 (140)	4 475 (176)
B_2	3 550 (140)	3 780 (149)	4 410 (174)
H	5 500 (216.5)	5 750 (226.4)	6 300 (248)



View shows for model TMD-13, 16.

An extensive line-up of peripheral equipment

Standard Accessories

1	Installation parts	1set
2	Special service tools	1set
3	Chip guard (When a coolant unit is provided, the splash guard serves also as a chip guard.)	1set
4	Automatic slideway lubricating unit	1set
5	Crossrail step positioning unit	1set
6	Locally operated 4-jaw chuck (4pcs.) (When the APC is provided, jaws included in a pallet serve also as a chuck.)	1set
7	Crossrail slide cover	1set
8	Automatic power OFF device	1set
9	Table lubricant oil cooling unit	1set

10 Automatic diameter and step difference measuring device

Optional Accessories

1 Coolant unit (only water-soluble coolant can be used.)

Item	TMD-13	TMD-16	TMD-20
Pump motor	2.2kW (3.0HP)×1		3.0kW (4.0HP)×1
Pump capacity	30 ℓ/min (7.9 gal / min)		
Tank capacity	500 ℓ (132 gal)	600 ℓ (158 gal)	700 ℓ (184 gal)
Splash guard	When the ATC or APC is provided, auto doors are equipped on the splash guard.		

2 Automatic tool changer (ATC)
- Tool storage capacity : 24, 48 or 60 tools

No. of tools	24	48	60
For turning	8	16	20
For milling	16	32	40
Total tool weight kg(lb)	560 (1 230)	1 120 (2 460)	1 400 (3 080)

- Type of tool shank
  For turning : 7 / 24 taper No. 50 and flange
  For milling : 7 / 24 taper No. 50
- Type of pull stud : 50P
- Maximum tool size : 350W×150T×530L mm
  (13.7W×5.9T×20.8L in)
- Maximum tool weight : 50kg (110 lb)
- Method of tool selection : Soft tool pot address

3 Coolant washer (Chip flushing system)

4 Chip conveyor
- Motor : AC 4P, 0.4kW (0.5HP), 1pc.

5 Operator call lamp : This lamp is mounted on top of the column.

6 Work light : Halogen lamp 50W

7 ATC jib crane : This is for lifting a TMD tool holder.
- Maximum lifting load : 50kg (110 lb)

8 Through tool type coolant function
When a coolant-through tool is used together with this unit, coolant can be delivered to the tool tip.
- Delivery at coolant pump delivery port :
  15 ℓ / min, 8 kgf / cm² (3.9gal / min, 113psi)

9 Automatic pallet changer (APC)

Item		TMD-13	TMD-16	TMD-20
Maximum workpiece swing	mm (in)	1 600 (63.0) [1 400 (55.1)]	2 000 (78.7) [1 800 (70.9)]	2 700(106.3) [2 100 (82.7)]
Pallet changing time (machine dwell time)	min	1.5	2.0	3.0
Pallet (including locally operated 4-jaw chuck)	pcs	2	2	2
Maximum load on pallet	kg (lb)	4 000 (8 800)	5 000 (11 000)	7 000 (15 400)
Setup station rotation speed	min^{-1}	2.5	1.5	1.0

This dimensions in brackets [ ] are values in parentheses signify the maximum workpiece swing on the other pallet.

10 Automatic diameter and step difference measuring device

11 Automatic tool tip measuring device
(10 & 11 are included automatic tool compensation function)

12 X-axis linear scale feedback :
- Optical linear pulse scale (HEIDENHAIN)

13 C-axis rotary scale feedback :
- Optical rotary pulse scale (HEIDENHAIN)

14 Custom paint color (Machine exterior only)

15 Hand rails and ladder for maintenance

16 Various tool holders

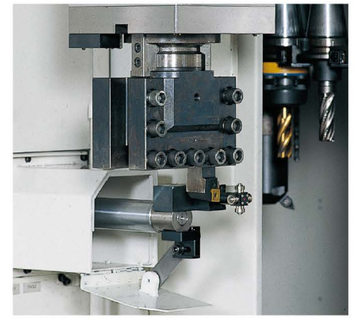
17 +250 mm High type column, +250 mm Ram travel extend

18 Roof cover (only APC type)

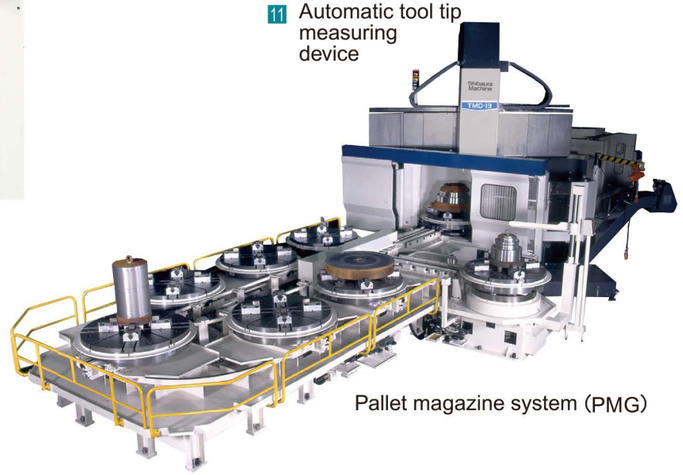
19 High speed spindle specification
max. 6 000 min^{-1}, 30/25 kW (40/33.5 HP)

TMD series

2 Automatic tool changer (ATC)
Photo shows for ATC 48/60 tools



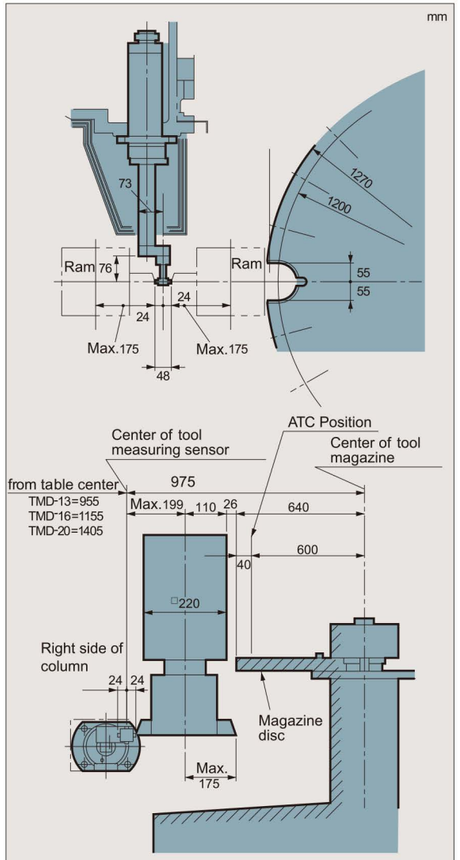
11 Automatic tool tip measuring device



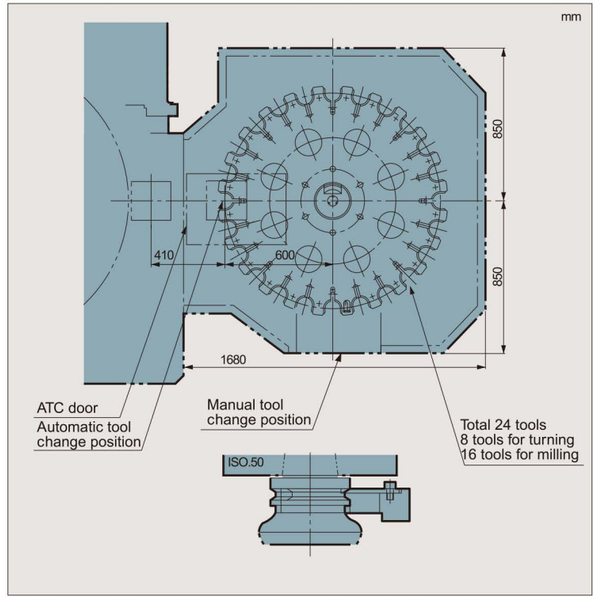
Pallet magazine system (PMG)

Automated functions (optional)

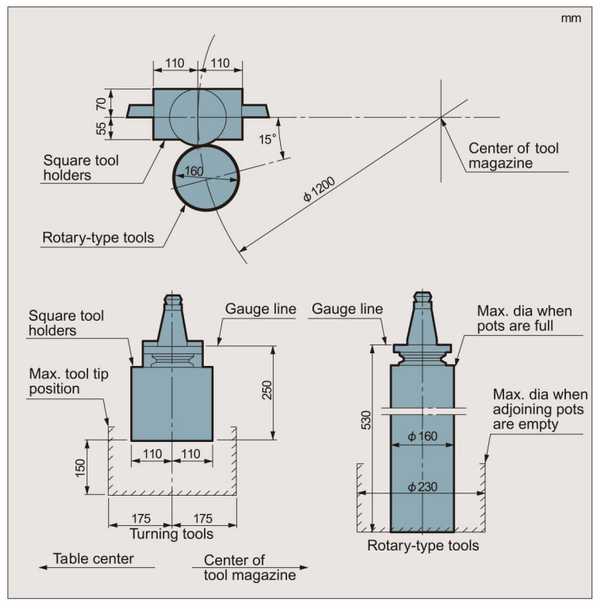
■ Automatic tool measuring unit



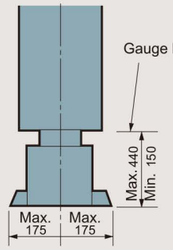
■ Automatic tool changer (ATC)



■ Maximum ATC tool dimension



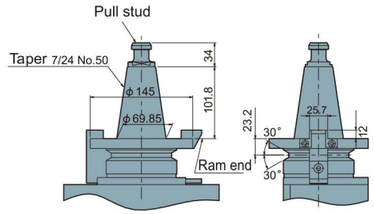
■ Dimension to be measured



Tool holders (optional)

TMD series

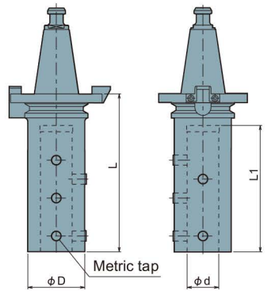
Tool shank & Pull stud



■ Pull stud

Thread		Type of tool holder
Metric	Standard	FMX50A-○○○○-○○○-J
	CTS - type ※	FMS50A-○○○○-○○○-JH
Inch	Standard	FMX50A-○○○○-○○○-JU
	CTS - type ※	FMS50A-○○○○-○○○-JHU

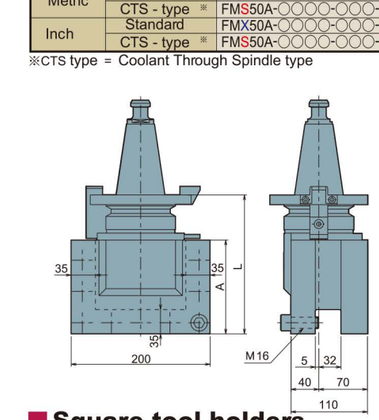
※CTS type = Coolant Through Spindle type



■ Side lock type holders (SL type)

mm

Model	Main dimension				
	D	d	L	L1	M tap
FMX50A-SL25-150-J	50	25	150	100	10
FMX50A-SL32-180-J	62	32	180	130	10
FMX50A-SL40-200-J	70	40	200	160	12
FMX50A-SL50-250-J	90	50	250	200	16
FMX50A-SL63-200-J	98	63	200	160	16
FMX50A-SL63-280-J	98	63	280	160	16

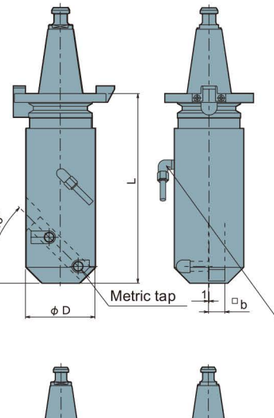


■ Square tool holders

mm

Model	Main dimension		Applicable tool size
	L	A	
FMX50A-ST-160-J	160	95	32×32
FMX50A-ST-200-J	200	135	
FMX50A-ST-250-J	250	185	

The initial of tool holder type for CTS is "FMS50A"

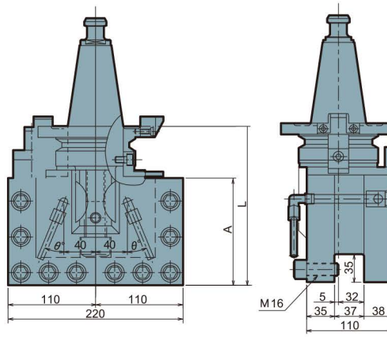


■ Boring tool holders (BA type)

mm

Model	Main dimension				Applicable tool size
	D	L	□b	M tap	
FMX50A-BA80-200-J	80	200	21	12	20×20
FMX50A-BA80-250-J		250			
FMX50A-BA80-300-J		300			
FMX50A-BA80-350-J		350			
FMX50A-BA110-250-J	110	250	26	16	25×25
FMX50A-BA110-300-J		300			
FMX50A-BA110-350-J		350			
FMX50A-BA110-400-J		400			

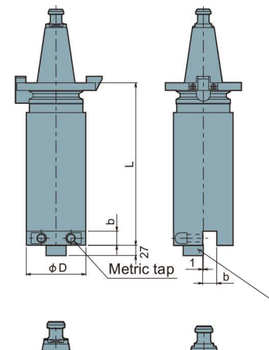
The initial of tool holder type for CTS is "FMS50A"



■ Square tool holders (OH type)

mm

Model	Main dimension		Applicable tool size
	L	A	
FMX50A-ST-160-OHS-J	160	95	32×32
FMX50A-ST-200-OHS-J	200	135	
FMX50A-ST-250-OHS-J	250	185	



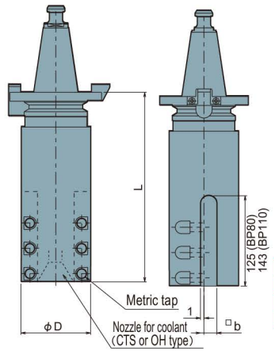
■ Boring tool holders (BF type)

mm

Model	Main dimension				Applicable tool size
	D	L	b	M tap	
FMX50A-BF80-200-J	80	200	21	12	20×20
FMX50A-BF80-250-J		250			
FMX50A-BF80-300-J		300			
FMX50A-BF80-350-J		350			
FMX50A-BF110-250-J	110	250	26	16	25×25
FMX50A-BF110-300-J		300			
FMX50A-BF110-350-J		350			
FMX50A-BF110-400-J		400			

The initial of tool holder type for CTS is "FMS50A"

Nozzle for coolant (CTS or OH type)



■ Boring tool holders (BP type)

mm

Model	Main dimension				Applicable tool size
	D	L	□b	M tap	
FMX50A-BP80-250-J	80	250	21	12	20×20
FMX50A-BP80-300-J		300			
FMX50A-BP80-350-J		350			
FMX50A-BP110-250-J	110	250	26	16	25×25
FMX50A-BP110-300-J		300			
FMX50A-BP110-350-J		350			
FMX50A-BP110-400-J		400			

The initial of tool holder type for CTS is "FMS50A"

Efficient operation panel

Manual operation

The operation panel includes all necessary controls for such manual operations as table start CW/CCW, rail head vertical/horizontal movement, mode selection, feedrate override, table speed override and MPG handwheel feed. As with conventional manual machines, efficient operation is possible through the panel while observing the tool tip.

Abundant NC functions for simplified and diverse machining operations

Such as constant surface speed control, multiple repetitive cycles for turning and custom macros are included in the pack specifications.

FANUC Series 31i-A

Basic Specifications

Axis control

Controlled axis (total)	3 axis
Simultaneous controllable axis	2 axis
Axis name	X, Z, C
Controlled axis detach	
Least input incrementIncrement system C	X, Z-axis 0.001 mm (0.0001 in) Diametrical designation for X-axis) C-axis 0.0001°
Interlock	All axis / each axis / automatic operation axis Block start Cutting block start
Machine lock	All axis
Emergency stop	
Over travel	1st : Stored stroke check 2nd : Emergency stop
Stored stroke check 1	
Mirror image	Each axis
Follow-up	At emergency stop
Servo off	
Chamfering on/off	

Operation

Automatic operation	Memory operation MDI operation
DNC operation	Reader/puncher interface is required.
DNC operation with memory card	CF card and PCMCIA card attachment is required.
Program number search	
Sequence number search	
Wrong operation prevention	
Buffer register	
Dry run	
Single block	
Manual continuous feed (JOG)	21 steps, X, Z-axis 0 ～ 2 000 mm/min (78.74 inch/min) C-axis 0 ～ 360 deg/min
Manual reference position return	
Reference position return speed set	
Reference position shift	

Interpolation

Positioning	G00 Linear interpolation type positioning is possible.
Exact stop mode	G61
Tapping mode	G63
Cutting mode	G64
Exact stop	G09
Linear interpolation	
Circular interpolation	G03, G04
Dwell	The stop time is specified by G04 code. (Max. 99999.999)
Thread cutting, synchronous cutting	Equal lead thread cutting
Multi threading	
Continuous threading	
Skip	
Reference position return	G28
Reference position return check	G27
2nd reference position return	G30

Feed function

Rapid traverse rate	Refer to specification "page-9".
Rapid traverse override	0~100%, 10%step
Feed per minute	1~2 000 mm/min (0.039~78.740 inch/min)
Feed per revolution	0.01~500.00 mm/rev (Not exceeding 2 000 mm/min)
Tangential speed constant control	
Cutting feedrate clamp	
Automatic acceleration/deceleration	Rapid traverse:linear Cutting feed:linear or exponential
Rapid traverse bell-shaped acceleration/deceleration	
Feedrate override	0~200%, 10% step(Not exceeding 2 000 mm/min)
Override cancel	
Linear acc/dec after cutting feed interpolation	

Program input

Tape code	EIA RS244, ISO840 automatic recognition
Label skip	
Parity check	Horizontal and vertical parity
Control in/out	
Optional block skip	1 pc.
Max. programmable dimension	±99999.999 mm (±9999.9999 inch)±9999.9999 deg
Program number / program file name	Program number : O4-digjit Program file name : 32 characters
Sequence number	N8 digit
Absolute / incremental programming	Combined use in the same block
Decimal point programming	
Diameter programming	X-axis
Plane selection	G17, G18, G19
Rotary axis designation	
Rotary axis roll over	
Coordinate system setting	
Automatic coordinate system setting	
Manual absolute on	
Programmable data input	G10
Programmable parameter input	
Sub program call	Subprogram: 10 folds nested
Canned cycles for turning	
Circular interpolation by R programming	
Coordinate system shift	

Auxiliary/spindle speed function

Miscellaneous function	M2-digits
Auxiliary function lock	
High-speed M,S,T,B interface	
Multiple command of auxiliary function	
Spindle speed function	S4-digits
Spindle override	0~120%, 5% step

Tool function/Tool compensation

Tool function	T2+2digits
Tool offset memory	32 pairs
Tool offset	
Tool offset value counter input	

Accuracy compensation

Backlash compensation	
Backlash compensation for each rapid traverse and cutting feed	
Smooth backlash compensation	

Editing operation

Part program storage size	64Kbyte (approximately 160m) (Among 64Kbyte, standard machine already uses 2Kbyte for sequence.)
Registerable programs	63pcs. (Among 63pcs, standard machine already uses 11 programs for sequence.)
Part program editing	
Program protect	
Extended part program editing	
Memory card program edit & operation	Max.63 programsThe tool on PC is required to convert and store files.

Setting and display

Status display	
Clock function	
Current position display	
Program comment display	
Parameter setting and display	
Alarm display	
Alarm history display	
Operation history display	
Actual cutting feedrate display	
Display of spindle speed and T code at all screens	
Operating monitor screen	
Servo setting screen	
Spindle setting screen	
Servo waveform display	
Maintenance information screen	
Input / output device setting screen	
Self-diagnosis function	
Dynamic display language switching	
Data protection key	
Erase CRT screen display	
Parameter set supporting screen	
Help function	
Self-diagnosis function	
Periodic maintenance screen	
Display of hardware and software configuration	
Servo information screen	

Data input/output

External key input	
External workpiece number search	
Memory card input/output	Program, Offset data, Parameter, Pitch error compensation data, Custom macro common variables data, Work coordinate setting data, Operation history data, Tool management data
Screen hard copy	
Automatic data backup	

Interface function

Embedded Ethernet	

Others

Status output signal	
Control unit incorporated type display unit	10.4 in. color LCD
MDI unit	Separate MDI
Servo motor	FANUC AC servo motor X-axis : Model α30/3000i Z-axis : Model α30/3000i (With brake) C-axis : Model α30/3000i
Servo amp.	FANUC AC servo amp. αi series SVM
Connectable position detector	Pulse coder / optical scale(2-pause pulse interface)
Spindle motor	FANUC AC spindle motor Table:Model αil40/6000 Spindle: Model α160LL/13000iB
Spindle amp.	FANUC AC spindle amp. αi series SPM
Environmental conditions (At operation)	Ambient temperature : 0°～58℃ Relative humidity: 95% or less

S Function

(1) Table rotation (S-code direct) is available on the turning mode.

	Low-Speed Range(M41)	High-Speed Range(M42)
TMD-13	S2～S120 (2～120 min^{-1})	S8～S450 (8～450min^{-1})
TMD-16	S2～S90 (2～90 min^{-1})	S8～S350 (8～350min^{-1})
TMD-20	S2～S62 (2～62 min^{-1})	S8～S250 (8～250min^{-1})

(2) Spindle rotation (S-code direct) is available on the milling mode.

standard	S25～S3000(25～3 000 min^{-1})
High speed option	S25～S6000 (25～6 000 min^{-1})

M Function

M00	Program stop
M01	Optional stop
M02	End of program
M03	Table and spindle forward rotation
M04	Table and spindle backward rotation
M05	Table and spindle stop
＊M08	Coolant ON
＊M09	Coolant OFF
M10	Through coolant ON
M11	Through coolant OFF
M14	Through tool coolant (CTT) selection
M15	Through spindle coolant (CTS) selection
M18	Table orientation stop
M19	Spindle orientation stop
＊M20	Chip conveyor forward
＊M21	Chip conveyor stop
＊M22	Coolant washer ON
＊M23	Coolant washer OFF
M30	End of program (Cut off electric power)
M32	Turning mode
M33	Milling mode
M36	Chamfering mode ON
M37	Chamfering mode OFF
M41	Table low-speed range
M42	Table high-speed range
M48	Cancel of M49
M49	Bypass override
M52	Manual tool change command
＊M55	Tool nose measuring mode
＊M56	Tool nose position detecting sensor advance
＊M57	Tool nose position detecting sensor retract
＊M06	Tool change
＊M63	ATC magazine feed
＊M64	ATC door open
＊M65	ATC door close
＊M66	Tool clamp
＊M67	Tool unclamp
M80	Crossrail M80 position (Crossrail at lowest position)
M81	Crossrail M81 position
M82	Crossrail M82 position
＊M83	Crossrail M83 position (TMD-20)
＊M84	Crossrail M84 position
＊M87	Tool in (ATC48/60)
＊M88	Changer arm lift up (ATC48/60)
＊M89	Changer arm lowering (ATC48/60)
＊M90	Changer arm magazine side (ATC48/60)
＊M91	Changer arm ATC side (ATC48/60)
＊M92	Changer arm initial position (ATC48/60)
＊M93	Magazine tool clamp (ATC48/60)
＊M94	magazine tool unclamp (ATC48/60)
＊M95	Changer arm jaw clamp (ATC48/60)
＊M96	Changer arm jaw unclamp (ATC48/60)
＊M97	Changer arm 180deg. turn (ATC48/60)
M98	Subprogram call
M99	Main program call

NC Options

Pack Specifications

Inch/metric conversion	
Program restart	
Manual handle feed	1 unit
Manual handle feed rate	x1 : 0.001mm (0.0001in) or 0.0001deg / pulse x10 : 0.010mm (0.001in) or 0.001deg / pulse x100 : 0.100mm (0.01in) or 0.01deg / pulse
Manual handle interruption	
Polar coordinate interpolation	
Thread cutting retract	
Optional block skip	(total) 9 pcs.
Workpiece coordinate system	G52～59
Workpiece coordinate system preset	G92.1
G code system	System B
Chamfering / corner R	
Custom macro	
Addition of custom macro common variables	#100~#199, #500~#999
Multiple repetitive cycles for turning	
Canned cycles for drilling	
Automatic corner override	
Tape format for FS15	
Spindle serial output	
Constant surface speed control	
Spindle orientation	
Spindle output switching function	
Rigid tap	
Tool offset memory B	
Tool nose radius compensation	
Tool management function	64 pairs
Stored pitch error compensation	
By-directional type pitch error compensation	
Back ground editing	
Multi part program editing	
Operator message history display	
Run hour and parts count display	
Multi language display	English
Graphic function	
Reader/puncher interface	Ch.1
External data input	Including External tool offset, External reference position shift and External message

Special Specifications

Simultaneous controllable axis	3 axis
Stored stroke check 2,3	G22/G23
Stored limit check before move	
Chuck and tale stock barrier	
Sequence number comparison and stop	
Tool retract and recover	
Cylindrical interpolation	G07.1
Helical interpolation	
Hypothetical axis interpolation	G07
Variable lead thread cutting	G34
Circular thread cutting	G35/G36
High speed skip function	Is necessary for automatic measuring options.
Addition of workpiece coordinate system	48 pairs
Direct drawing dimension programming	
Multiple repetitive cycles for turning Ⅱ	
Manual guide i	
Manual guide i basic	
Manual guide i milling cycle	
Manual guide i turning cycle	
Manual guide i animation	
Spindle positioning	
Tool offset pair	Total 64 pairs Total 99 pairs Total 200 pairs Total 400 pairs
2nd geometry tool offset	
Tool life management	
Part program storage size	Total 128Kbyte (approx. 1 050ft) Total 256Kbyte (approx. 2 100ft) Total 512Kbyte (approx. 4 200ft)
Number of registerable programs (*Note 1)	Expansion 1
Playback	
Machining time stamp	
Memory card program entry count extension	Max.1 000 pcs.
Fast data server	
Data server buffer mode	
Fast Ethernet	
Programmable mirror image	
Rotary axis control	
Program number O8-digit	

Note 1: Total expansion number depends on the part program storage size as follows.

Part program storage size	Number of registerable programs
64Kbyte	120
128Kbyte	250
256Kbyte	500
512Kbyte	1 000

Option	Registered program expansion (m)
Tool offset memory A	
Number of tool offsets Total 32 pairs	0
Number of tool offsets Total 64 pairs	1.5
Number of tool offsets Total 160 pairs	5.9
Tool offset memory B	
Number of tool offsets Total 32 pairs	1.5
Number of tool offsets Total 64 pairs	4.4
Number of tool offsets Total 160 pairs	13.2
Tool life management	5.9
Custom macro common variables 300 pcs.	2.2
Custom macro common variables 600 pcs.	7.4