

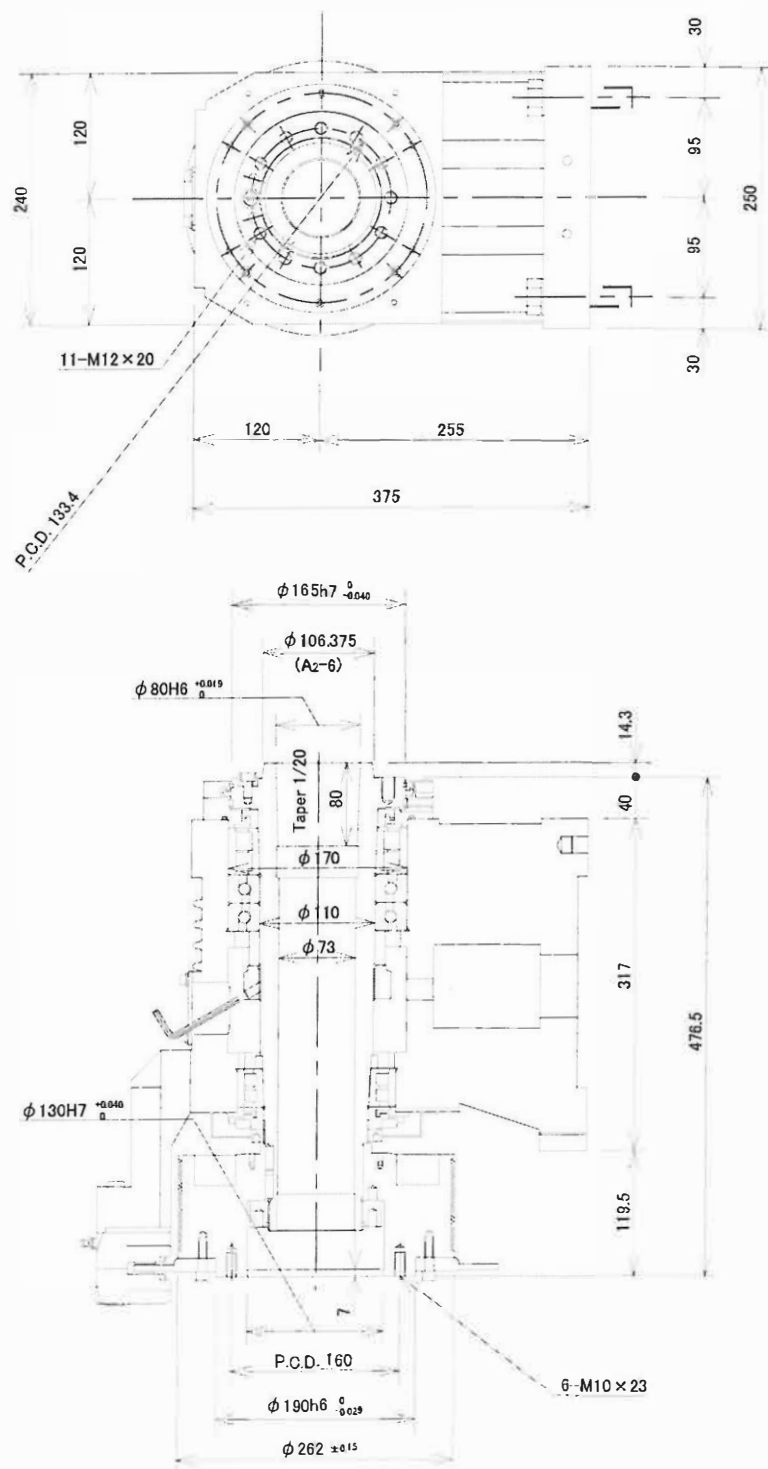


Fig. D5-1(d) Major dimensions of spindle (10 inch type, C-axis, milling)

5-2 Spindle speed/output diagram

Each spindle speed/output diagram is as shown in the following diagram.
Refer to the diagram corresponding to the machine specifications (Spindle motor output and maximum spindle speed).
The diagram does not indicate the machine efficiency.

FANUC MODEL β i18/10000 (11/7.5 kW) 4000 min⁻¹

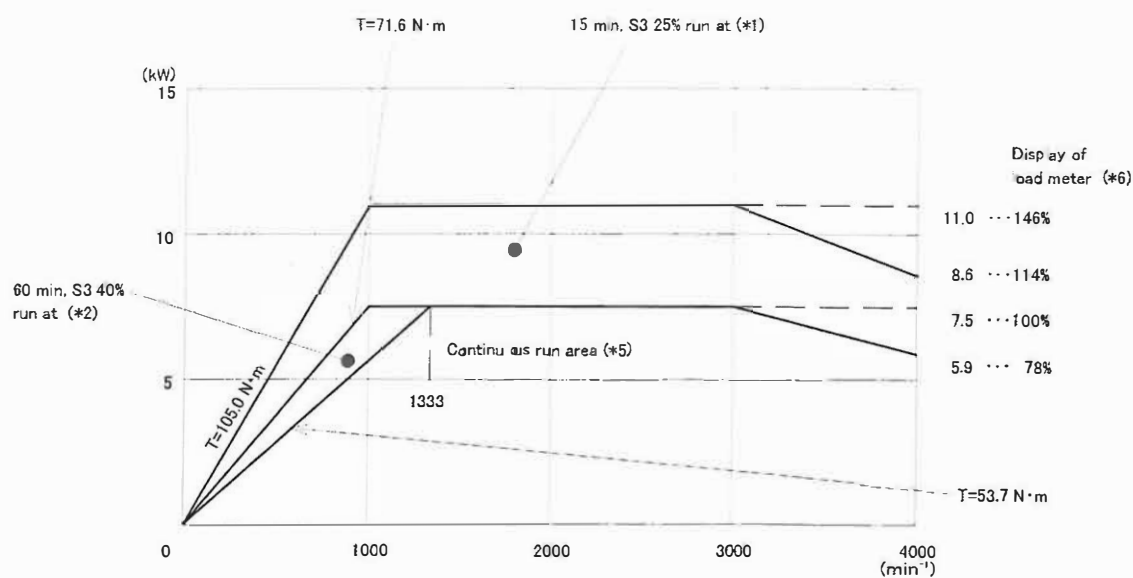


Fig. D5-2(a) Spindle speed/output diagram (8 inch type)

FANUC MODEL β i12/8000 (15/11 kW) 4000 min⁻¹

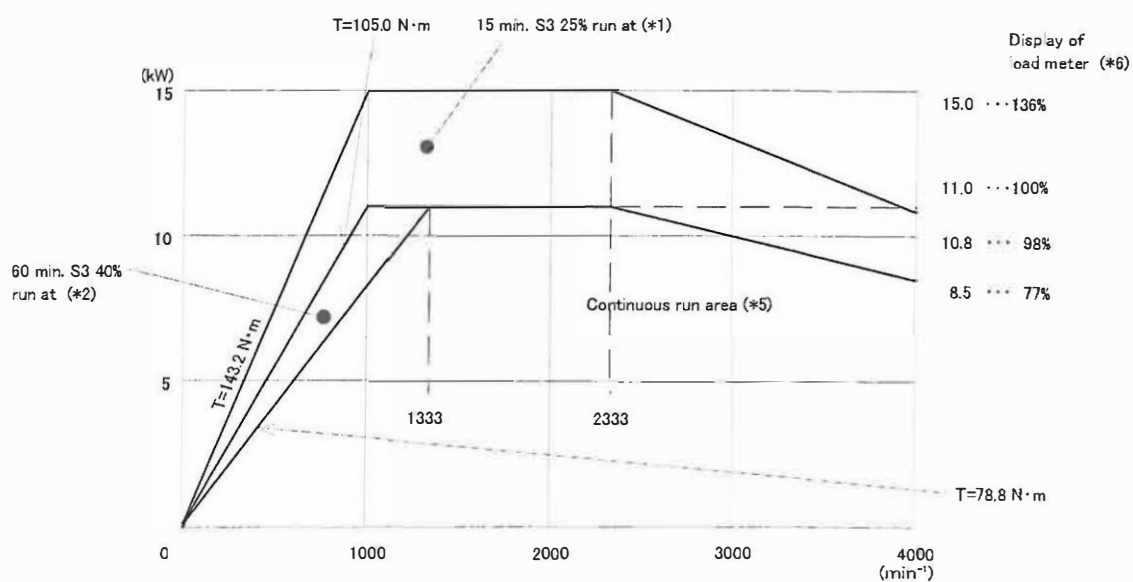


Fig. D5-2(b) Spindle speed/output diagram (8 inch type, 10 inch type)

FANUC MODEL α iI15/7000 (18.5/15 kW) 4000 min⁻¹

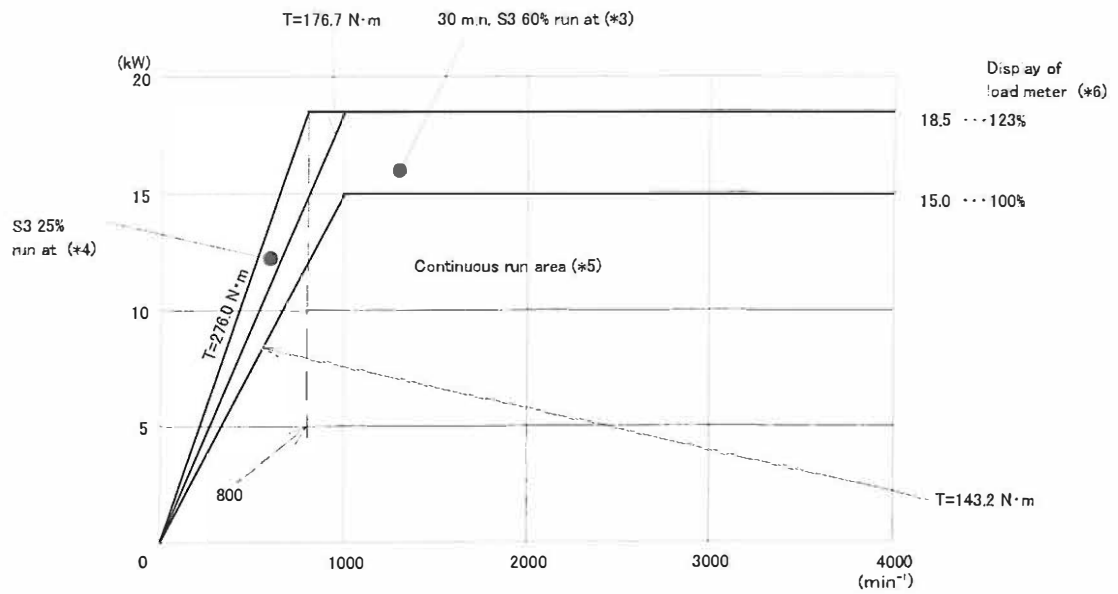


Fig. D5-2(c) Spindle speed/output diagram (10 inch type)

FANUC MODEL β iI8/10000 (11/7.5 kW) 3200 min⁻¹

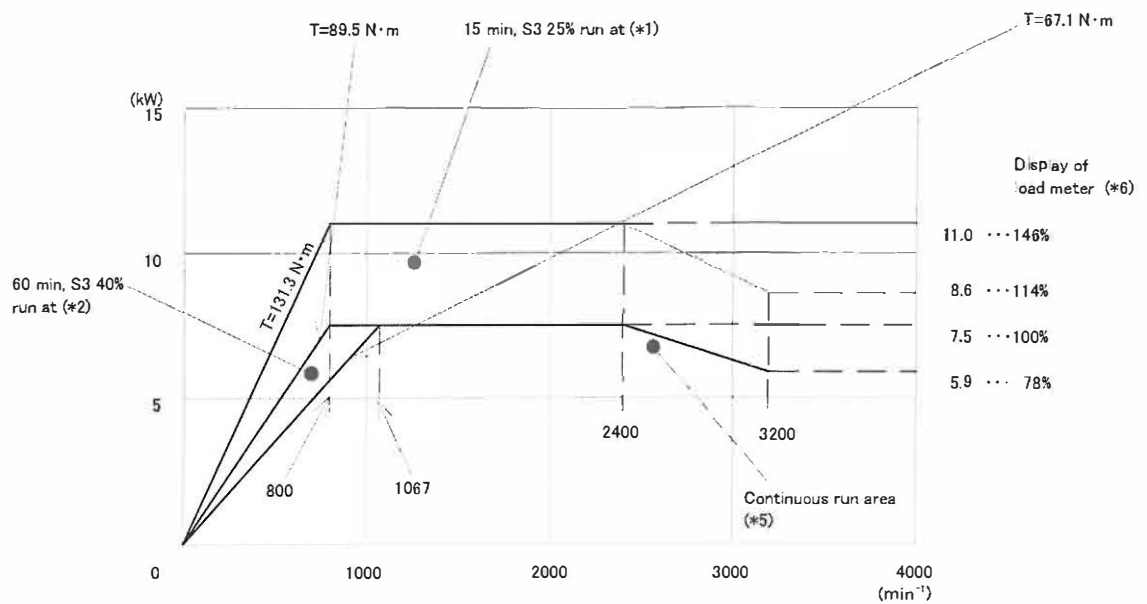


Fig. D5-2(d) Spindle speed/output diagram (8 inch type)

FANUC MODEL β iI12/8000 (15/11 kW) 3200 min⁻¹

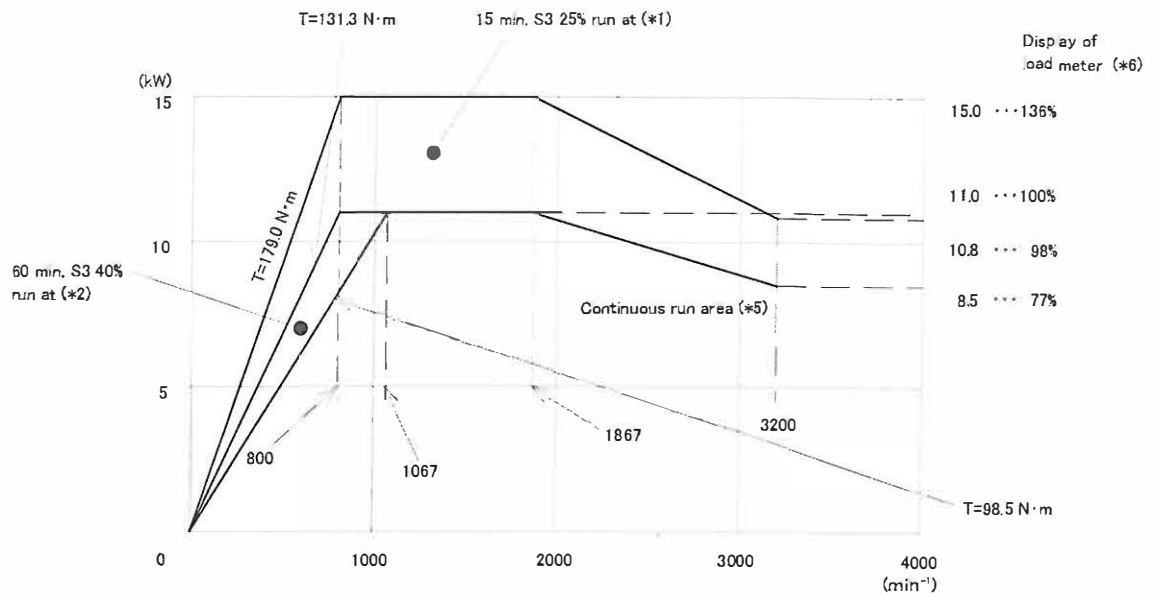


Fig. D5-2(e) Spindle speed/output diagram (8 inch type, 10 inch type)

FANUC MODEL α iI15/7000 (18.5/15 kW) 3200 min⁻¹

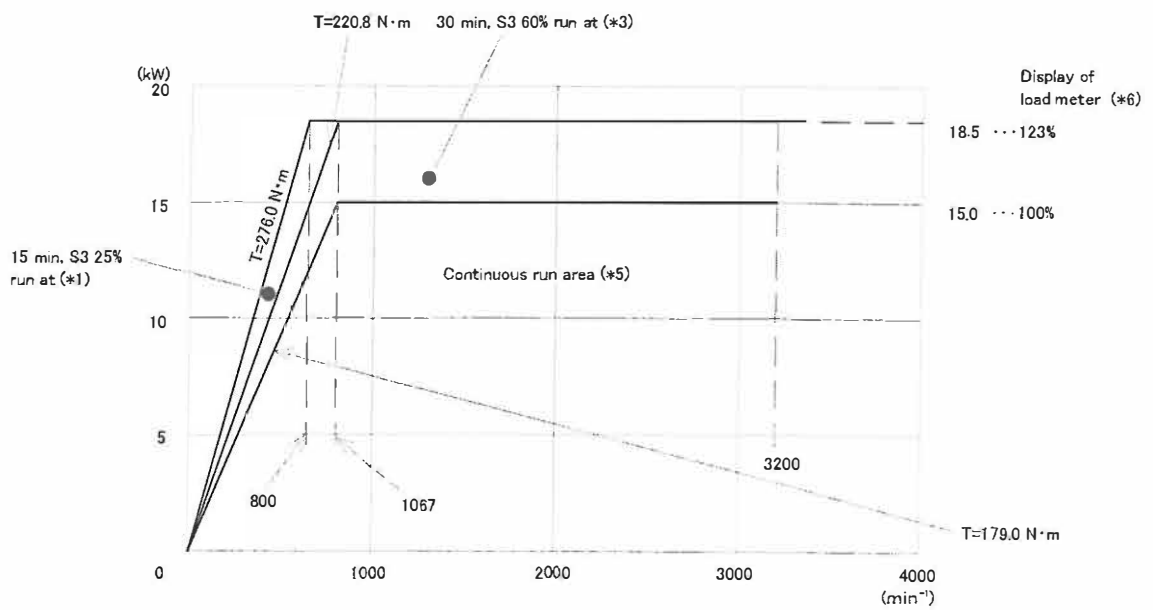


Fig. D5-2(f) Spindle speed/output diagram (10 inch type)

FANUC MODEL β iI8/10000 (11/7.5 kW) 2500 min⁻¹

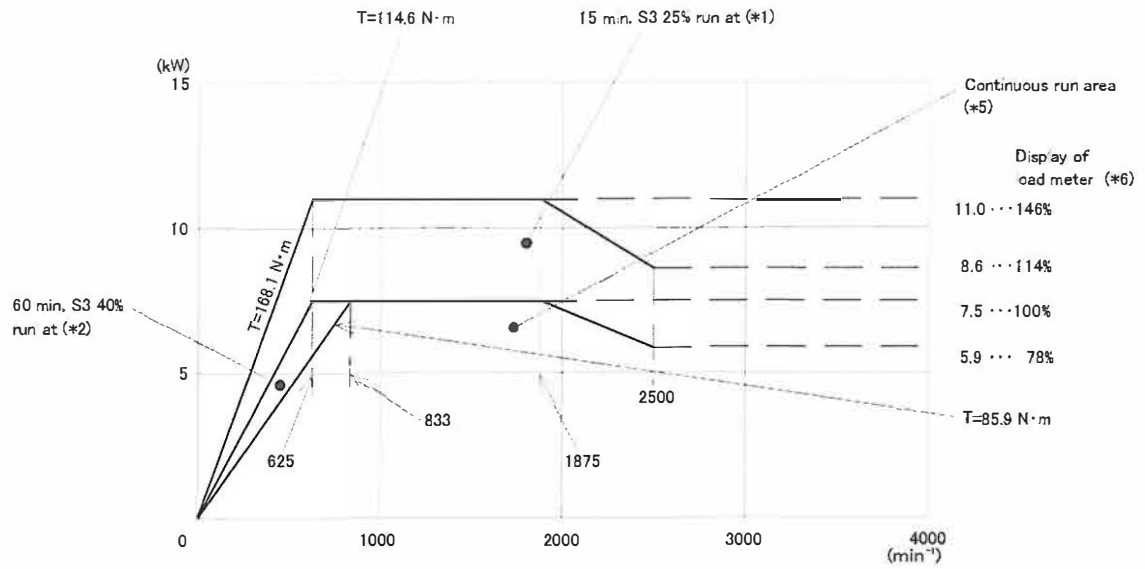


Fig. D5-2 (g) Spindle speed/output diagram (8 inch type)

FANUC MODEL β iI12/8000 (15/11 kW) 2500 min⁻¹

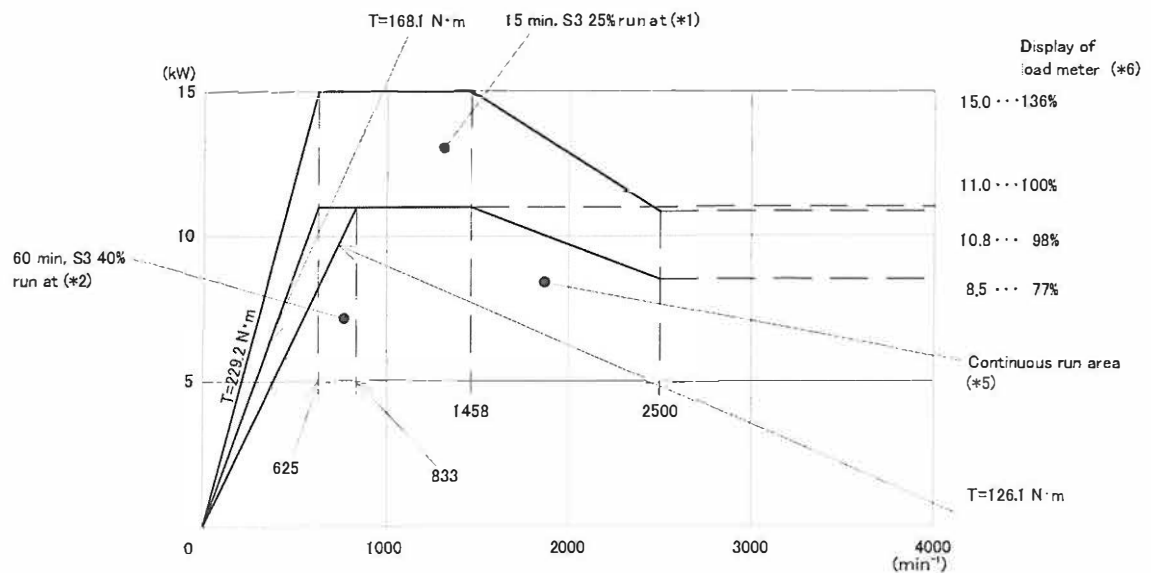


Fig. D5-2 (h) Spindle speed/output diagram (8 inch type, 10 inch type)

*1 : [15 min] is meaning case of constant load on machine.

It is shown 15 min possible of machine running from starting around temperature.

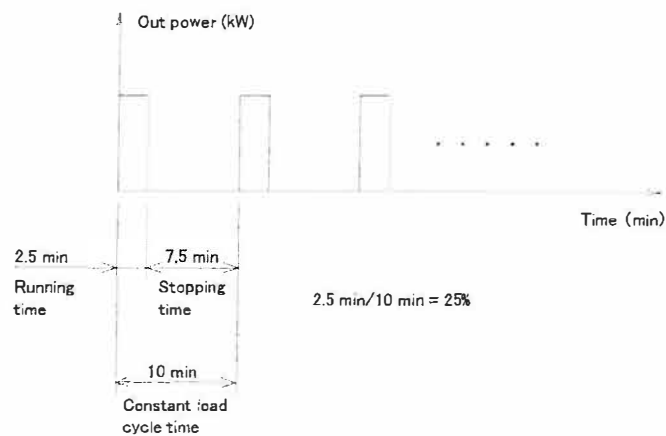
[S3 25%] is meaning case of constant load and stopping repeated on machine.

It is shown the constant running as under the condition.

Condition : The constant load cycle time is max 10 min.

The constant load running is 25%, that is 2.5 min. of the constant load cycle time.

The stopping time is last 7.5 min.



*2 : [60 min] is meaning case of constant load on machine.

It is shown 60 min possible of machine running from starting around temperature.

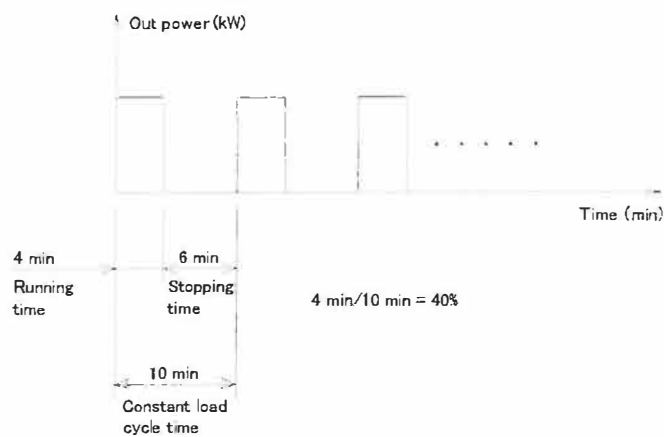
[S3 40%] is meaning case of constant load and stopping repeated on machine.

It is shown the constant running as under the condition.

Condition : The constant load cycle time is max 10 min.

The constant load running is 40%, that is 4 min. of the constant load cycle time.

The stopping time is last 6 min.



*3 : [30 min] is meaning case of constant load on machine.

It is shown 30 min possible of machine running from starting around temperature.

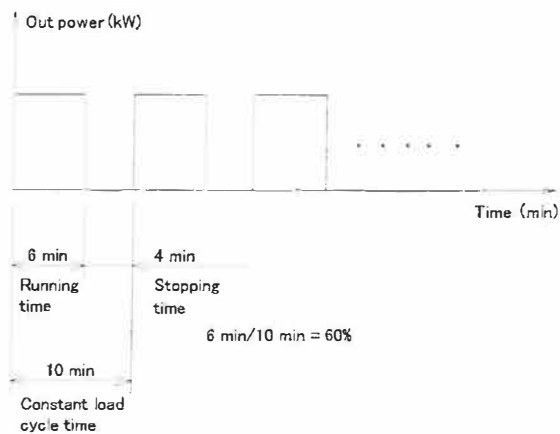
[S3 60%] is meaning case of constant load and stopping repeated on machine.

It is shown the constant running as under the condition.

Condition : The constant load cycle time is max 10 min.

The constant load running is 60%, that is 6 min. of the constant load cycle time.

The stopping time is last 4 min.



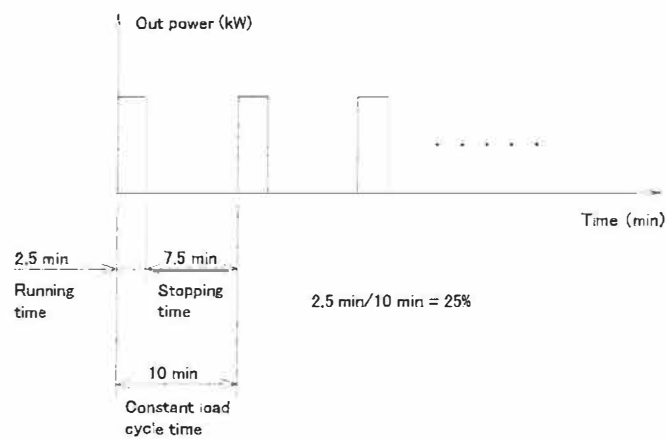
*4 : [S3 25%] is meaning case of constant load and stopping repeated on machine.

It is shown the constant running as under the condition.

Condition : The constant load cycle time is max 10 min.

The constant load running is 25%, that is 2.5 min. of the constant load cycle time.

The stopping time is last 7.5 min.



*5 : [Continuous run area] is shown constant running with some constant load.

*6 : The load meter of NC CRT is shown 100% for out put as continuous run area.

But no display with cutting lord.

5-3 Centering of headstock

When machining the outer workpiece dia. face, the workpiece can be in the taper shape and the end face of the workpiece can also be in the crown shape.

In this case, adjust the parallelism of the spindle by the following procedure.

< Adjusting steps >

* Headstock REF.: [Fig. 5-3 Centering of headstock]

- (1) With the test bar mounted to the spindle and the dial indicator mounted to the tool slide, allow the saddle to travel in the Z-axis direction.

At this time, read the deflection of the pointer.

- (2) If the deflection of the pointer is large, loosen bolts, which fix the headstock and adjust the parallelism of the spindle with the adjusting screws, watching the dial indicator.
- (3) After adjusting, completely tighten the mounting bolts of the headstock and travel the tool slide again.

At this time, read the deflection of the pointer to check the parallelism.

< Check item >

Parallelism of spindle ... every 1000 hrs.

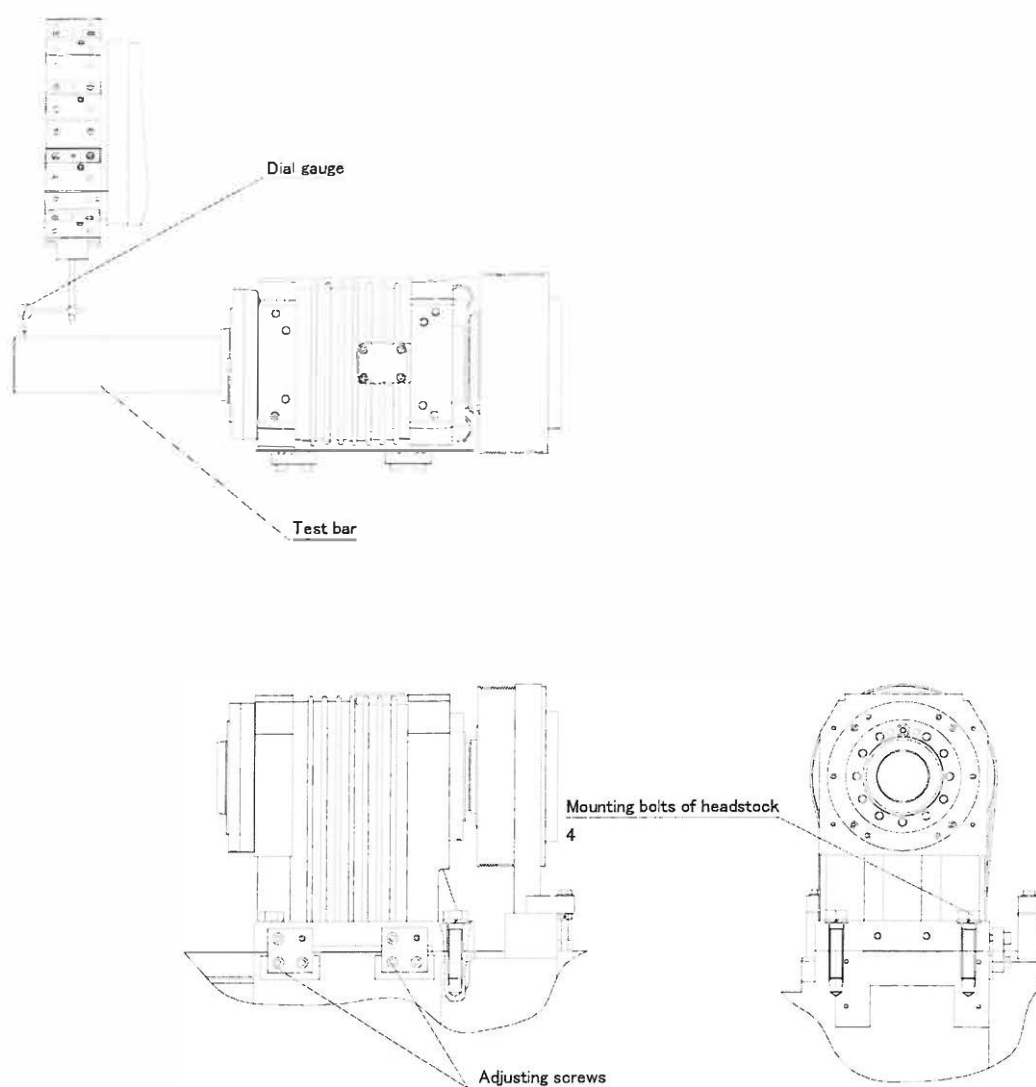


Fig. D5-3 Centering of headstock

5-4 Belt tension

The belt server for ensure transmitting the power of the spindle motor. Since this belt tension influences the cutting efficiency and parts service life, it is necessary to set the adequate tension. The belt may reduce the tension by extension or wear. Periodically check and adjust the belt. The adjusting bolts with four mounting bolts loosened adjust the belt tension.

The belt tension is measured by two kinds of UNITTA sonic belt tension meter and BANDO tension meter.

Our company adjusts the belt tension with the "UNITTA sonic belt tension meter (U-507)".

REF.: [Fig. D5-4(a), (b) Adjustment of belt tension]
[Table D5-4(a), (b) Belt tension]

< Check items >

- * Wear and crack of belt ... every 2000 hrs.
- * Belt tension every 2000 hrs.

If coolant or lubrication is adhered on the belt, it results in belt slip. Therefore, take care when the belt will be replaced.

Measuring methods by UNITTA sonic belt tension meter

Bring the measuring microphone close to the belt span center so as not to touch it to the belt.

Measure the belt tension, flipping the belt span by your finger to adjust the tension so as to be the measured value of [Table D5-4(a)].

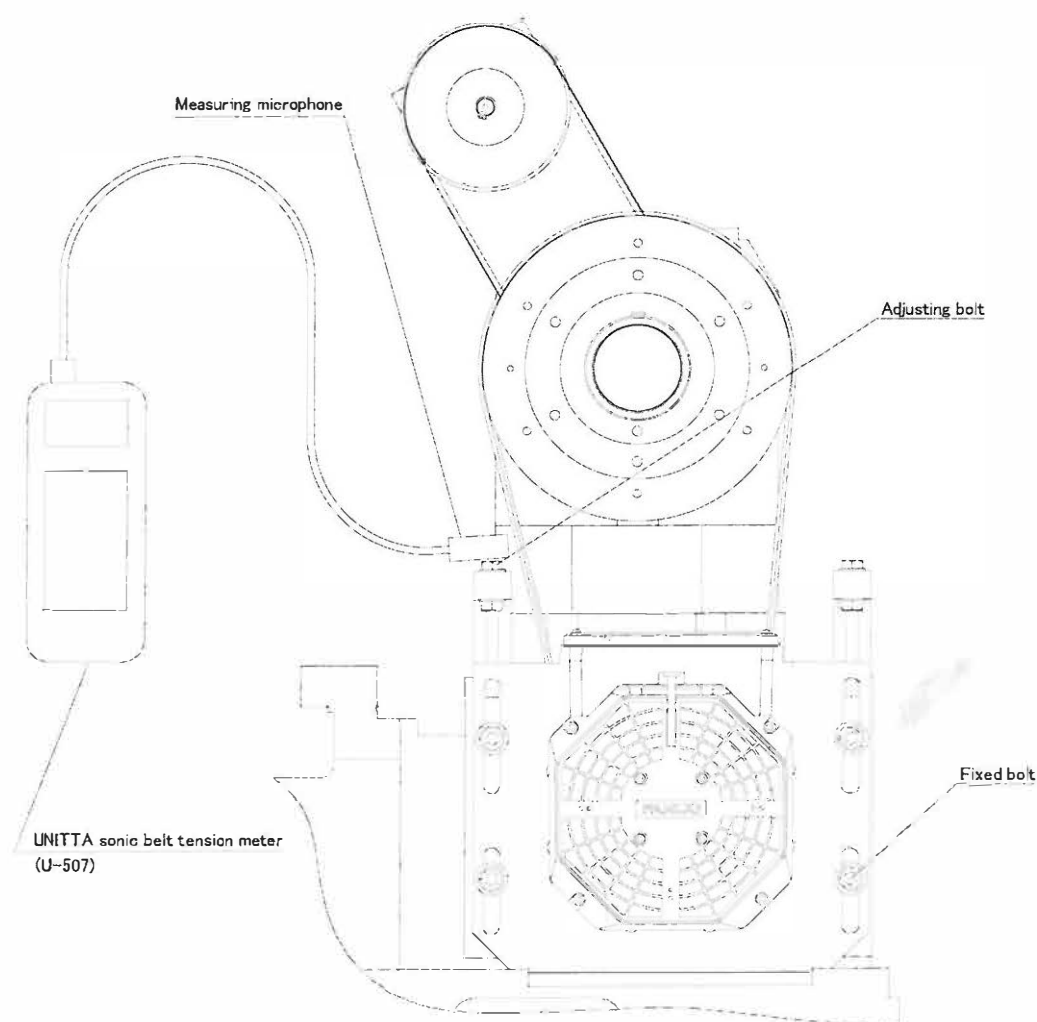


Fig. D5-4(a) Adjustment of belt tension (UNITTA sonic belt tension meter)

Chuck size	Spindle motor FANUC (kW)	Spindle speed (min ⁻¹)	Input value			Measured value
			Belt weight (g/rib × m)	Belt width (rib)	Belt span (mm)	Tension (N)
8"	β iI8/10000 (11/7.5)	2500	20	7	366	1170.8 to 1522.0
		3200		9	367	895.8 to 1164.6
		4000		7	364	712.5 to 926.2
	β iI12/8000 (15/11)	2500		9	366	1595.9 to 2074.6
		3200		7	367	1210.9 to 1572.2
		4000		10	364	973.0 to 1264.9
10"	β iI12/8000 (15/11)	2500		8	360	1463.5 to 1902.5
		3200		11	380	1122.8 to 1459.6
		4000		9	380	896.2 to 1165.1
	α iI15/7000 (18.5/15)	3200		9	380	1704.0 to 2215.2
		4000		7	380	1346.3 to 1570.4

Table. D5-4(a) Belt tension (UNITTA sonic belt tension meter)

Measuring methods by BANDO tension meter

The tension between the spindle motor and the spindle is adjusted so that the deflection will be L (mm) when pressing the belt span center with the force of P (N).

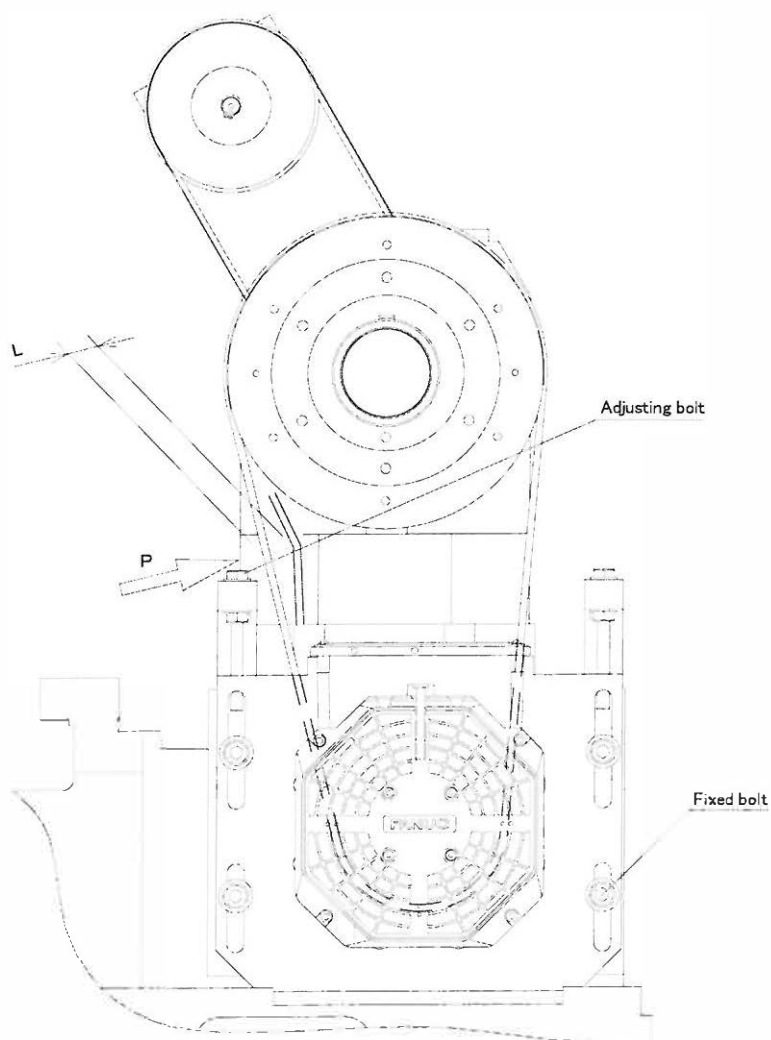


Fig. D5-4(b) Adjustment of belt tension (BANDO tension meter)

Chuck size	Spindle motor FANUC (kW)	Spindle speed (min ⁻¹)	Load P		Deflection L (mm)	Belt type (MITSUBOSHI)
			New	Readjusting		
8"	β iI8/10000 (11/7.5)	2500	113.7 N/7 rib	98.5 N/7 rib	5.9	2-7PK1280
		3200	89 N/9 rib	77.2 N/9 rib	5.9	9PK1320
		4000	70.7 N/7 rib	61.3 N/7 rib	5.8	7PK1360
	β iI12/8000 (15/11)	2500	154.7 N/9 rib	134.1 N/9 rib	5.9	2-9PK1280
		3200	117.5 N/7 rib	101.8 N/7 rib	5.9	2-7PK1320
		4000	96.8 N/10 rib	83.9 N/10 rib	5.8	10PK1360
10"	β iI12/8000 (15/11)	2500	141.7 N/8 rib	122.8 N/8 rib	5.8	2-8PK1320
		3200	111.4 N/11 rib	96.6 N/11 rib	6.1	11PK1400
		4000	89.1 N/9 rib	77.2 N/9 rib	6.1	9PK1450
	α iI15/7000 (18.5/15)	3200	164.8 N/9 rib	142.8 N/9 rib	6.1	2-9PK1400
		4000	130.2 N/7 rib	112.8 N/7 rib	6.1	2-7PK1450

Table D5-4(b) Belt tension (BANDO tension meter)

6 TOOL SLIDE

The tool slide is a total 10-station all holder type.

Also, the rich tooling systems feature various machining of the workpiece.

The index servomotor is used for the purpose of achieving the high speed indexing and the high productivity.

6-1 Major dimension of turret

The major dimensions of the turret are as follows.

For major dimensions of tool holder, etc., refer to [TOOLING MANUAL].

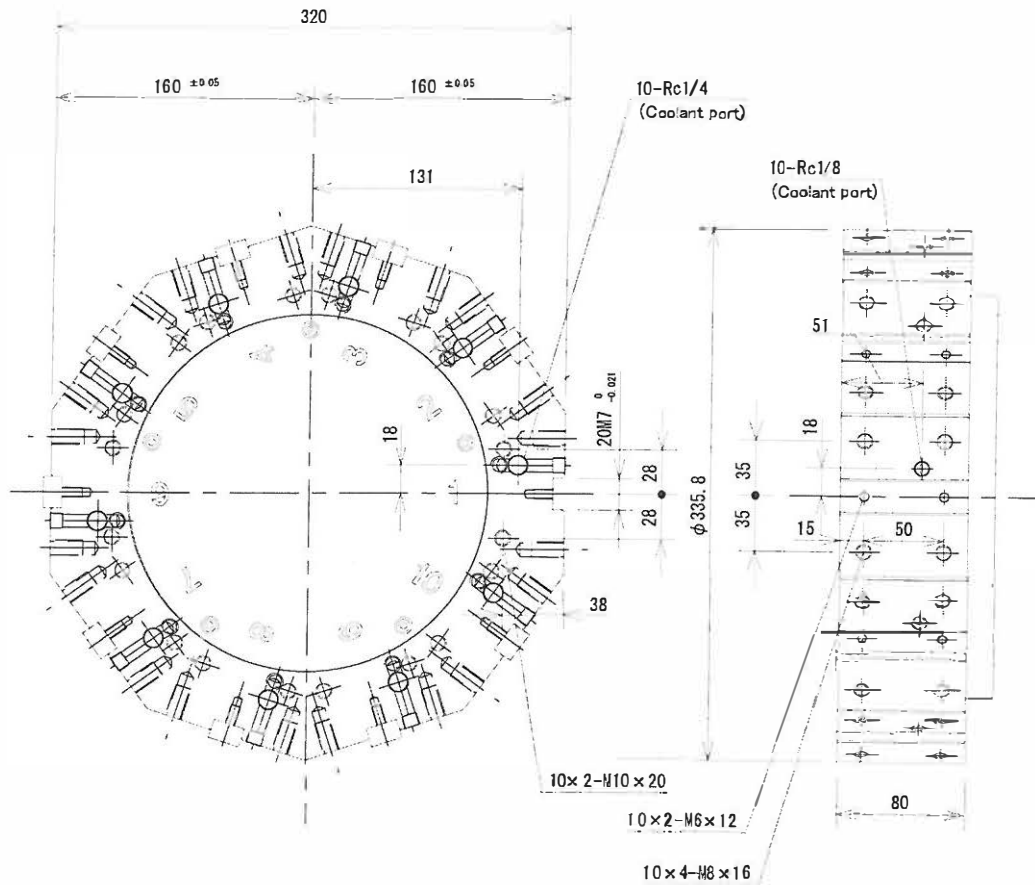


Fig. D6-1 (a) Major dimensions of turret

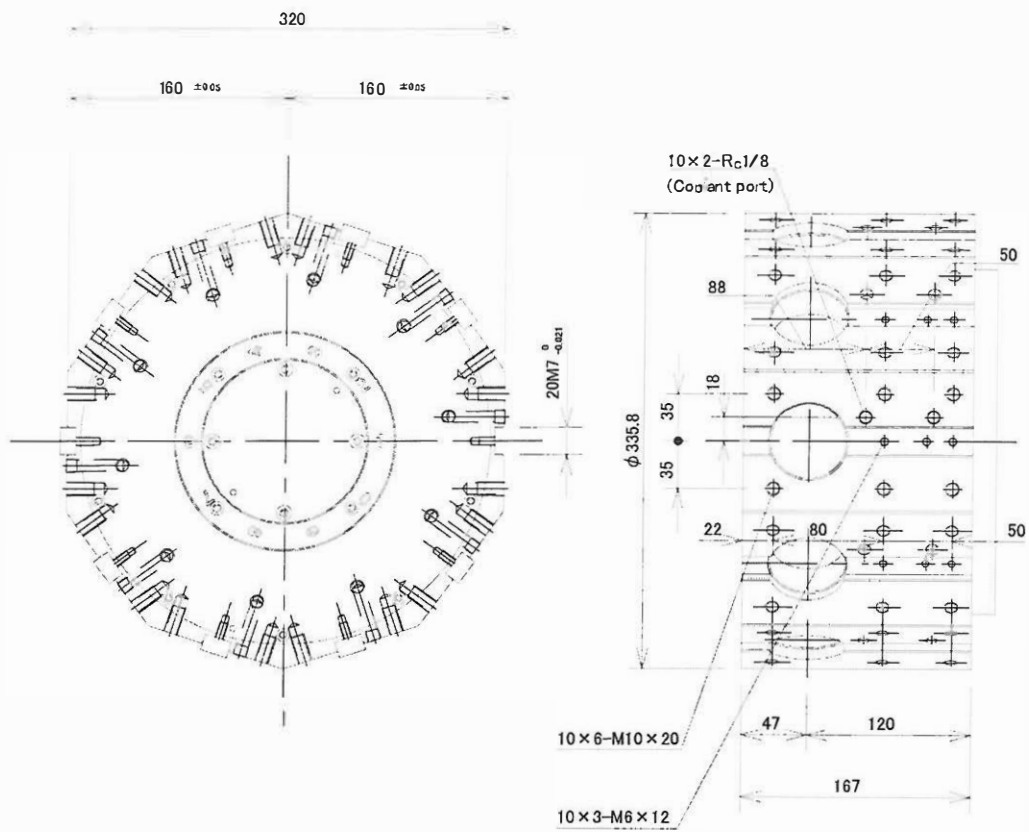


Fig. D6-1 (b) Major dimensions of turret (C-axis, milling)

6-2 Structure of tool slide

For each component name, arrangement and function, refer to [Fig. D6-2(a) to (b) Structure of tool slide].

The lubrication is forcedly lubricated with the lubrication pump.

REF.: [Chapter D, 9 LUBRICATION SYSTEM].

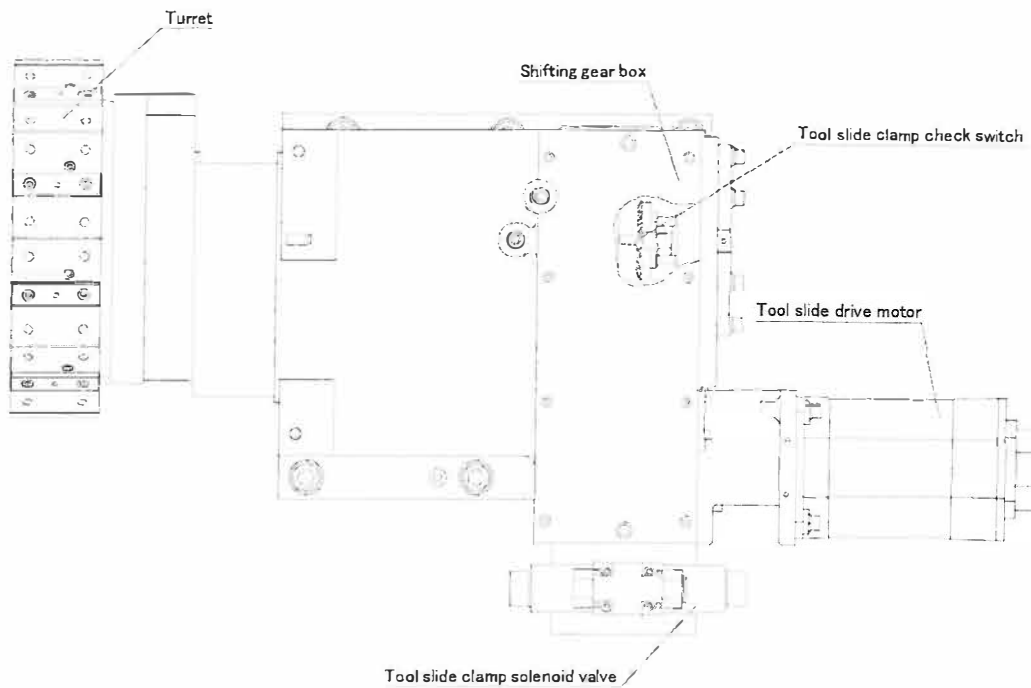


Fig. D6-2(a) Structure of tool slide

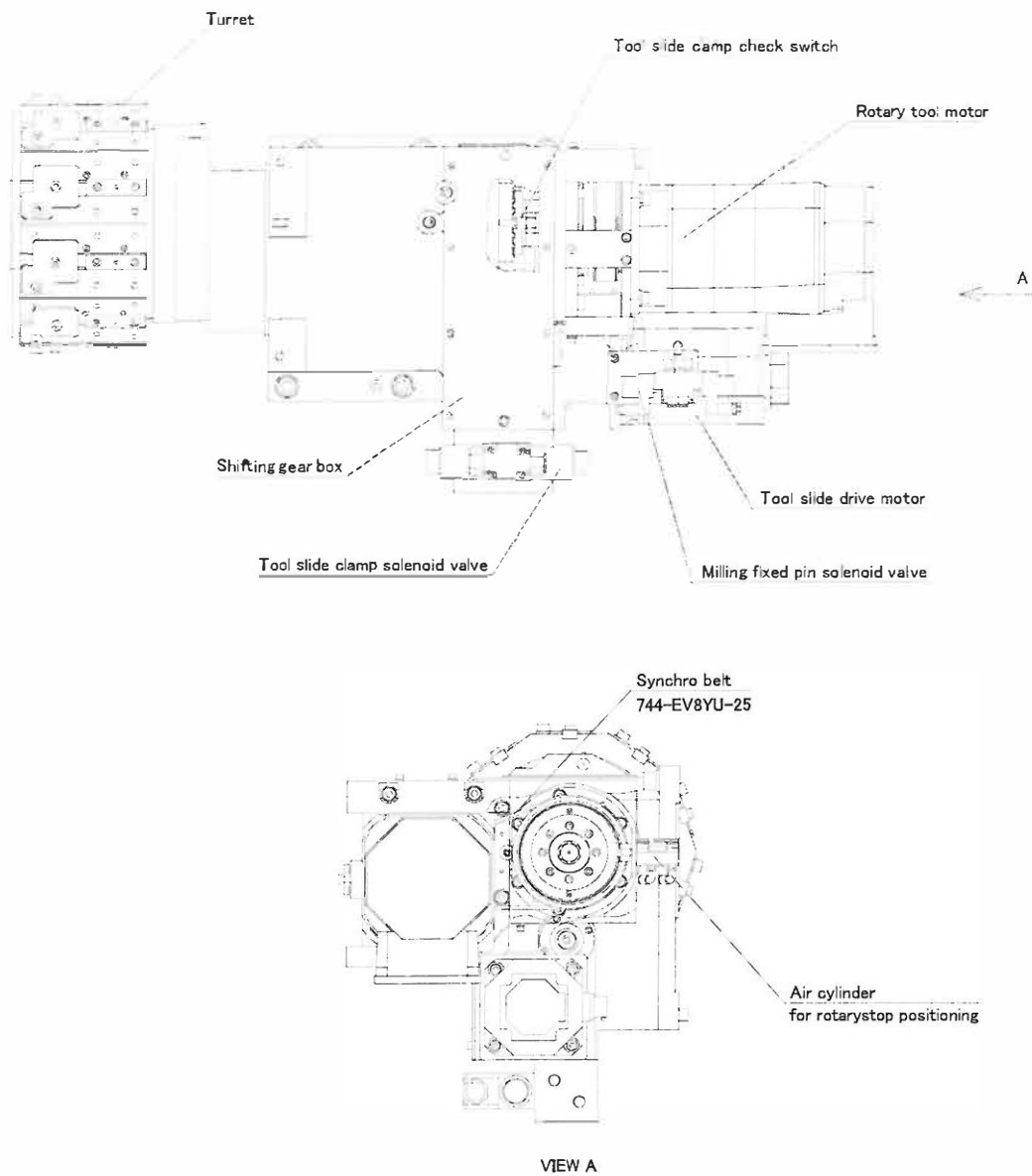


Fig. D6-2(b) Structure of tool slide (C-axis, milling)

6-3 Spindle speed for rotary tool/output diagram (C-axis, milling)

Each spindle speed/output diagram is as shown in the following diagram.
The diagram does not indicate the machine efficiency.

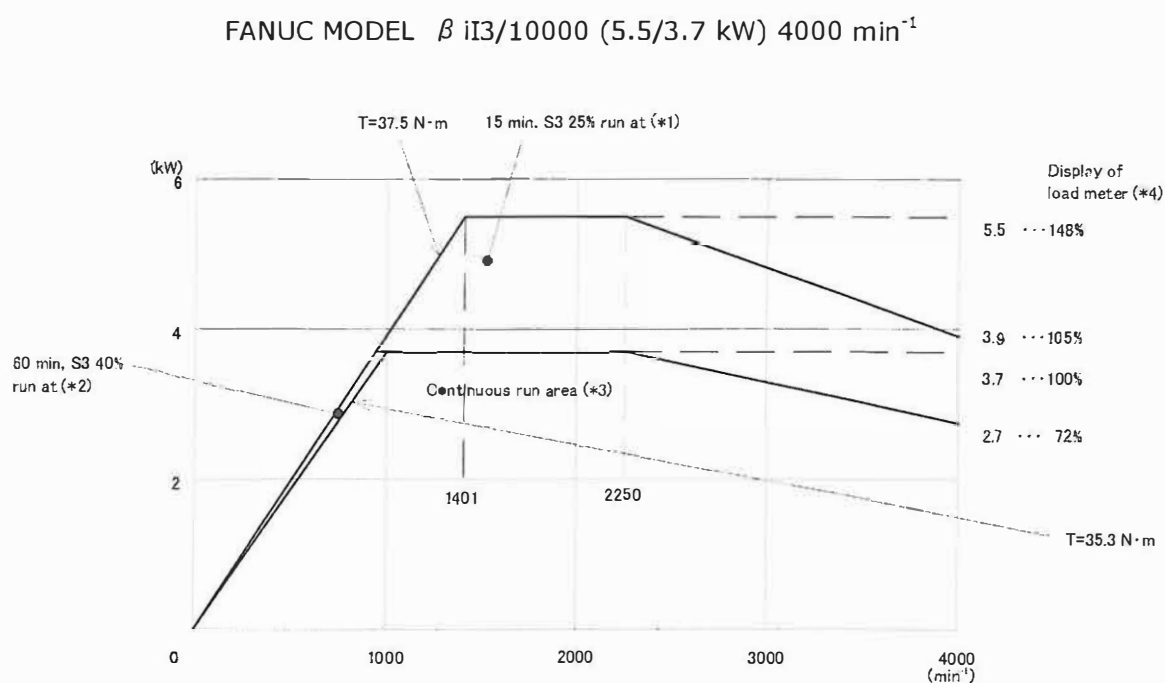


Fig. D6-3 Spindle speed for rotary tool/output diagram (8 inch/10 inch, milling)

*1 : [15 min] is meaning case of constant load on machine.

It is shown 15 min possible of machine running from starting around temperature.

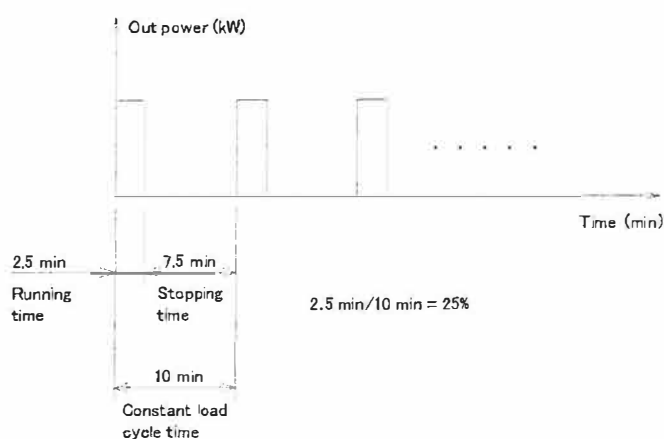
[S3 25%] is meaning case of constant load and stopping repeated on machine.

It is shown the constant running as under the condition.

Condition : The constant load cycle time is max 10 min.

The constant load running is 25%, that is 2.5 min. of the constant load cycle time.

The stopping time is last 7.5 min.



*2 : [60 min] is meaning case of constant load on machine.

It is shown 60 min possible of machine running from starting around temperature.

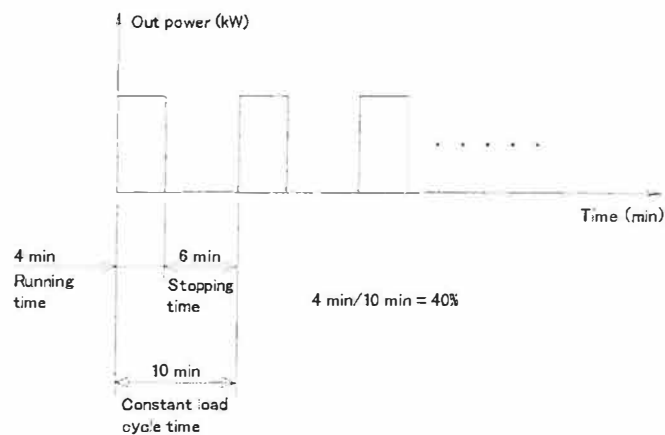
[S3 40%] is meaning case of constant load and stopping repeated on machine.

It is shown the constant running as under the condition.

Condition : The constant load cycle time is max 10 min.

The constant load running is 40%, that is 4 min. of the constant load cycle time.

The stopping time is last 6 min.



*3 : [Continuous run area] is shown constant running with some constant load.

*4 : The load meter of NC CRT is shown 100% for out put as continuous run area.

But no display with cutting load.

6-4 Origin adjustment of turret (Establishment of machine coordinate of servo motor for turret swing)

To index the turret, it is necessary to assign the absolute pulse coder (APC) incorporated into the turret swing servo motor and the turret swing position.

However, when status that the battery for backup of the absolute pulse coder goes out is continuous for a long period of time or the servo motor itself is replaced, the association of the absolute pulse coder and the machine position becomes lost.

[DS300 (T) APC ALARM : NEED REF RETURN] is displayed on the screen.

In this case, it is necessary to assign (hereinafter referred to as the establishment of machine coordinate) the absolute pulse coder and the machine position.

* : In case of a rotary tool type turret, change 3-axis to 7-axis for reading on the right side of machine, and 3-axis to 4-axis for reading on the left side of machine.

1. Outline of (first) establishment procedure of machine coordinate

[DS300 (T) APC ALARM : NEED REF RETURN] is displayed on the alarm screen.

Swing the turret 20° or more with the handwheel and stop the turret at index position No. 1 (T1).

Clamp the turret.

The correct index position where the coupling is engaged is regarded as an origin (0°) before assigning.

Turn On power.

Set NC parameter of 1815#4 to 1. (4 bit of 3rd-axis*)

2. Details of (first) establishment procedure of machine coordinate

(1) Turret handwheel swing mode

Press [RESET key] on MDI panel.

Press [Handwheel feed select switch of each axis] to change the feed mode to handwheel.

Press [Turret forward select switch] and [Turret reverse select switch] simultaneously for 1 second.

The turret is unclamped and [Turret origin indicating lamp] flickers.

In case of rotary tool type turret

The turret swing mode can be changed to handwheel for only when the rotary tool fixed pin is locked. To lock the rotary tool fixed pin, rotate the rotary tool once and stop the tool with the stop switch.

(2) Swing the turret by rotating the handwheel.

The turret swings 0.1° at 1 pulse of handwheel.

When rotating the handwheel one-revolution (100-pulse), the turret swings 10° .

To establish the machine coordinate, it is necessary to rotate the servo motor one-revolution or more. When swinging the turret 20° (by 2-revolution of handwheel), the servo motor is rotated one-revolution or more.

(3) After swinging the turret 20° or more, stop the turret at position of No. 1 (T1).

The turret stops at about its indexing position by using a hole discharging coolant.

(4) Clamp the turret.

Press [Turret indexing switch] several times to clamp and unclamp the turret.

When the coupling is engaged and clamped correctly, [Turret origin indicating lamp] goes out. When the coupling is unengaged and clamped incorrectly, [Turret origin indicating lamp] flickers quickly.

Adjusting the swing position finely with the handwheel, search for the position to be clamped correctly.

(5) When the turret is clamped correctly at No. 1 (T1), turn OFF the power of machine once.

(6) When turning ON the power of machine,

[DS300 (T) APC ALARM : NEED REF RETURN] is displayed.

(7) Set NC parameter 1815#4 to [1] from [0]. (4 bit of 3rd-axis*)

(8) Repower and cancel alarms.

(9) Perform a normal manual index and check the motion.

(10) Command a T-code and check that a commanded No. is indexed.

3. Fine readjusting (reestablishment) steps of machine coordinate

- (1) Index turret No. 1 (T1).
- (2) Set NC parameter 1815#4 to [0] from [1]. (4 bit of 3rd-axis*)
Although [000 PLEASE TURN OFF POWER] is displayed, return a number to [1] without respect to it.
- (3) Turn ON the power of machine again.
- (4) Perform a normal manual index and check its motion.
- (5) Command a T-code and check the commanded No. is indexed.

4. Displaying current position of turret on position screen

Set NC parameter 3115#0 to [0] from [1]. (0 bit of 3rd-axis*)
To eliminate display, set the number to [1].

7 CHUCK SYSTEM

The chuck system consists of the chuck, which clamps the workpiece and the hydraulic (pneumatic) cylinder which makes the clamping force.

The chuck system features the grasping of the workpiece, with standing the centrifugal force by spindle rotation and cutting resistance.

Since the chuck system is divided into various types, it is important to use the system suited to the workpiece shape.

TAKISAWA can offer various chuck system to meet various chucking methods.

7-1 Structure of chuck system

The solid type chuck is used for machining with the single end of workpiece chucked and the hollow type chuck is used for machining the bar.

The representative structure is as follows.

Example

Name	Type	Manufacturer
Hyd. solid chuck	H01MA-8S-A6-J (8 inch type)	HOWA
	H01MA-10S-A6-J (10 inch type)	
Hyd. solid cylinder	HH9C125	HOWA

Table D7-1 Chuck system

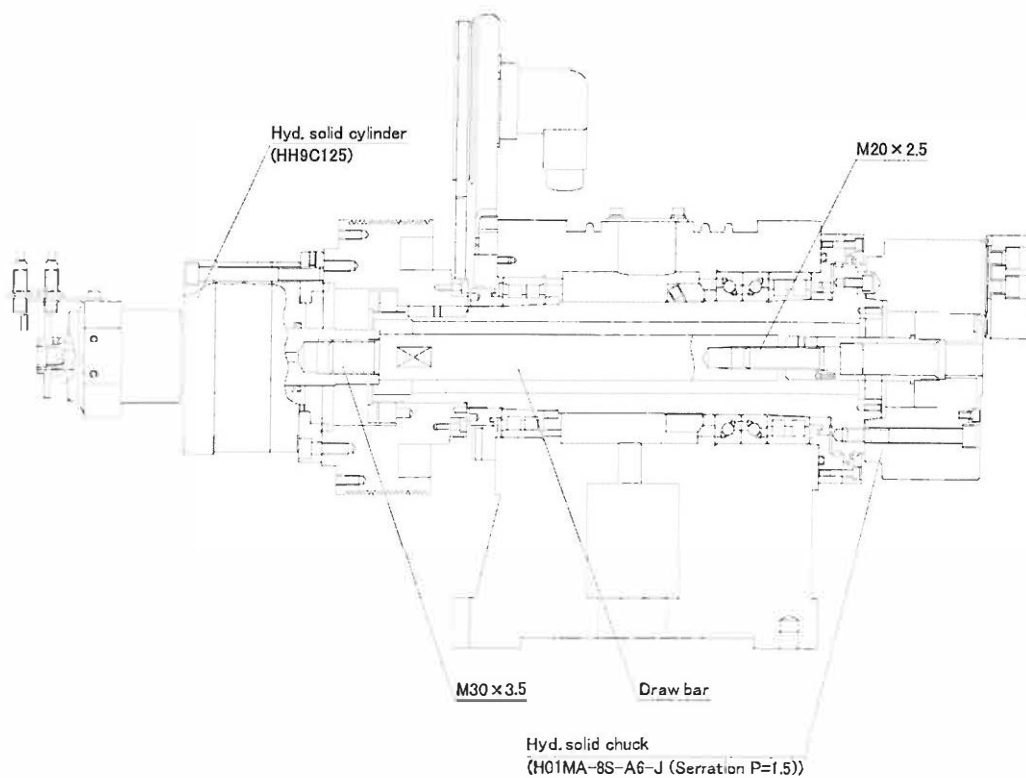


Fig. D7-1(a) Hydraulic solid chuck (8 inch type)

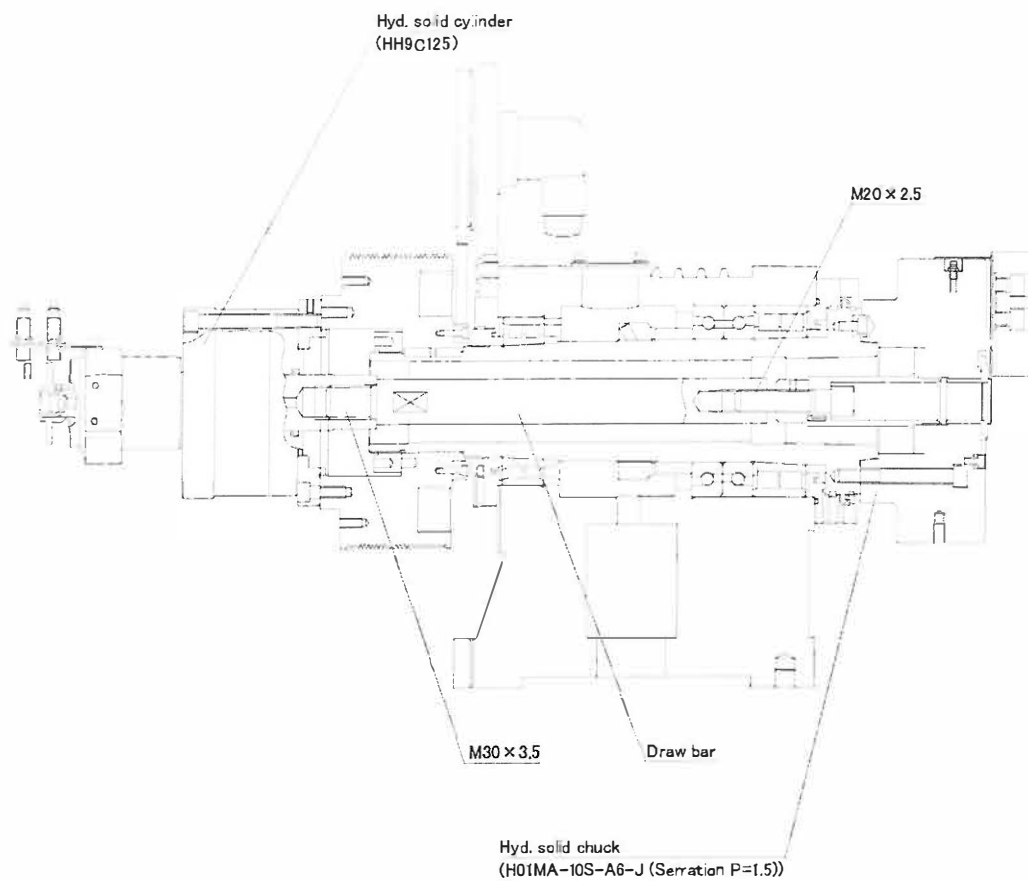


Fig. D7-1(b) Hydraulic solid chuck (10 inch type)

7-2 Hydraulic chuck

1. Chuck specifications

Type		8 inch	10 inch
Name		Solid chuck	
Manufacturer		HOWA	
Type		H01MA-8S-A6-J	H01MA-10S-A6-J
Jaw stroke (dia.)	mm	7	8.8
Chucking dia. (Max.)	mm	210	254
(Min.)	mm	18	24
Through hole dia.	mm	-	-
Allowable thrust	kN	24.5	30.4
Max. Static chucking force	kN	67.7	94.1
Max. permissible speed	min ⁻¹	4000	3500
Inertia moment	kg/m ²	0.11	0.26
Mass	kg	23.3	33.5

Table D7-2 Specifications of hydraulic chuck

2. Maintenance check

Periodically disassembly and clean the chuck.

When assembling, assemble the chuck, coating it with oil.

< Check items >

- * Disassembly and cleaning ... every 1000 hrs.
- * Check of chucking accuracy ... every 500 hrs.
- * Check of stroke ... every 500 hrs.
- * Cleaning of chuck jaws ... every 8 hrs.
- * Oiling of master jaw ... every 8 hrs.

Oil with the grease gun (Clamping force reduces if oil runs out to master jaw.)

Grease: Moricoat EP grease

Refer to [Chapter C, 3-1 Lubrication] for lubrication method.

Increase the oiling times so as not to run out the grease when the coolant discharges the chuck.

7-3 Hydraulic cylinder

1. Cylinder specifications

Type		8 inch	10 inch
Name		Solid cylinder	
Manufacturer		HOWA	
Type		HH9C125	
Through hole dia.	mm	-	
Inner dia.	mm	125	
Piston thrust (Press side)	mm	118.4	
(Draw side)	mm	103.1	
Jaw stroke (dia.)	mm	25	
Piston thrust (Press side)	mm	46	
(Draw side)	mm	42	
Max. Pressure	MPa	3.5	
Max. permissible speed	min ⁻¹	6000	
Inertia moment	kg/m ²	0.057	
Mass	kg	21	

Each piston thrust shows the value when the service pressure is 3.5 MPa.

Table D7-3 Specifications of hydraulic cylinder

2. Maintenance check

If oil leaks, disassemble and clean the cylinder and replace the O-ring with a new one.

When assembling the cylinder, take care so that the hydraulic piping ports are correctly connected.

< Check item >

Coolant recovery port ... every 8 hrs.

7-4 Chuck cylinder pressure and chucking force

Since the chucking force of the chuck is immediately reduced in accordance with increased spindle speed, take extreme care when the chucking force is set.

Refer to the [Relationship between hydraulic pressure and cylinder thrust] and [Spindle speed and chucking force characteristic diagram].

[Spindle speed and chucking force characteristic diagram] for the spindle speed is drawn on the basis of the values calculated at the max. allowable pressure of hydraulic chucking.

It is recommended to use it as reference values when determining the chucking force.

When the set hydraulic pressure is changed, find the cylinder thrust by the diagram of [Relationship between hydraulic pressure and cylinder thrust].

Also, find static chucking force (in spindle stop) by the found cylinder thrust.

This static chucking force shows the value on status in which the spindle stops.

Next, draw the characteristic diagram for the chucking force on the [Spindle speed and chucking force characteristic diagram].

At this time, the cross point of the curve and the spindle speed shows the chucking force.

Chucking forces of both 8 inch type and 10 inch type are found in the same manner.

< Example >

The following chucking force is found with the 10 inch type hydraulic chuck H01MA-10S-A6-J, and hydraulic cylinder HH9C125.

* Chuck pressure ... 1.5 MPa

* Spindle speed 2000 min⁻¹

- (1) Find the thrust at the hydraulic pressure 1.5 MPa from the [Relationship between hydraulic pressure and cylinder thrust] of 10 inch type.

$$F=17.74 \text{ kN}$$

- (2) In H01MA-10S-A6-J, since the static chucking force, when the cylinder thrust is 30.4 kN, is 94.1 kN, find the static chucking force when F=17.74 kN.

$$\Sigma S = \Sigma S_{\text{max.}} \times \frac{F}{F_{\text{max.}}} = 94.1 \times \frac{17.74}{30.4} = 54.91 \text{ kN}$$

- (3) Parallel lower the chucking force characteristic diagram where the start point is 94.1 kN at spindle speed 0 min⁻¹ so that the start point will be 54.91 kN before drawing.

- (4) When finding the cross point for the spindle speed 2000 min⁻¹ and reading the scale of chucking force on the following chucking force characteristic diagram, the required chucking force is found.

It is 31.73 kN at spindle speed 2000 min⁻¹.

As shown above, when the spindle stops and the cylinder thrust is 17.74 kN (hydraulic pressure 1.5 MPa), the chucking force of 54.91 kN shows that it lowers to 31.73 kN at spindle speed 2000 min⁻¹ and hydraulic pressure 1.5 MPa (cylinder thrust 17.74 kN).

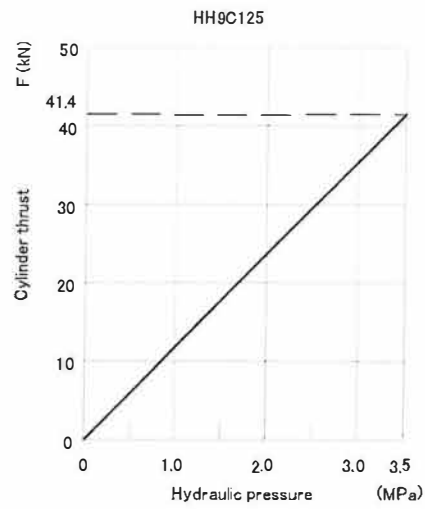


Fig. D7-4(a) Relationship between hydraulic pressure and cylinder thrust (8 inch type)

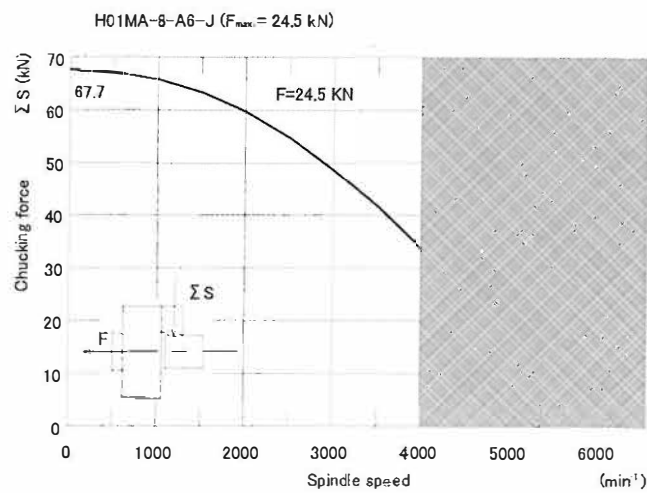


Fig. D7-4(b) Spindle speed and chucking force characteristic diagram (8 inch type)

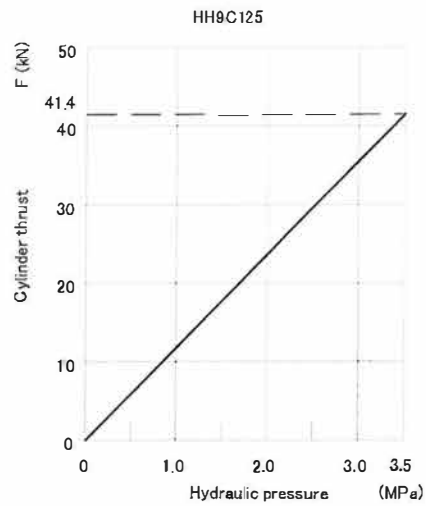


Fig. D7-4(c) Relationship between hydraulic pressure and cylinder thrust (10 inch type)

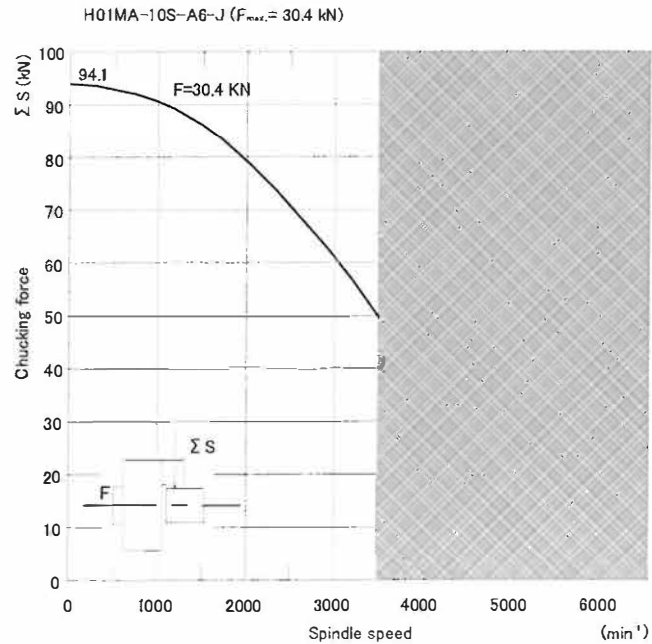


Fig. D7-4(d) Spindle speed and chucking force characteristic diagram (10 inch type)

8 HYDRAULIC SYSTEM

8-1 Hydraulic circuit diagram

The hydraulic system supplies the hydraulic pressure to the following functions.

The optional functions can be offered in addition to the above.

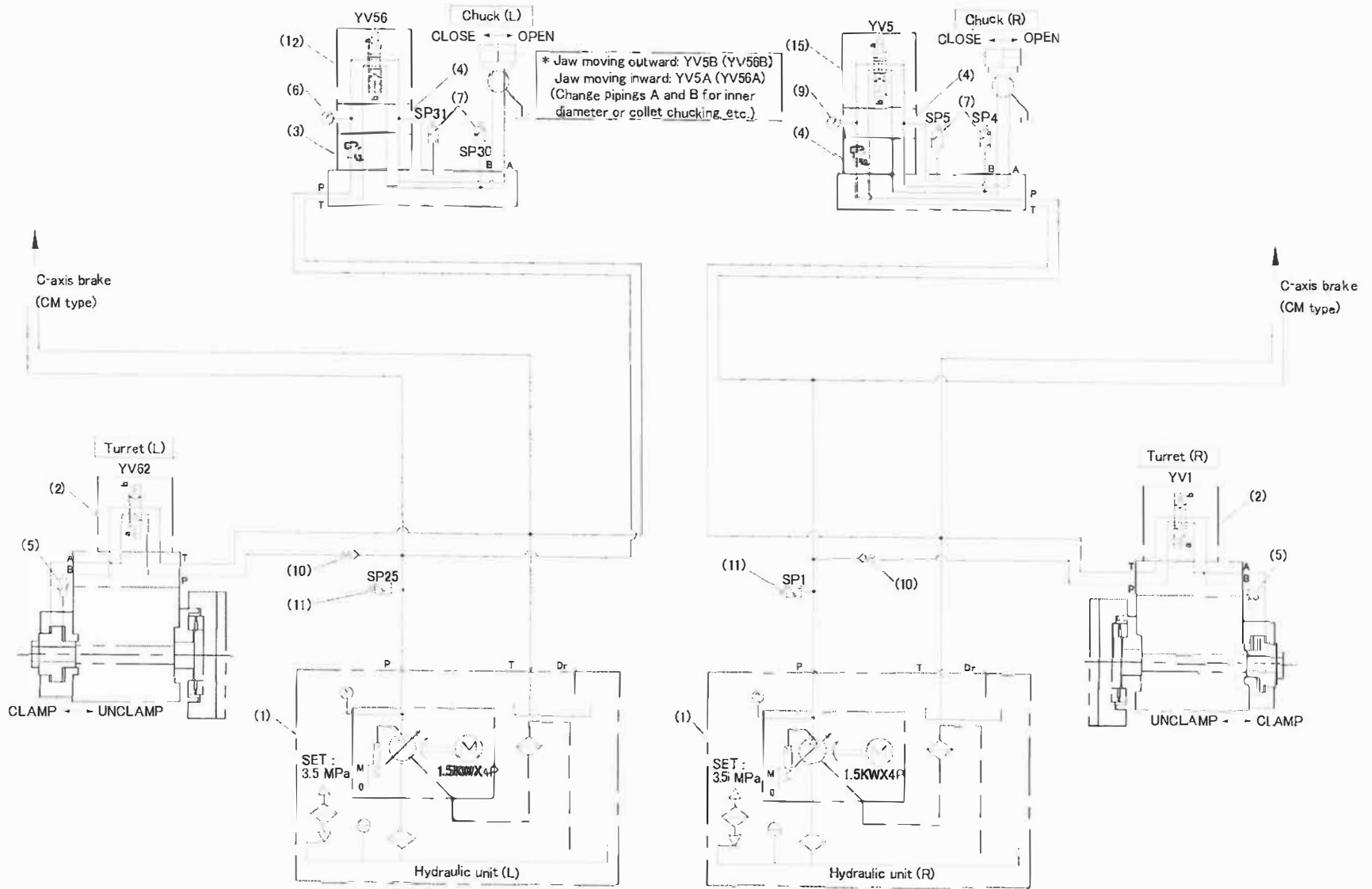
- (1) Clamp of turret
- (2) Chucking force of chuck
- (3) C-axis brake (C-axis, milling)

The hydraulic unit list and hydraulic circuit diagram are as follows.
(including option)

No.	Name	Model	Manufacturer
(1)	Hydraulic unit	UH2 UA2-68500-7	YUKEN
(2)	Solenoid valve	E-DSG-01-3C2-D24-60	YUKEN
(3)	P-port reducing valve	MRP-01-B-3041	YUKEN
(4)	Block	NR40006-001	TAKISAWA
(5)	Throttle check valve	HT-720-01 (PR1/8)	HIROSE
(6)	Pressure gauge	IADGU-PT1/4-39 ϕ 6MPA85%SB	YODOGAWA
(7)	Pressure sensor	PG-35H-104R-PR2B	COPAL
(8)	Check valve	MCT-01-0-30	YUKEN
(9)	Solenoid valve	E-DSG-01-2B2-D24-60	YUKEN
(10)	Check valve	CIT-03-04-50	YUKEN
(11)	Pressure sensor	PK6732	EFECTOR
(12)	Solenoid valve	E-DSG-01-2D2-D24-60	YUKEN

Table D8-1 Hydraulic unit list

Fig. D8-1(a) Hydraulic circuit diagram



8-2 Hydraulic unit

For the structure of hydraulic unit, refer to [Table D8-2 Hydraulic unit list] and [Fig. D8-2 Hydraulic unit]. For the replacement of hydraulic oil, refer to the item of [Chapter C, 3 LUBRICATION AND OILING].

Remove the plug located on the upper part of the pump and fill the hydraulic oil before trial run.

The main pressure 3.0 MPa of the pump is adjusted with the pressure adjusting screw. However, it has already been set before shipping.

< Check items >

- * Main pressure 3.0 MPa ... every 8 hrs.
- * Replacement of hydraulic oil ... every 2000 hrs.
- * Cleaning of suction strainer every 2000 hrs.
- * Cleaning inside of tank every 2000 hrs.

No.	Name	Type	Manufacturer
(1)	Radiator	3A92-001-1054	TRAD
(2)	Motor	ML-1.5-10	YUKEN
(3)	Piston pump	ARL1-16-FR01A-10	YUKEN
(4)	Oil inlet with air breather	MSA-V22-VS10	MASUDA
(5)	Pressure gauge	ODR-16M-TM-S	ASK
(6)	Oil tank	19L	YUKEN
(7)	Suction strainer	SFT-06-150W	TAISEI
(8)	Oil gauge	KLA-80SN-AR	KYOWA

Table D8-2 Hydraulic unit list

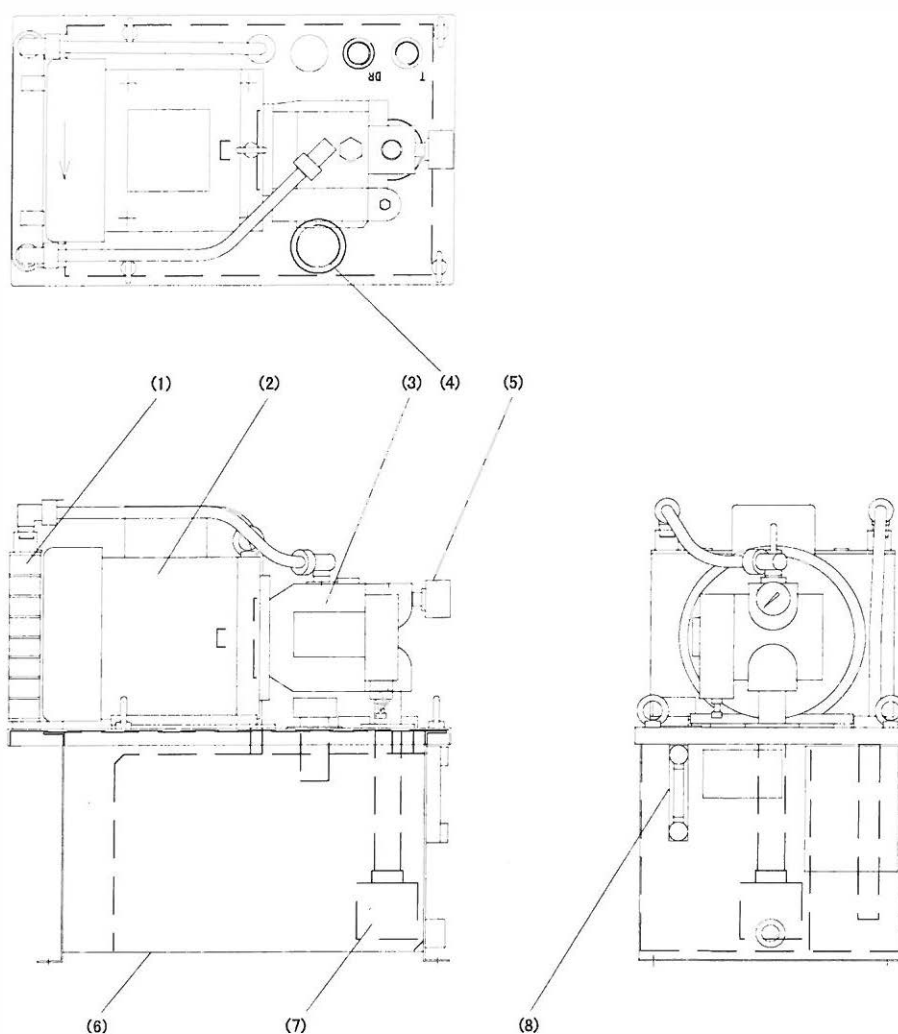


Fig. D8-2 Hydraulic unit

8-3 Adjustment of hydraulic equipment

For the operation of hydraulic equipment, refer to [OPERATION MANUAL].

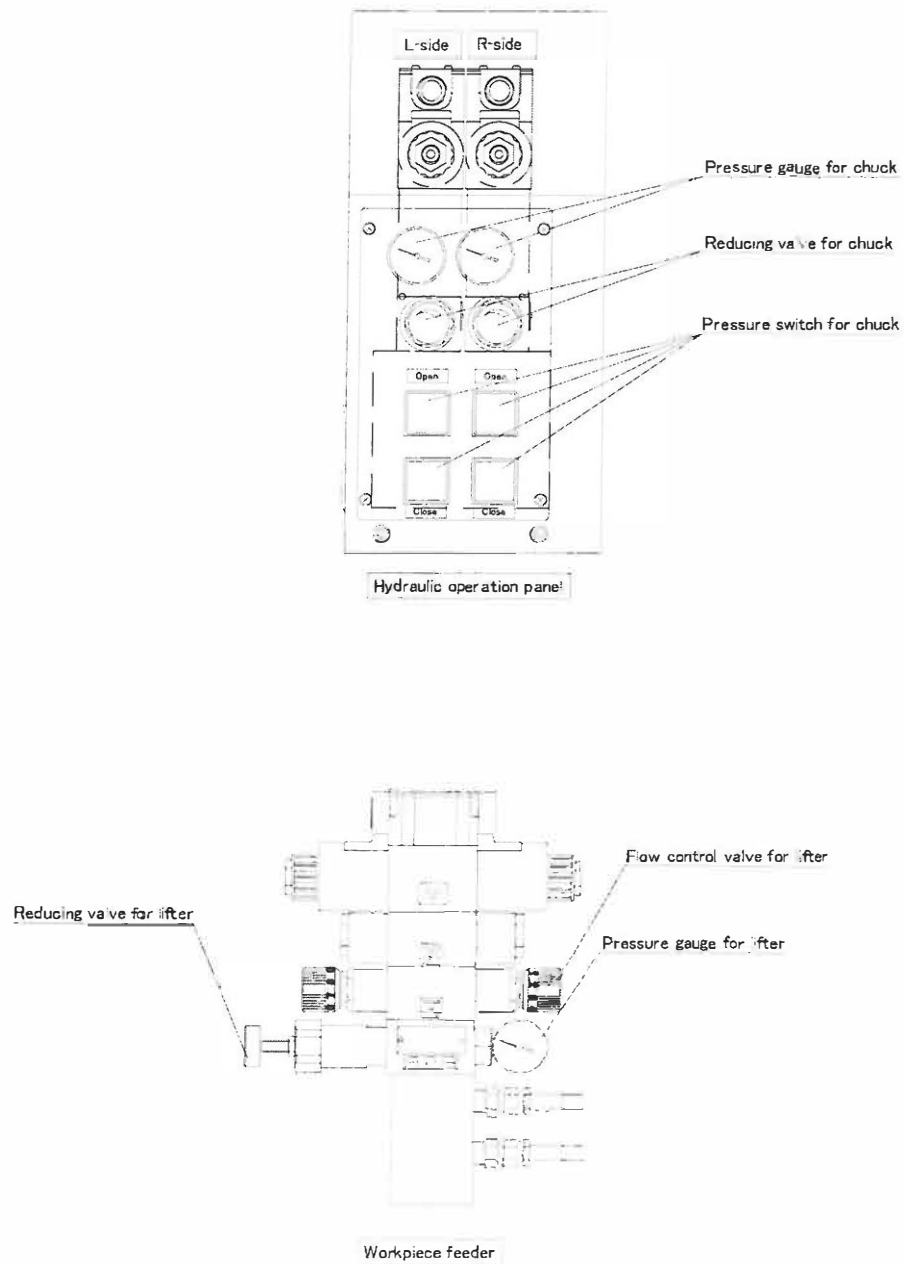


Fig. D8-3(a) Hydraulic equipment

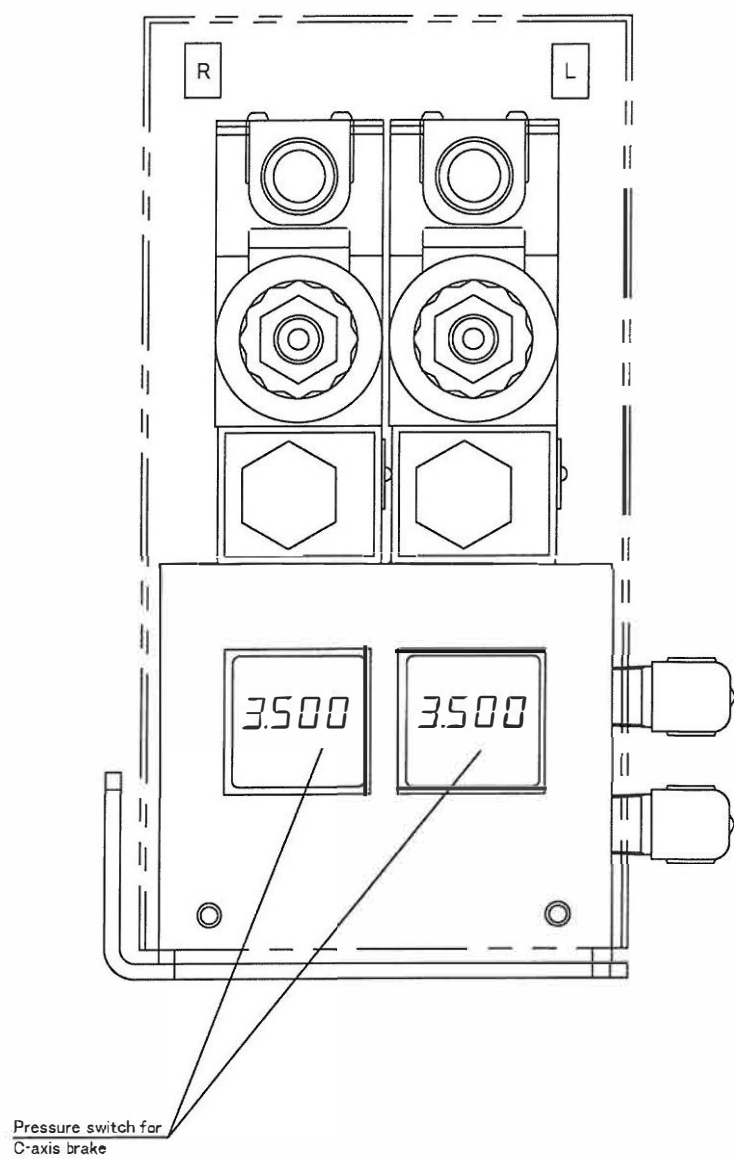


Fig. D8-3(b) Hydraulic equipment (C-axis, milling)

1. Main pressure

- * Check the main pressure with the pressure gauge mounted onto the hydraulic unit.

- * Do not change the setting pressure for clamp thoughtlessly since the turret clamps each tool with the main pressure.

Setting pressure ... 3.5 MPa

- * The pressure switch (option) is provided to the machine so that the stop will be applied if the main pressure is reduced for any reason. It is usually set to 0.2 MPa.

The pressure switch is mounted inside of frame on the upper part of hydraulic unit.

2. Pressure of hydraulic cylinder for chuck

- * The chucking force of the chuck is adjusted with the adjusting valve.

CW Increase of pressure

CCW ... Decrease of pressure

Setting pressure: Set adequate pressure after understanding the items of [Chapter D, 7 CHUCK SYSTEM].
Never set the pressure exceeding the allowable thrust of chuck.

- * The pressure switch is provided to check the [CLAMP] of the chuck are mounted.

When changing the pressure supplied to the chuck cylinder, also change the setting value of the pressure switch.

3. Pressure switch for C-axis brake

- * It detects that the pressure when C-axis brake is released is 0.2 [MPa] or less.
- * It is set at the time of factory shipment.

Use	C-axis brake release check
Pressure	3.5 MPa
Output port	SW1 output, SW2 output
P.S number	SP13 (SP23)
Mode	Separate (L-motion)
	A24
Setting 1 (P1)	0.2
Setting 2 (P2)	0.2
Hysteresis (H)	0.1
Filter	F-2

9 LUBRICATION SYSTEM

The working condition of the machine becomes severe according to the improvement of labor saving, rationalization and productivity for machine facility. Under this condition, the lubrication system has the part of the essential to maintain the machine performance.

The lubrication system serves for the purpose of preventing or reducing the following items.

- (1) Seizure of slideway
- (2) Wear of slideway
- (3) Wear resistance of slideway
- (4) Cleaning of slideway

Sufficiently lubricate the slideway by understanding the lubrication purpose.

The lubrication system lubricates the bed, saddle, slideways of cross slide, ball screws and bearings of X-axis, Z-axis and the inside of tool slide forcedly.

The spindle have already individually greased separately with the lubrication system before shipping.

9-1 Lubrication system diagram

The [Lubrication equipment list] and [Lubrication system diagram] are as follows.

No.	Name	Type	Manufacturer
(1)	Lubrication unit	AMZ-3-100S-30LP	LUBE
(2)	Dester plunger (piston distributor)	DPB12-0.06	SHOWA
(3)	Dester plunger (piston distributor)	DPB15-0.06	
(4)	Dester plunger (piston distributor)	DPB18-0.06	
(5)	Dester plunger (piston distributor)	DPB110-0.06	
(6)	Dester unit (junction bar)	DB4K	

Table D9-1 Lubrication equipment list

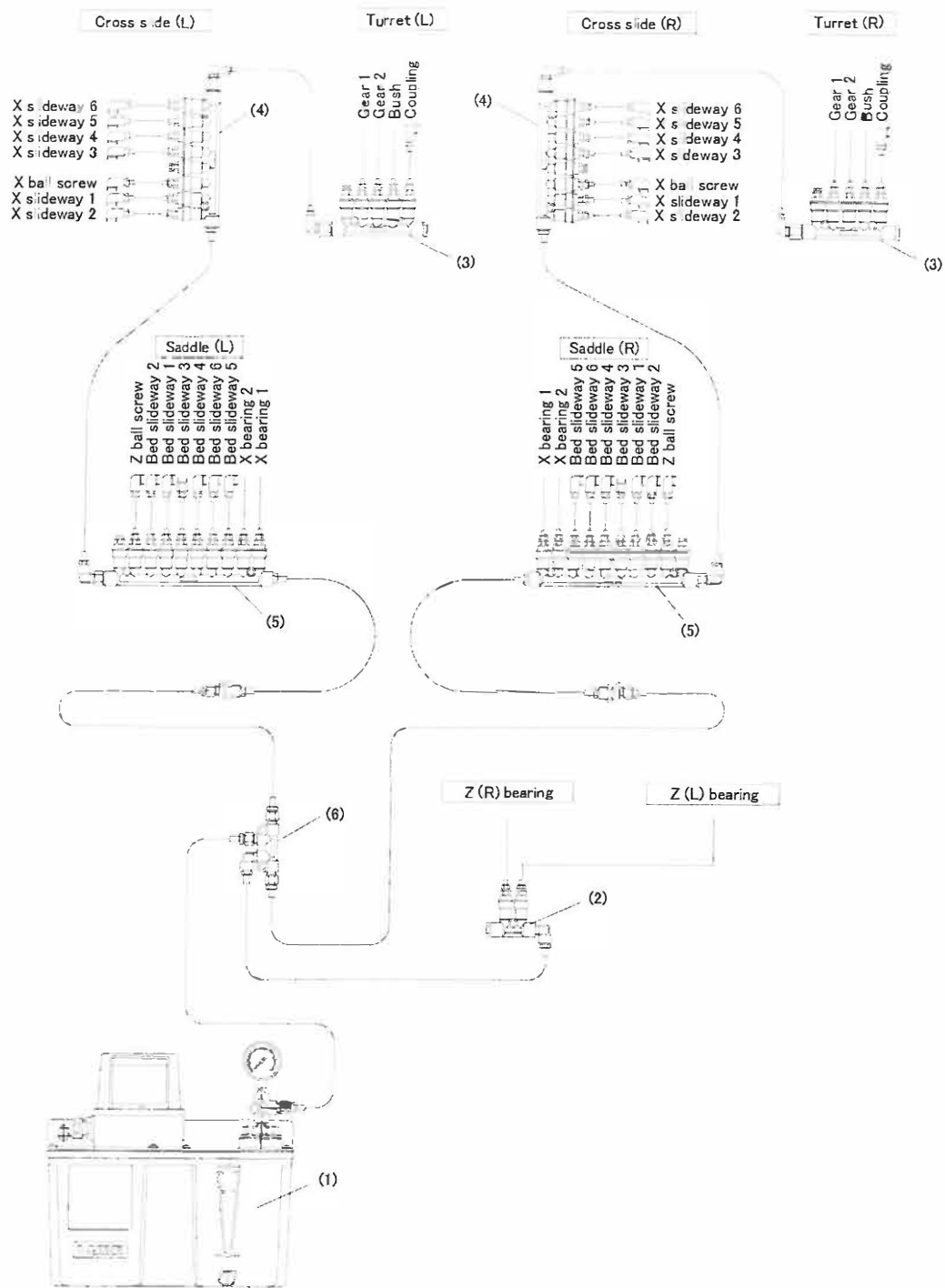


Fig. D9-1 Lubrication system diagram

9-2 Lubrication unit

The lubrication unit adopts the positive displacement centralized lubrication automatic pump. It supplies a constant oil periodically and securely.

1. Pump specifications

- * Discharge volume ... 0.09 L/min (50 Hz), 0.1 L/min (60 Hz)
- * Discharge pressure ... 1.5 MPa
- * Motor voltage ... AC 100V
- * Tank capacity ... Total capacity 4 L, Effective capacity 3 L
- * Max. running time ... 1 min
- * Mim. downtime ... 3 min

2. Maintenance adjustment

Changing the timer 6 (running time) and timer 7 (downtime) of PMC timer can adjust the intermittent time.

The timer setting time unit is ms.

The inadequate change of the intermittent time can result in machine malfunction.

Wash the suction filter and the tank with a treated oil.

However, do not use the treated oil of thinner system.

< Check items >

- * Replacement and cleaning of suction filter ... every 2000 hrs.
- * Tank cleaning ... every 2000 hrs.

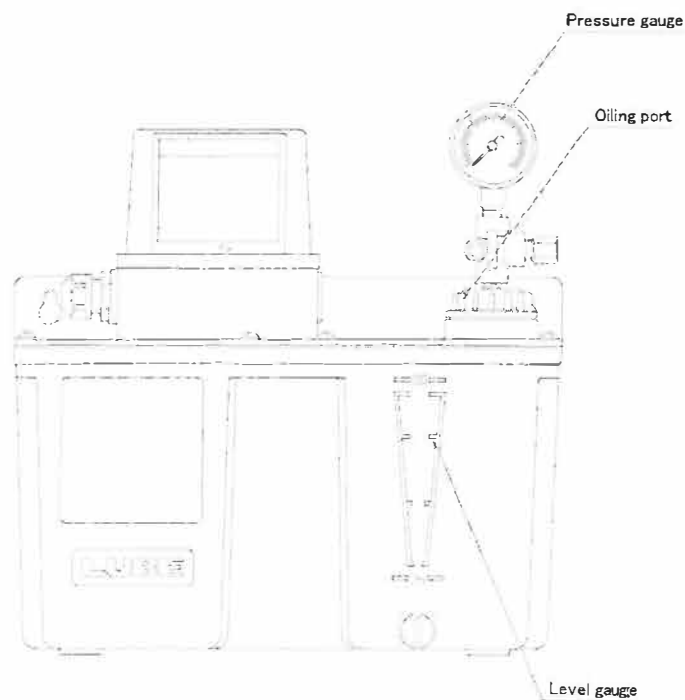


Fig. D9-2 Lubrication unit

10 COOLANT SYSTEM

The coolant is used for the purpose of improving the machine accuracy and lengthening the tool life by two actions of the lubrication and cooling.

Also, it serves for removing chips and preventing rust.

10-1 Coolant system diagram

The [Coolant system diagram] and the [Coolant system list] are as follows.

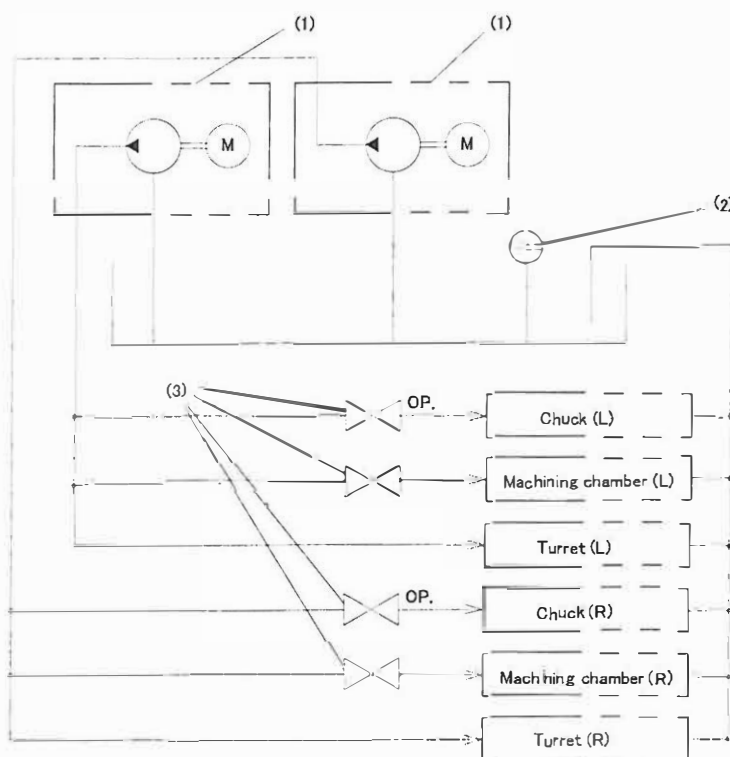


Fig. D10-1 Coolant system diagram

No.	Name	Type	Manufacturer
(1)	Coolant pump	HCP-250F	HANSUNG
(2)	Oil gauge	KLA-100A	KYOWA
(3)	Stop valve	400, PT1/2	KITZ

Table D10-1 Coolant system list

10-2 Coolant pump

The submerged type coolant pump integrates the motor and pump.
For the pump appearance, refer to [Fig. D10-2 Appearance of coolant pump].

1. Pump specifications

Type	HCP-250F	
Output (W)	250	
Rated voltage (V)	200	200
		220
Frequency (Hz)	50	60
Rated current (A)	1.4	1.5
Discharge volume (L/min)	125	150
Total head (m)	4	

Table D10-2 Pump specification

2. Maintenance check

- * The pump rotates counterclockwise when viewed from the upward position.
- * When the oil level of oil tank lowers from the lower limit, the pump sucks air from the suction port, thus reducing a discharge volume. Also, the pump may not suck oil.
For safety, fill the coolant at the filling range into the oil tank as much as possible.

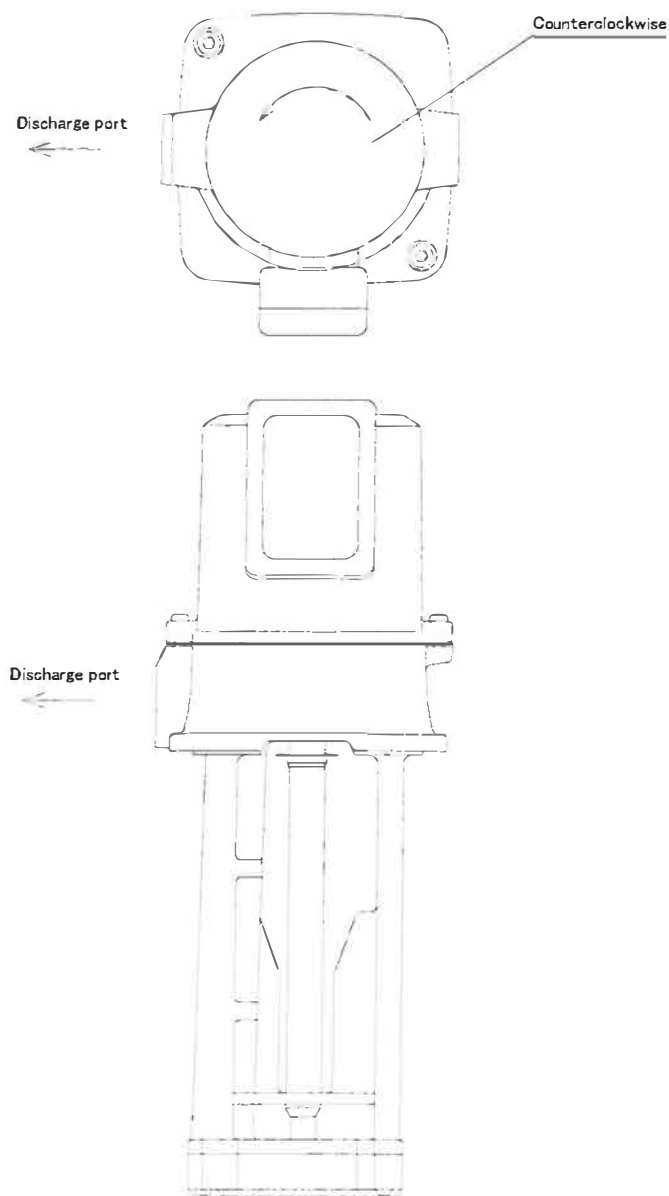


Fig. D10-2 Appearance of coolant pump

10-3 Cleaning of coolant tank

WARNING

- * Turn [OFF] and lock out the main breaker before cleaning the machine.
If not so, any operator may be wound in rotary members or caught in movable parts because of accidental cause, thus leading to a personal injury.

CAUTION

- * Do not treat chips or coolant with bare hands.
It gets injured by a chip or there is a possibility that the skin may cause inflammation with coolant.

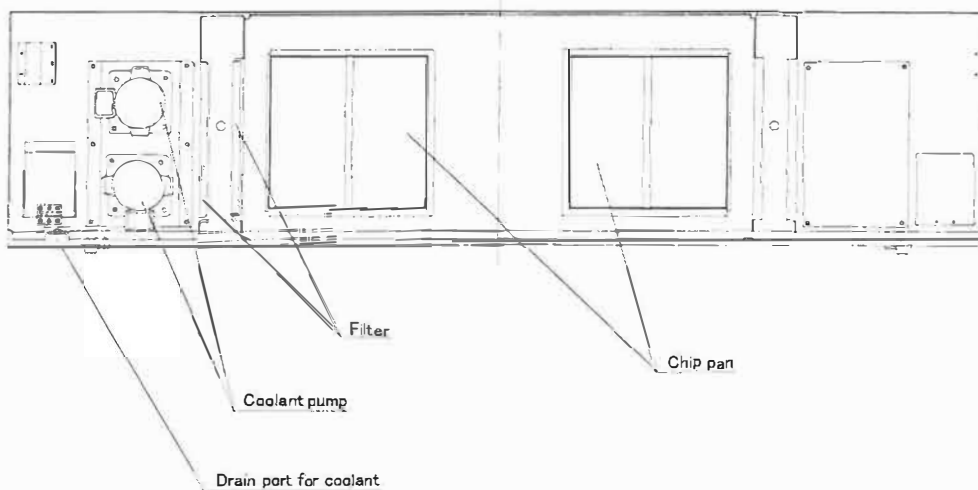
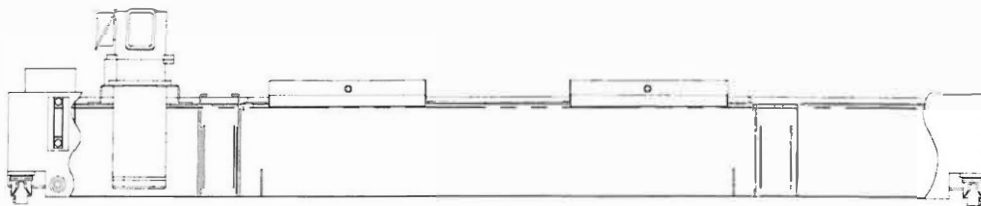
Prepare the drain container and clean the machine by the following procedure.

- (1) Turn [OFF] and lock out the main breaker.
- (2) Remove chip inside of the machine.
- (3) Remove the coolant hose of coolant pump outlet.
- (4) Draw out the coolant tank so that the wiring routes for pump and foot switch will not be excessively tensed.
- (5) Remove the taper plug in the drain port to discharge the coolant.
- (6) Clean the inside of tank.
- (7) Reset the taper plug in the drain port.
- (8) Mount the coolant tank to the original position.
- (9) Mount the coolant hose.
- (10) Fill the coolant into the tank.

NOTE: To treat the drain, consult the oil sales shop or waste treatment trader.

< Check items and frequencies >

- * Filter cleaning ... every 8 hrs.
- * Chip pan cleaning ... every 8 hrs.
- * Replacement of coolant .. every 1000 hrs.
- * Coolant capacity ... 240 L
- * Tank cleaning ... every 2000 hrs.



The pump and the filter may be mounted in the reverse direction of right and left by the method specification.

Fig. D10-3 Cleaning of coolant tank

11 PNEUMATIC SYSTEM

11-1 Pneumatic circuit diagram

The pneumatic system can be equipped with various optional functions according to application. Please request them if required.

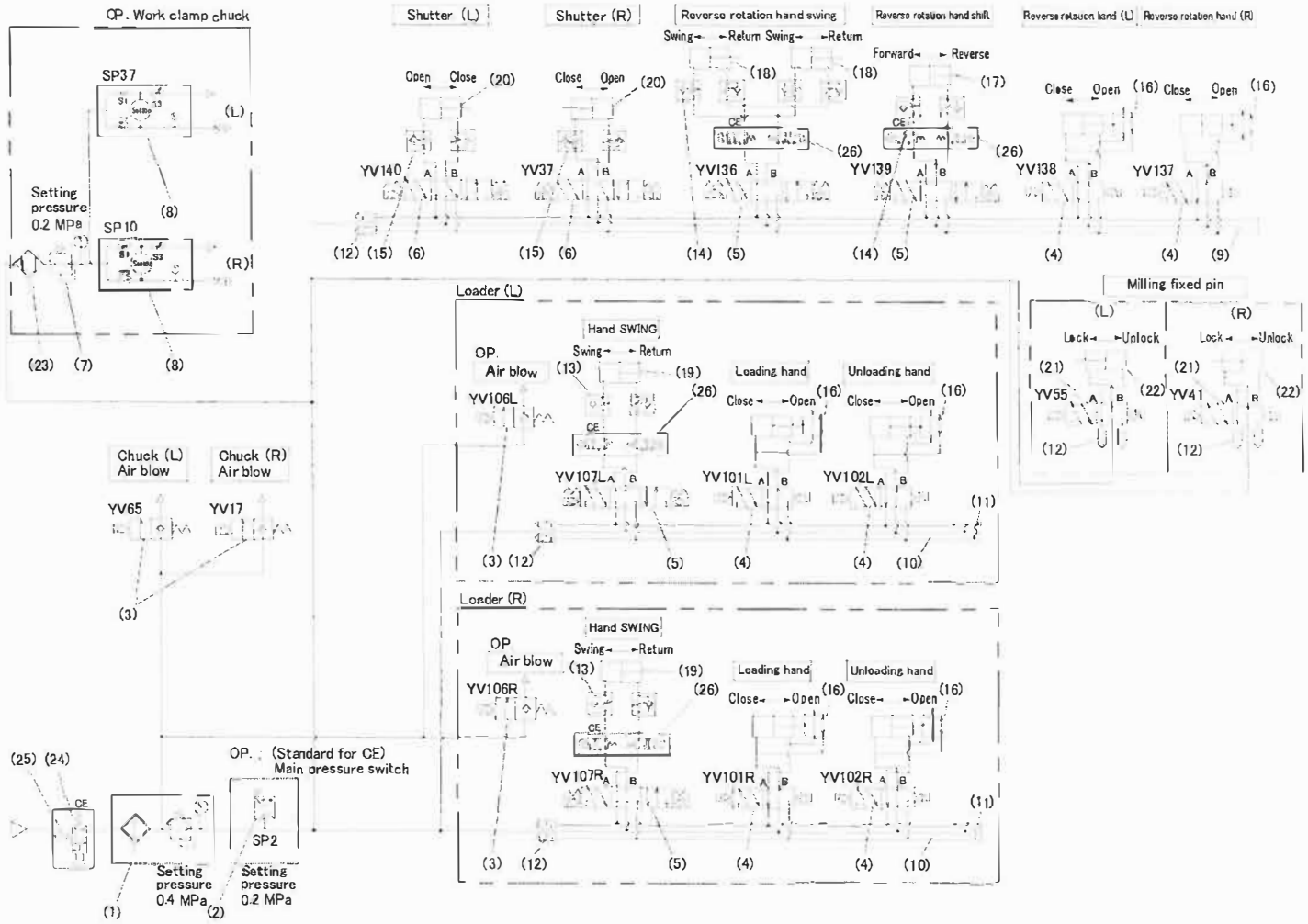
Refer to the following typical [Table D11-1 Pneumatic equipment list] and [Fig. D11-1 Pneumatic circuit diagram].

The circuit diagram shows the symbols of the [Electric circuit diagram].

No.	Name	Type	Chuck type	Manufacturer
(1)	F.R kit	AC25B-02DE-T	Common to 8" and 10"	SMC
(2)	Pressure switch	IS1000E-3002-X201		
(3)	Solenoid valve	VXD2130-02-5DZ1-B		
(4)	Solenoid valve	SY3240-5LOU		
(5)	Solenoid valve	SY3340-5LOU		
(6)	Solenoid valve	SY3440-5LOU		
(7)	Regulator	ARP30-02BG		
(8)	Sensor (Detection distance 0.01 ~ 0.25)	ISA2-GE45-X137		
	Sensor (Detection distance 0.03 ~ 0.5)	ISA2-HE45-X137		
(9)	Manifold	SS5Y3-41P-06-C6		
(10)	Manifold	SS5Y3-41P-04-C6		
(11)	Blanking plate	SY3000-26-10A		
(12)	Silencer	AN101-01		
(13)	Speed controller	AS2051F-06		
(14)	Speed controller	AS2201F-01-06S		
(15)	Speed controller	AS2211F-01-06S		
(16)	Air chuck	MHSL3-63D-Y7BALS	8"	SMC
		MHSL3-100D-M9BALS	10"	
(17)	Air cylinder	CDG1BA25-250-C73LS	8"	
		CDG1BA32-250-C73LS	10"	
(18)	Air cylinder	CDM2E25-50A-C73L	8"	
		CDM2E32-100A-M9BL	10"	
(19)	Air cylinder	CDG1BA50-125-M9BL	8"	
		CDG1BA63-125-M9BL	10"	
(20)	Air cylinder	HCM-LB-25B-380-T2H5-R	Common to 8" and 10"	CKD
(21)	Solenoid valve	SY5220-5DZ-C6-F2		SMC
(22)	Air cylinder	RSDQB20-10D-J79L		
(23)	Mist separator	AFM30-02D		
(24)	Exhaust valve	VHS30-02		
(25)	Silencer	AN203-02		
(26)	Residual pressure exhaust valve	KEA06		

Table D11-1 Pneumatic equipment list

Fig. D11-1 Pneumatic circuit diagram



11-2 Pneumatic unit

The pneumatic unit consists of the filter, regulator and lubricator.

However, there is the possibility that the lubricator or regulator is not provided.

[Fig. D11-2] shows the outline view.

< Check items >

* Drain of filter ... every 100 hrs.

* Oil capacity of lubricator ... 50 cm³

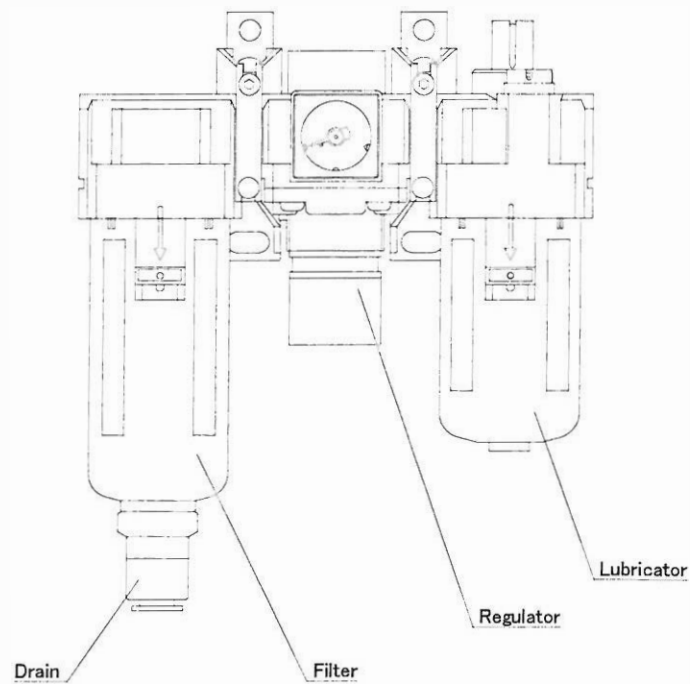


Fig. D11-2 Sketch drawing of pneumatic unit

11-3 Air panel

Solenoid valves mounted to each air panel are as follows.

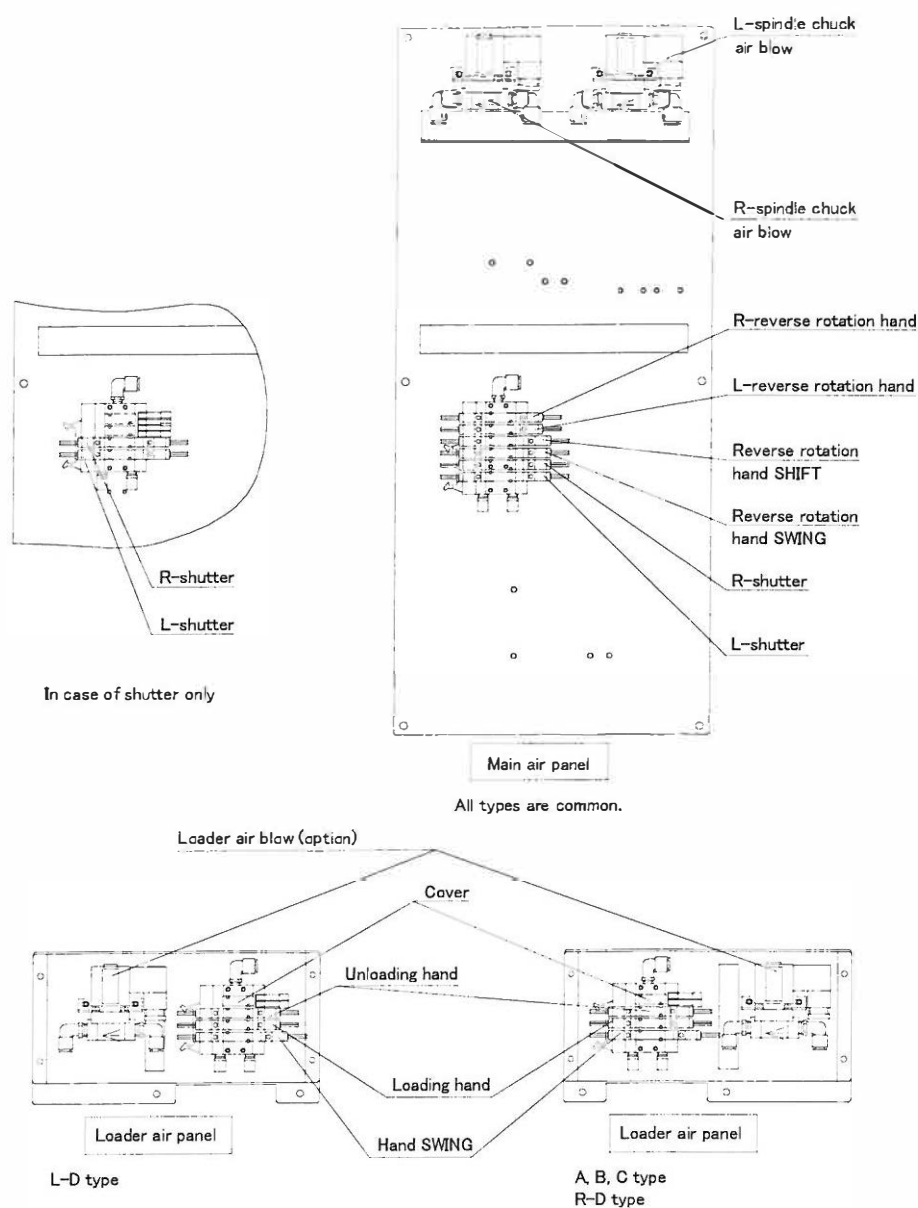


Fig. D11-3 Air panel

11-4 Adjustment of pneumatic cylinder

Though each air cylinder is equipped with the speed controller, since it has already been adjusted before shipping, don't change the speed unreasonably because the cycle time of loader may be influenced.

If the speed must be adjusted by parts change, etc., keep optimum speed according to [Table D11-4].

Name	Operation	Time (sec.)	Control method of speed controller	Cushion method	Cushion control method
Shutter	OPEN	0.5	Meter-in	Relief valve + fixed orifice	Meter-out
	CLOSE				
Reverse rotation hand	SWING	1.0	Meter-out	Orifice adjustment of needle valve	
	RETURN				
Reverse rotation hand SHIFT	FORWARD	2.0			
	REVERSE				
Loader hand	SWING	1.0			
	RETURN				

Table D11-4 Adjustment of pneumatic cylinder (8 inch type, 10 inch type)

Each time in [Table D11-4] is the value from single lead switch OFF to opposite side ON. Each hand is opened and closed without the speed adjusting device. The workpiece may be slipped or drop by workpiece form and balance or chucking conditions.

The following procedure is recommended for workpiece drop-prevention measures.

- (1) Lengthen the chucking part as much as possible.
- (2) Cut the soft jaw by gathering it together with chucking diameter of workpiece. (Commonly-cut jig can be optionally offered.)
- (3) Clamp the workpiece, keeping its balance.
- (4) Wipe excess oil adhered on the workpiece. (The workpiece may be closely contacted with another workpiece by oil.)

If the workpiece is slipped or drop in spite of the above measures and other measures, reduce the loader speed in acceleration/deceleration or cylinder speed.

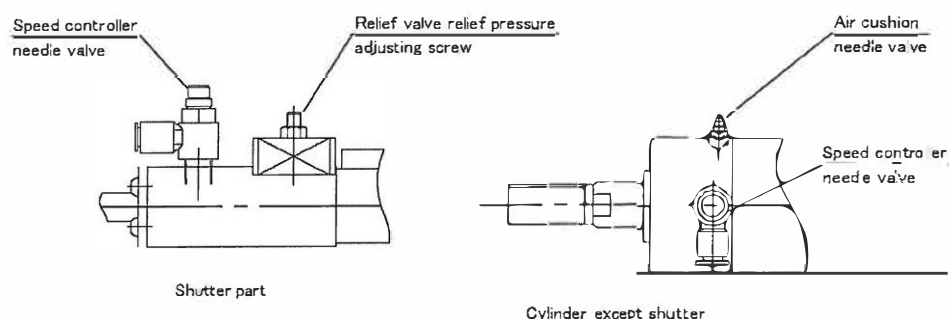


Fig. D11-4 Adjustment of pneumatic cylinder

The speed controller decelerates at CW and accelerates at CCW.

The air cushion increases cushion effect at CW and reduces the cushion effect at CCW.

The relief valve increases pressure at CW and reduces the pressure at CCW.

If the air cushion and relief valve are too throttled, bouncing occurs.

Adjust the air cushion and relief valve in condition just before bouncing.

12 NC EQUIPMENT

12-1 Replacement of fuses

If the NC screen is not displayed or the machine is not started correctly with the message of I/O link failure displayed, there is a possibility that a fuse blows for any reason.

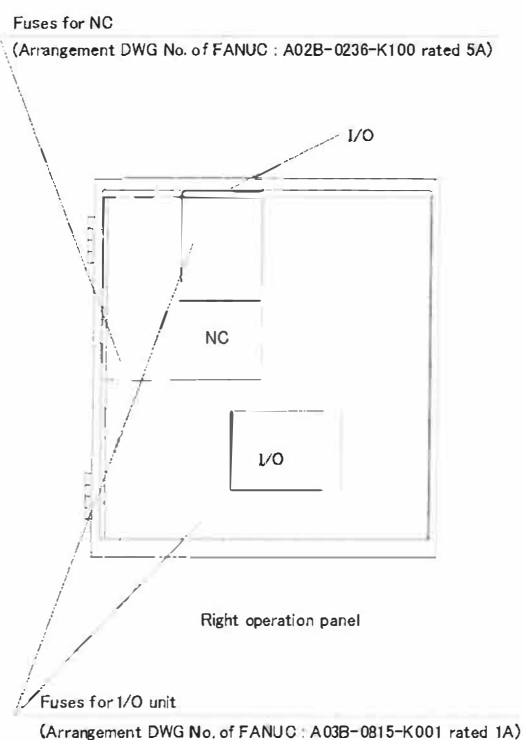


Fig. D12-1 Replacement of fuses

12-2 Replacement of batteries

When "APC" is displayed on the screen, the service life of battery for the absolute pulse coder is expired.

- * Replace size D batteries for the absolute pulse coder, referring to the maintenance manual issued by FANUC.

- * Replace 4 alkaline size D batteries per 1 absolute pulse coder.

When "BAT" is displayed on the screen, the service life of battery for CNC unit (size D) is expired.

- * Replace size D batteries for CNC unit, referring to the maintenance manual issued by FANUC.

- * Replace 2 alkaline size D batteries per 1 CNC unit.

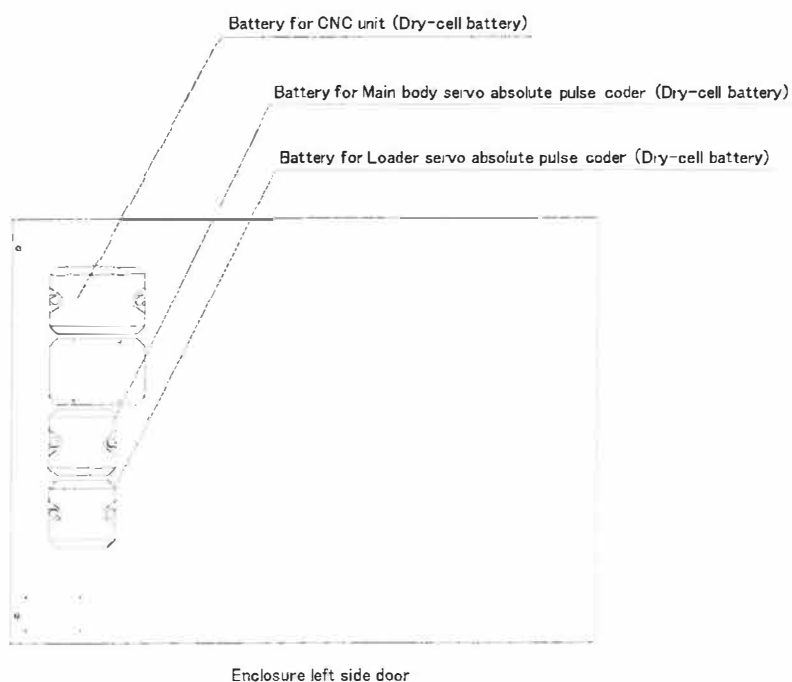


Fig. D12-2 Replacement of batteries

13 PERIODICAL CHECKLIST

Maintain and check the machine according to the periodical checklist on the next table.

Simultaneously, daily check the machine according to the daily checklist.

Components	Description	Check cycle
Bed	Level check	1000 h
	Damage of slide wiper	500 h
Feed system	Adjustment of taper gibs	2000 h
	Measuring and correction of backlash	1000 h
Headstock	Parallelism of spindle	1000 h
	Check of belt tension	2000 h
Chuck	Disassembly and cleaning of chuck	1000 h
	Check of chucking accuracy	500 h
	Check of stroke	500 h
Hydraulic unit	Replacement of hydraulic oil	2000 h
	Cleaning of suction strainer	2000 h
	Tank cleaning	2000 h
Lubrication unit	Washing of suction filter	2000 h
	Tank cleaning	2000 h
Coolant system	Cleaning of filter	500 h
	Replacement of coolant	1000 h
	Tank cleaning	2000 h
Pneumatic system	Drain of filter	100 h
Loader	Lubrication to gear box, rack and pinion	240 h
	Lubrication to guide	56 h

Table D13 Periodical checklist

E. INSTRUCTION OF ATTACHMENT MAKER

This chapter explains about INSTRUCTION MANUAL for attachment maker.

CONTENTS

1	SETTING METHOD OF DIGITAL PRESSURE SWITCH (PG-35H)	E3
1-1	Basic operation	E3
1-2	Zero point adjustment	E3
1-3	Chuck clamp/unclamp pressure setting methods	E4
1-4	Setting methods of Cs-axis brake release check	E6

1 SETTING METHOD OF DIGITAL PRESSURE SWITCH (PG-35H)

1-1 Basic operation

Mode

- * Operations mode
- * Initial setting mode
- * Pressure setting mode

Mode change

- * Change to operation mode from initial setting mode and pressure setting mode.
Press the M button (more than one second).
- * Change to initial setting mode from operation mode.
Press the ↓ and M buttons simultaneously.
- * Change to pressure setting mode from operation mode.
Press the ↑ and M buttons simultaneously.

1-2 Zero point adjustment

- (1) Open the pressure port to atmosphere.
- (2) Press the M button for more than one second to the operations mode.
- (3) Press the ↓ and ↑ simultaneously.
"0Ad" is displayed.
- (4) After about 1 second, a zero point adjustment will be performed, and number 0.00 [MPa] will also appear.

1-3 Chuck clamp/unclamp pressure setting methods

1. Outline

Specification : Optional chuck M function (Digital pressure switch type)

Purpose : Detecting the chuck action pressure within setting area.

Switch 1 : Detecting the pressure of chuck closing.

Switch 2 : Detecting the pressure of chuck opening.

Example setting value (It is difference by the workpiece and using chuck specification)

Setting list

Mode	Window comparator mode (B-motion)	A28
Setting 1	Minimum pressure of detection range	0.8
Setting 2	Maximum pressure of detection range	3
Hysteresis		0.1
Digital filter		F-2

2. Mode setting

(1) Press the ↓ and M buttons simultaneously to enter the initial settings mode.

The +/- LED flashes.

(2) Press a M button twice.

The SW2 LED flashes.

(3) Set the value to 8 using the ↑ and ↓ buttons.

Number A28 is displayed.

At this time, the mode becomes the window comparator mode (B-motion).

(4) Press the M button for more than one second to return to the operations mode.

3. Pressure setting

- (1) Press the M and ↑ buttons simultaneously to enter the pressure settings mode.

The SW1 LED flashes.

- (2) Press ↑ and ↓ buttons to set the minimum pressure [MPa].

Set number 0.8 [MPa] as a setting example.

At this time, check that +/- LED go out.

- (3) Press the M button.

The SW2 LED flashes.

- (4) Press ↑ and ↓ buttons to set the maximum pressure [MPa].

Set number 3.0 [MPa] as a setting example.

At this time, check that +/- LED go out.

- (5) Press the M button.

The +/- LED flashes.

- (6) Press ↑ and ↓ buttons to set hysteresis 0.1 [MPa].

- (7) Press the M button.

All LEDs go out.

- (8) Set the value to F-2 using the ↑ and ↓ buttons.

- (9) Press the M button for more than one second to return to the operations mode.

1-4 Setting methods of Cs-axis brake release check

1. Outline

Specification : Cs-axis brake

Purpose : Check that pressure in brake releasing is less than 0.2 [MPa].

Setting list

Mode	Separate mode (L-motion)	A24
Setting 1	SW1 open check pressure setting	0.2
Setting 2	SW2 open check pressure setting	0.2
Hysteresis		0.1
Digital filter		F-2

2. Mode setting

- (1) Press the ↓ and M buttons simultaneously to enter the initial settings mode.
The +/- LED flashes.
- (2) Press a M button twice.
The SW2 LED flashes.
- (3) Set the value to 4 using the ↑ and ↓ buttons.
Number A24 is displayed.
At this time, the mode becomes the window comparator mode (L-motion).
- (4) Press the M button for more than one second to return to the operations mode.

3. Pressure setting

- (1) Press the M and ↑ buttons simultaneously to enter the pressure settings mode.

The SW1 LED flashes.

- (2) Press ↑ and ↓ buttons to set open check pressure 0.2 [MPa].
At this time, +/- LED should be gone out.

- (3) Press the M button.

The SW2 LED flashes.

- (4) Press ↑ and ↓ buttons to set open check pressure 0.2 [MPa].
At this time, +/- LED should be gone out.

- (5) Press the M button.

The +/- LED flashes.

- (6) Press ↑ and ↓ buttons to set hysteresis 0.1 [MPa].

- (7) Press the M button.

All LEDs go out.

- (8) Set the value to F-2 using the ↑ and ↓ buttons.

- (9) Press the M button for more than one second to return to the operations mode.

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NC Lathe

TT-2600

OPERATION MANUAL

XZ04030-101

Please read each manual and understand
contents enough.

Then keep these manuals handy for
answers to any questions you may have
and to check.

MACHINE TOOLS
TAKISAWA

IMPORTANT NOTICE

- Be sure to read each instruction manual before operating the machine.

Be sure to observe the safety precautions in the instruction manuals and the contents of warning labels adhered to the machine. If ignored, an accident resulting in injury or death or machine malfunction may be caused.

There are many [DISABLE] or [MUST NOT DO] conditions.

Unless [ABLE] is written in the instruction manual, consider it [DISABLE].

- Some illustrations in the instruction manual are given without cover or door to illustrate the detailed parts. In actual operation, it is necessary to mount the cover or door.
- Keep instruction manuals handy for ready reference as it will help you operate the machine and equipment to their full advantage.
- When any instruction manual is required again, contact your agent with the number of the instruction manual (or model name, manual name).
- Japanese laws prohibit this machine from being used to develop or manufacture "weapons of mass destruction" or "conventional arms", as well as from being used to process parts for them.
Export of the product may require the permission of governmental authorities of the country from where the product is exported.
Should you wish to resell, transfer or export the product, please notify Takisawa Machine Tool Co., Ltd. or our distributor in advance.
- Observe the laws and regulations established by the national and local governments.
- Observe the laws and regulations established by the national and local government for disposal of machines and waste oil.

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- All brand names and product name listed in this instruction manual are trademarks or registered trademarks of their respective companies.
- This instruction manual is prepared for native English-speakers. When the machine is operated by non-native English speakers, please provide safety instruction for the operators by customers. In addition, please provide warning labels in their native language.
- Be sure to attach this instruction manual in case of reselling this machine.
- The manual is written for people who have a basic knowledge of machine tools.
TAKISAWA disclaims all responsibility for damage or accidents arising due to people with insufficient knowledge or training with machine tools, attempting to operate, maintain or program said tools.
- When replacing the parts, use the parts specified by company.
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If the specified parts are not used, not only the machine function is reduced but also safety is compromised, thus possibly causing an accident resulting in injury or death or machine malfunction.

- There are many kinds of coolants.

Though TAKISAWA does not specify the coolant, select the coolant by consulting with maker about the following items.

TAKISAWA disclaims all the responsibility for trouble incurred by the coolant.

- Contact us for requesting an installation, modification, and specification change, and dismantlement of the machine. If the machine is installed, modified, or its specification is changed by customer, not only the performance of the machine may be lost but also the safety of the customer may not be secured.

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A. FUNCTION OF OPERATION PANEL

This Chapter explains the outline of operation panel.

Next Chapter explains about detailed machine operations such as switches, indicating lamps, etc.

For NC unit, refer to the Instruction Manual prepared by the manufacturer of NC unit.

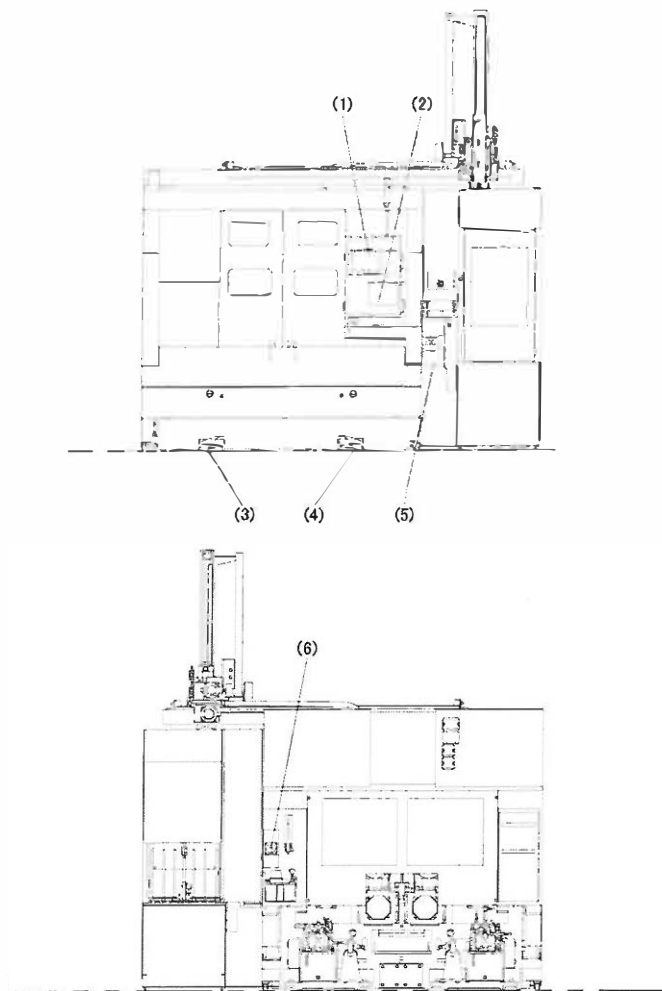
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1 ARRANGEMENT OF OPERATIONAL EQUIPMENT

The following figure shows the schematic arrangement of the operation panel to understand the equipment positions of the whole machine.

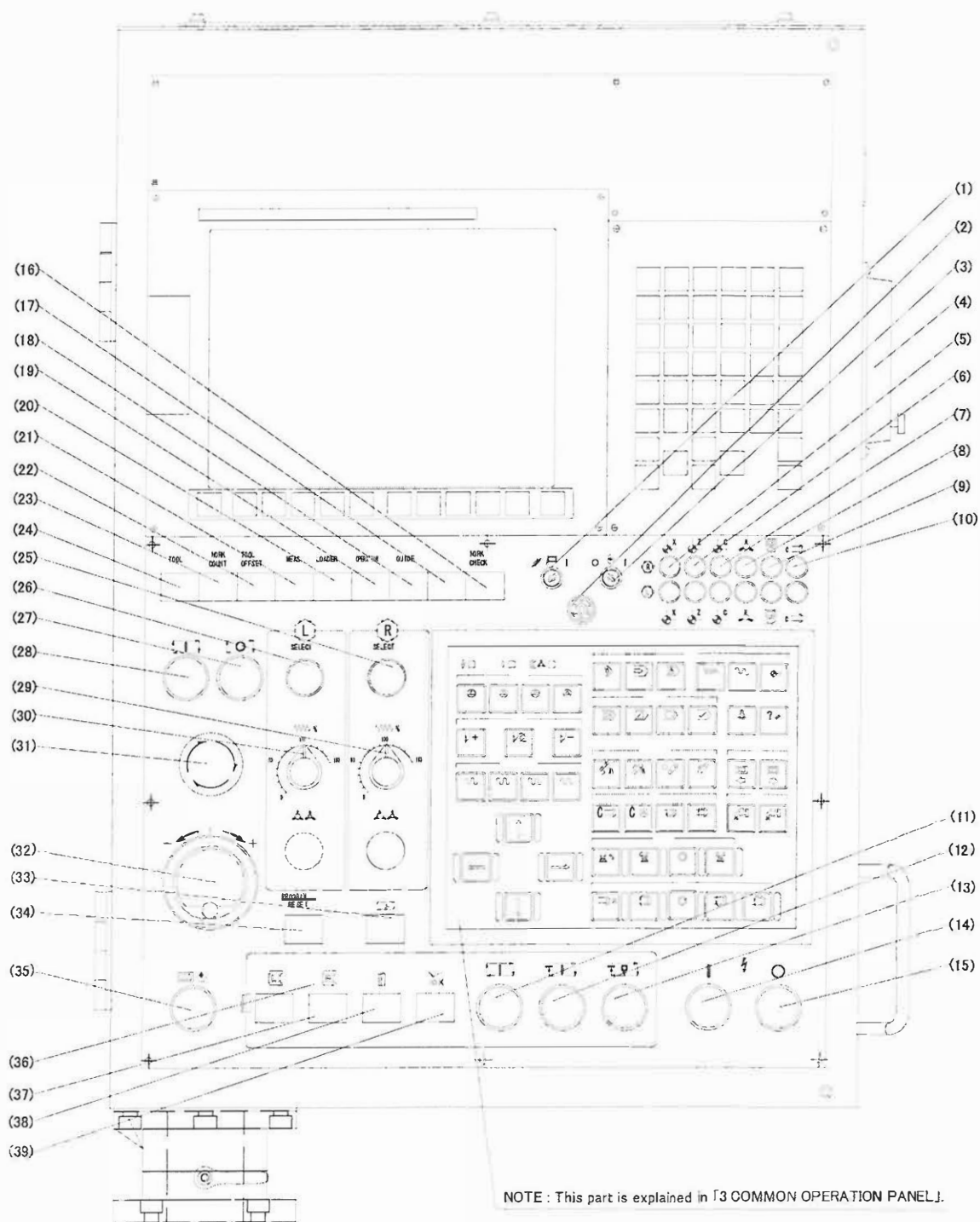
1-1 Standard/C-axis, rotary tool



- | | |
|---|---|
| (1) LCD/MDI panel | (4) R-chuck jaw clamp/unclamp foot switch |
| (2) Main operation panel | |
| (3) L-chuck jaw clamp/unclamp foot switch | (5) Hydraulic operation panel |
| | (6) Main breaker |

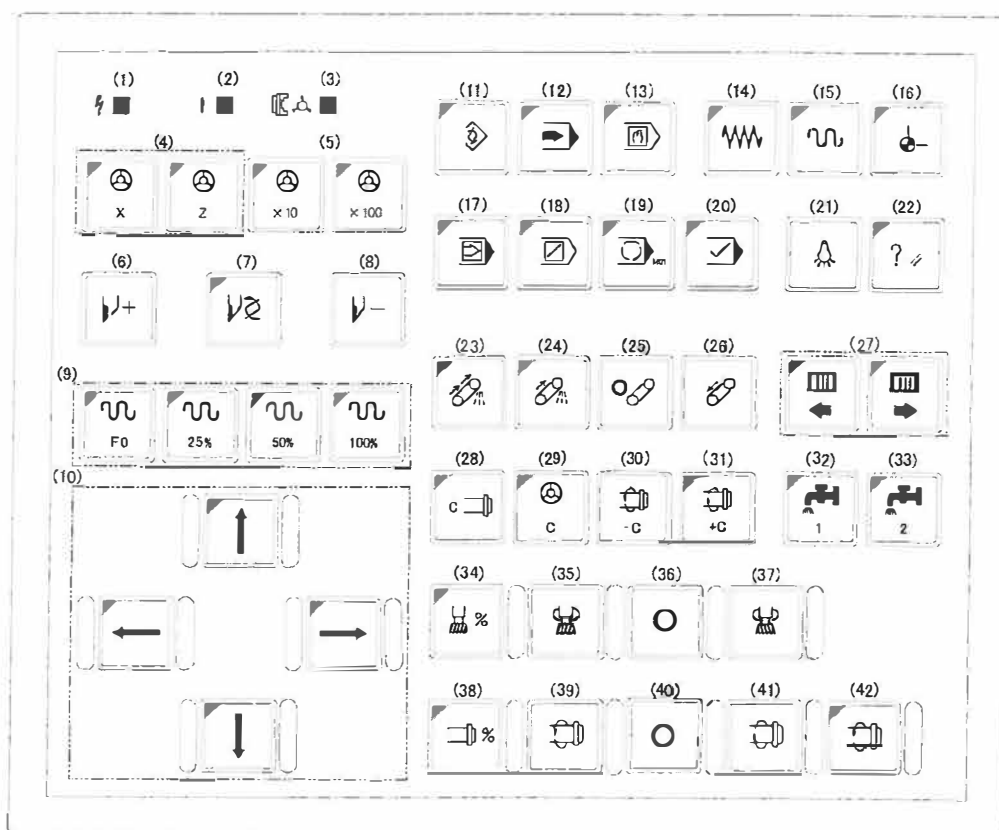
NOTE : For equipment not indicate here, see the [GANTRY LOADER OPERATION MANUAL].

2 EQUIPMENT OF OPERATION PANEL



- | | |
|---|--|
| (1) Front door interlock switch | (20) Loader switch |
| (2) Buzzer | (21) Automatic measuring switch |
| (3) Edit switch | (22) Compensation control switch |
| (4) RS-232C connector | (23) Product control switch |
| (5) X-axis reference position return ready
indicating lamp | (24) Tool control switch |
| (6) Z-axis reference position return
indicating lamp | (25) Right side operation select switch |
| (7) C-axis reference position return
indicating lamp (option) | (26) Left side operation select switch |
| (8) Chuck clamp ready indicating lamp | (27) Feed hold switch |
| (9) Front door close ready indicating lamp | (28) Cycle start switch |
| (10) C-axis/spindle turning mode select
indicating lamp (option) | (29) Right side cutting feedrate override
select switch |
| (11) Cycle start switch | (30) Left side cutting feedrate override
select switch |
| (12) Ejection cycle switch | (31) Emergency stop switch |
| (13) 1 cycle stop switch | (32) Handwheel (manual pulse generator) |
| (14) Power ON switch | (33) Automatic reference position return
switch |
| (15) Power OFF switch | (34) Program reset switch |
| (16) Quality check switch | (35) Front door lock release switch (option) |
| (17) Reserve | (36) Left side interlock ready OK switch |
| (18) Guide switch | (37) Right side interlock ready OK switch |
| (19) Operation switch | (38) Loader interlock preparation OK switch |
| | (39) Workpiece reset switch |

3 COMMON OPERATION PANEL



	Switch	Indicating lamp	Option
(1)		Power indicating lamp	
(2)		Operation ready indicating lamp	
(3)		(Not used)	
(4)	Handwheel feed select switch of each axis	Handwheel feed mode (X/Z) indicating lamp	
(5)	Handwheel feed magnification switches	Handwheel feed magnification (×10/×100) indicating lamp	
(6)	Turret forward select switch		
(7)	Turret indexing switch	Turret origin indicating lamp	
(8)	Turret reverse select switch		
(9)	Rapid traverse speed override select switches	Rapid traverse override (F0/25%/50%/100%) indicating lamp	
(10)	Feed direction select switches		
(11)	Edit mode select switch	Edit mode indicating lamp	
(12)	Memory mode select switch	Memory mode indicating lamp	
(13)	MDI mode select switch	MDI mode indicating lamp	
(14)	Jog feed mode select switch	Jog feed mode indicating lamp	
(15)	Manual rapid traverse mode select switch	Manual rapid traverse mode indicating lamp	
(16)	Manual reference position return mode select switch	Manual reference position return mode indicating lamp	
(17)	Single block mode select switch	Single block mode indicating lamp	
(18)	Optional block skip mode select switch	Optional block skip mode indicating lamp	
(19)	Optional program stop mode select switch	On: Optional program stop mode Flicker: Program stopping	
(20)	Program check mode select switch	Program check mode indicating lamp	
(21)	Working light ON/OFF		
(22)	Alarm reset switch	Alarm indicating lamp	
(23)	Chip conveyor automatic switch	Chip conveyor automatic mode indicating lamp	○

	Switch	Indicating lamp	Option
(24)	Chip conveyor forward switch	Chip conveyor forward indicating lamp	○
(25)	Chip conveyor stop switch		○
(26)	Chip conveyor reverse switch		○
(27)	Front door OPEN/CLOSE switches (Shutter OPEN/CLOSE switches : loader spec.)		○
(28)	C-axis/Spindle turning mode select switch		○
(29)	Handwheel feed select switch of C-axis	Handwheel feed mode (C) indicating lamp	○
(30)	C-axis left turn switch		○
(31)	C-axis right turn switch		○
(32)	Coolant 1 ON/OFF switch	Coolant 1 ON indicating lamp	
(33)	Coolant 2 ON/OFF switch	Coolant 2 ON indicating lamp	○
(34)	Rotary tool speed override select switch	Rotary tool speed override indicating lamp	○
(35)	Rotary tool forward switch		○
(36)	Rotary tool stop switch		○
(37)	Rotary tool reverse switch		○
(38)	Spindle speed override select switch	Spindle speed override indicating lamp	
(39)	Spindle forward switch		
(40)	Spindle stop switch		
(41)	Spindle reverse switch		
(42)	Spindle jog switch	Spindle jog indicating lamp	

4 SCREEN OPERATION PANEL MANUAL OPERATION

4-1 Operation panel changing method

This machine has 2 main spindles, right side one and left side one, arranged in parallel. Each spindle is able to independently be operated. When operating manually, it is necessary to select either right side or left side in advance.

1. In case of operating right side of this machine



Press [Right side operation select switch].
[Right side operation select indicating lamp] will light, and the working light on the right side will also light. However, changing the spindle may not be performed when operating the program on the left side has already been started. Also, when the operation is not performed for a long time, the operation will be invalidated for safety purpose, and the [Right side operation select indicating lamp] will go out. To continue the operation, perform the same operation.

2. In case of operating left side of this machine

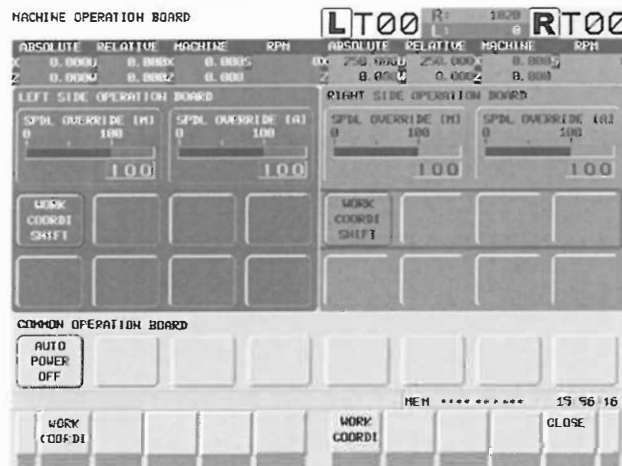


Press [Left side operation select switch].
[Left side operation select switch] will light will light, and the working light on the left side will also light. However, when the operation is not performed for a long time, the operation will be invalid for safety purpose, and the [Left side operation select indicating lamp] will go out. To continue the operation, perform the same operation.

4-2 Operation of machine operation panel screen

OPERATION

When  button is pressed, the machine operation panel screen will be displayed.



Buttons including spindle override, milling override (page 2) and optional specifications are displayed.

With the soft key, setting for override or turning on/off the buttons becomes possible.

Up/Down key



For moving a selected cursor (red) up or down.

Right/Left key



For moving a selected cursor to right or left.

The cursor is moved to the selected one button, and only the selected one become valid.

Up/Down page key



For moving the machine operation panel display to previous page or next page.

For the machine with milling, milling override is displayed on page 2.

Soft key

A soft key corresponding to the selected cursor is displayed.

With the soft key, setting override or turning on/off of the buttons becomes possible.

4-3 Workpiece coordinate system shift switch (option)

Some difference could cause between a programmed work coordinate system and coordinate system set according to G50 command or set by the automatic coordinate system.

If such difference is caused, the set coordinate system can be shifted to the programmed system. Perform this when the set coordination should be shifted to the work coordinate shift memory.

The coordinate can be shifted in Z-axis direction only, and shifting in X-axis direction is not possible.

Either valid or invalid can be set from the machine operation panel screen.

<Valid>

For setting the shift of the work coordinate system, set  to valid (yellow background.)

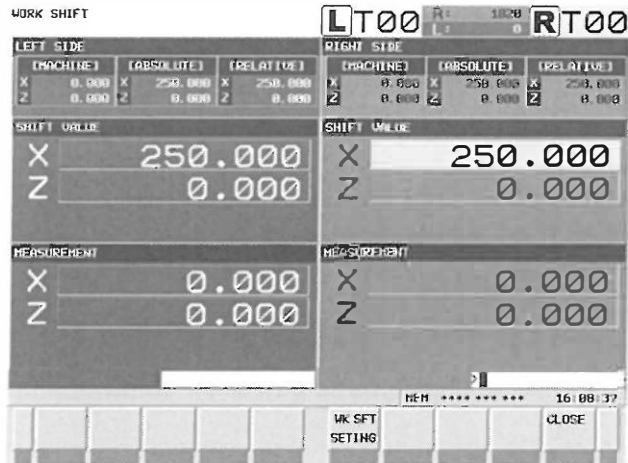
<Invalid>

After setting shifting value of the work coordinate system, or when such a setting is not performed, set  to invalid (background color other than yellow.)

Normally, set it to invalid.

Workpiece coordinate system shifting value writing procedure

- Set the [WORK SHIFT] on the machine operation panel screen to be valid.
- The screen will automatically be changed to the workpiece coordinate system shift screen.



- Move the tool to the position to which it should be shifted.
- Press the soft key [OK SFT SETTING] on the work coordinate system shift screen.

That position will be a reference position (Z0) of the program.

The tool will be shifted in Z-axis direction only from the reference position, and a reference position for a new program will automatically be set.

- After setting, invalidate [Workpiece coordinate system shift] on the machine operation panel screen.

4-4 Automatic power off switch

Either valid or invalid can be set from the machine operation panel screen.

<Valid>

Set  to be valid (yellow background). After the timer preset time is set, the power is automatically off when the conditions are met.

Conditions: (1) The counter is counted up.

(2) Cycles end.

(3) Cycle time exceeds the preset time.

(4) External automatic power off command is input.

<Invalid>

Set  to be invalid (grey background). Then, the automatic power off function is ignored.

When turning ON power, the setting is to be invalid.

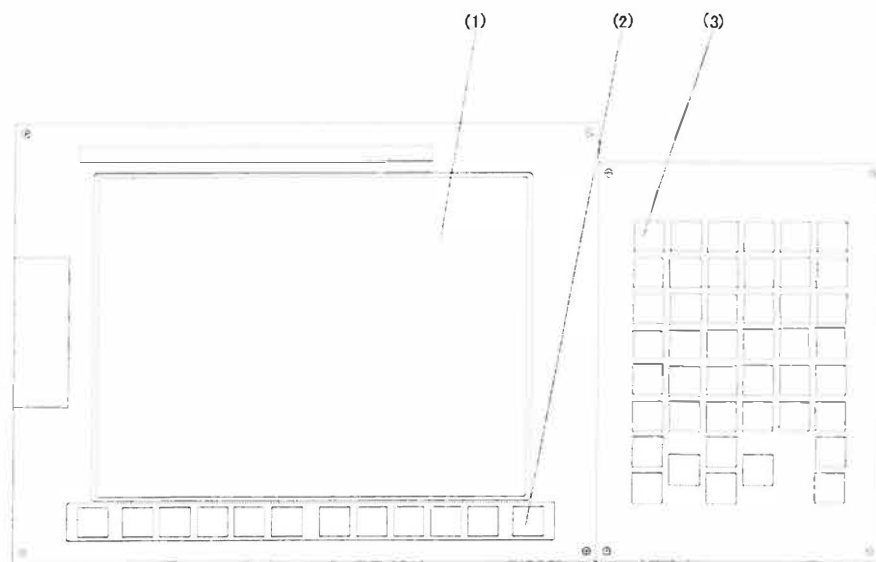
5 NC UNIT

This paragraph explains the outline relative to the operation of NC (numerical control) unit.

For details, refer to the Instruction Manual of NC unit manufacturer.

5-1 LCD/MDI panel

LCD having the indication function for operation apparatus of NC unit and MDI panel which enables to edit the program and to perform the key input for parameter setting, etc., are located on the front face of the machine.



- (1) LCD
- (2) Soft key
- (3) MDI

5-2 LCD

LCD is displayed as the edit screen of the program.

Various menu screens can be selected with function keys and soft keys.

Displaying each menu on the screen, the conditions of NC unit and machine can be easily grasped.

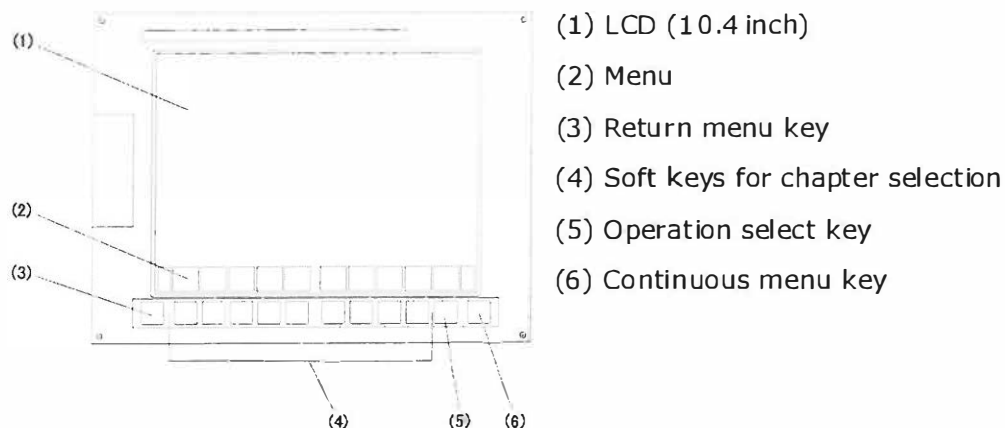
Display functions are as follows.

1. Status display
2. Key input display
3. Program number, Sequence number
4. Alarm display
5. Warning message display
6. Current position display
7. Overall position display
8. Command value display
9. Setting
10. Displaying the tool offset value
11. Program contents display
12. Parameter setting and display
13. Display of self-diagnosis results
14. Custom macro common variables
15. Display of operator message, outer operator message, outer alarm message
16. Display of actual cutting feedrate and spindle speed
17. Program check screen
18. Alarm history display

5-3 Soft keys

The soft keys have various functions, according to the application.

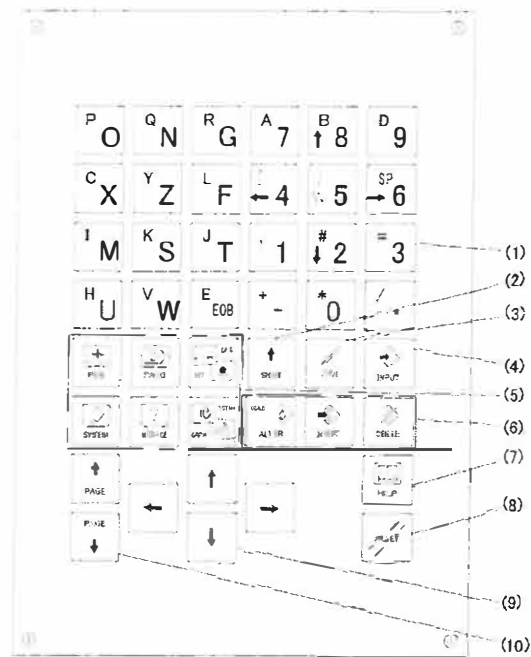
The soft key functions are displayed at the bottom of the screen.



Display steps of screen

- (1) When selecting [Function key] on MDI panel, the chapter select menu belong to its function is displayed.
- (2) When pressing [Soft keys for chapter selection], the screen of its chapter is displayed. If there is no menu of chapter to display, press [Continuous menu key].
- (3) Press [Operation select key] with the chapter screen displayed in order to display the content to desire the operation.
- (4) When returning to the menu for chapter selection, press [Return menu key].

5-4 MDI panel



- | | |
|--------------------------|-----------------------|
| (1) Address/Numeric keys | (6) Edit keys |
| (2) Shift key | (7) Help keys |
| (3) Cancel key | (8) Reset key |
| (4) Input key | (9) Cursor keys |
| (5) Function keys | (10) Page change keys |

1. Address/Numeric keys

Press these keys to input alphabetic, numeric, and other characters.

2. Shift key [SHIFT]



Some keys have two characters on their keytop. Pressing the [SHIFT] key switches the characters. Special characters [^] cursor are displayed on the screen when a character indicated at the bottom right corner on the keytop can be entered.

3. Cancel key [CAN]



Press this key to delete the last character or symbol input the key input buffer.

4. Input key [INPUT]



When an [Address/Numeric keys] is pressed, the data is input to the buffer, and it is displayed on the screen.

To copy the data in the key input buffer to the offset register, etc., press the [INPUT] key.

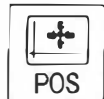
This key can be used as well as the [INPUT] key of soft key.

5. Function keys

Function keys are provided to select the type of screen to be displayed.

The following function keys are provided on the LCD/MDI panel.

(1) Position display [POS]



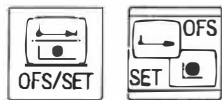
Press this key to display the position screen.

(2) Program [PROG]



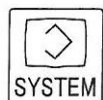
Press this key to display the program screen.

(3) Offset/Setting [OFFSET/SETTING]



Press this key to display the offset/setting screen.

(4) System [SYSTEM]



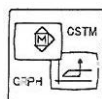
Press this key to display the system screen.

(5) Message [MESSAGE]



Press this key to display the message screen.

(6) Custom/Graphics [CUSTOM/GRAPH]



Press this key to display the custom/graphics screen.
(Standard)

6. Edit keys

Press these keys when editing the program.

(1) Alteration [ALTER]



Used when altering the part of program.

(2) Insertion [INSERT]



Used when inserting and altering the program content.

(3) Deletion [DELETE]



Used when deleting the part of program.

7. Help key [HELP]



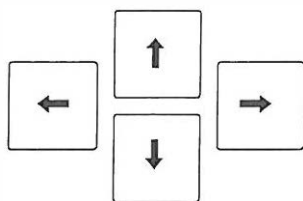
Press this key to display how to operate the machine tool, such as MDI key operation, or the details of an alarm, which occurred in the NC unit (Help function).

8. Reset key [RESET]



Press this key to reset the NC unit, to cancel an alarm, etc.

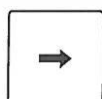
9. Cursor keys



The cursor indicates the input point of character or numeric when editing the program, etc., and moves to its point.

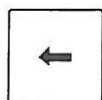
There are four different cursor move keys.

(1) Right direction



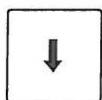
This key is used to move the cursor to the right or in the forward direction.

(2) Left direction



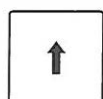
This key is used to move the cursor to the left or in the reverse direction.

(3) Lower direction



This key is used to move the cursor in a downward or forward direction.

(4) Upper direction



This key is used to move the cursor in an upward or reverse direction.

10. Page change keys

Two kinds of page change keys are provided to change the display of LCD screen at the page unit.

(1) Forward direction



This key is used to changeover the page on the LCD screen in the forward direction.

(2) Reverse direction



This key is used to changeover the page on the LCD screen in the reverse direction.

B. MANUAL OPERATION

This Chapter explains about functions for switches and indicating lamps, and manual operations of machine.

Since the machine is actually started, take extreme care for the operation.

Especially, observe items for safety.

For NC unit, understand it, referring to the Instruction Manual of NC unit manufacturer.

WARNING

Since the machine is actually started, read [SAFETY GUIDE] again before operation in order to perform the safety work.

When the machine is operated without understanding details sufficiently, an accident causing injury or death, or machine malfunction and damage will be caused.

CAUTION

Perform [DAILY CHECK] before operation.

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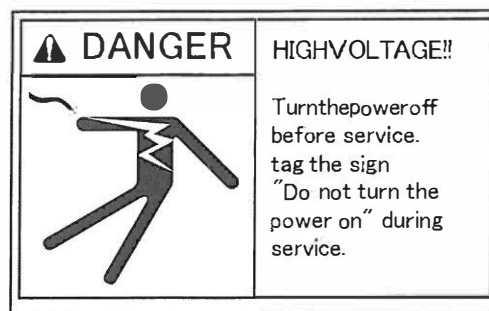
1 POWER ON/OPERATION READY

DANGER

Close the door on the enclosure before turning on power source.

Turn off the power before performing the inspection maintenance.

There is a danger of being killed by an electric shock.



CAUTION

Inspect the machine according to [DAILY CHECK] in the machine instruction manual before turning on the power and after operation ready.

The following procedure is recommended for performing operation ready.

1. Release of emergency stop



Turn [Emergency stop switch] to right to release the emergency stop mode.

This switch is the red mushroom type. A yellow paint is coated around the switch to highlight the switch.

If machine failure occurs, this switch is pressed to stop the machine immediately.

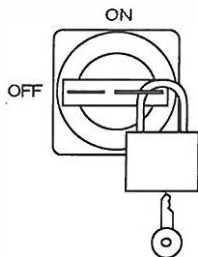
At this time, each equipment stops and operation ready is turned off.

When work is finished, this switch is also pressed before turning off the power source.

When this switch is pressed once, the switch is locked.

When restarting the operation, it is necessary to press the [Operation ready ON switch].

2. Unlocking of padlock for main breaker



Unlock the padlock of [Main breaker].

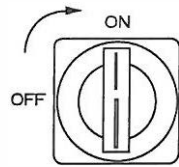
The main breaker is mounted on the enclosure of machine.

This [Main breaker] turns ON or OFF the power supply to the machine and the power supply is supplied from the shop side to the [Main breaker].

The breaker handle is equipped with the locking function so that other persons will not operate the machine.

Please prepare the padlock by customer.

3. Main breaker ON



When turning the breaker handle to "ON", the power is turned on.

4. Power indicating lamp ON



[Power indicating lamp] on the operation panel lights.
The lamp lights with the main breaker ON.

5. Operation ready ON



With only main breaker ON, the machine cannot be operated.

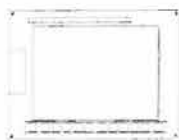
The operation panel is equipped with the switch for operation ready to supply the power to each equipment.

When pressing [Operation ready ON switch], the power is turned on NC unit, hydraulic unit, lubrication unit, coolant pump, etc., equipped to the machine.



When completing the operation ready, [Operation ready indicating lamp] lights.

6. LCD display



When [CNC starting status] is displayed on LCD, the system is normally started, a screen of the present position is displayed.

NOTE : While [CNC starting status] is displayed, the machine cannot be normally operated.

2 EMERGENCY STOP

If the machine must be immediately stopped because any trouble occurs during operation, press [Emergency stop switch]. When the immediate stop of machine is unnecessary, it is recommended to press [Feed hold switch] of the automatic operation mode.

To stop and release the machine by [Emergency stop switch], the following procedure is recommended.

1. Emergency stop



When the machine is operated under either [Manual operation mode] or [Automatic operation mode], this emergency stop mode can be used.

When pressing this switch, the tool slide and the spindle stop.

At this time, the switch is locked.

2. Message of emergency stop



The message is displayed on the LCD.

3. Release of emergency stop



When turning [Emergency stop switch] to right, the switch rises.

4. Operation ready ON



When pressing [Operation ready ON switch], the [Operation ready indicating lamp] lights after some seconds and then, the machine can be operated at any time.

3 POWER OFF

Turn off power source by the following procedure.

1. Machine stop

The equipment such as the spindle and tool slide, etc., are stopped.

2. Emergency stop



Press the [Emergency stop switch].

3. Operation ready OFF



Press [Operation ready OFF switch] on the operation panel.

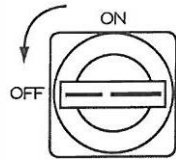
When pressing [Operation ready OFF switch], the power is turned off NC unit, hydraulic unit, lubricant unit, coolant pump, etc., equipped to the machine.

4. Delete of LCD display



LCD display is deleted.

5. Main breaker OFF



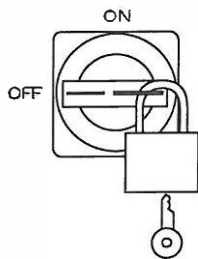
When turning the breaker handle to "OFF", the power is turned off.

6. Power indicating lamp OFF



[Power indicating lamp] on the main operation panel goes off.

7. Locking of main breaker



Lock of [Main breaker].

 DANGER

Be sure to lock the padlock for the main breaker so as not to be operated by other persons after finishing the work.

There is the possibility to be shocked by a high voltage or the program and parameter are changed.

If the machine will be operated without checking them, a potentially hazardous could result in serious injury or machine trouble.

 CAUTION

Safety manager shall carefully save the key of the padlock.

4 FRONT DOOR

4-1 Conditions of front door operation

To ensure worker's safety, the following conditions are added for opening and closing the front door.

C : CLOSE O : OPEN

Condition	Mode	Memory				Single memory MDI				Manual			
	Door interlock	Valid		Invalid		Valid		Invalid		Valid		Invalid	
	Door status	C	O	C	O	C	O	C	O	C	O	C	O
Command	Automatic operation start	O	O	O	O	O	O	O	O	/	/	/	/
	Spindle start	O	×	O	×	O	×	O	O	O	×	O	O
	C-axis start (op.)	O	O	O	O	O	O	O	O	O	O	O	O
	Rotary tool start (op.)	O	×	O	×	O	×	O	O	O	×	O	O
	Manual turret indexing	/	/	/	/	/	/	/	/	O	O	O	O
	Manual axis feed	/	/	/	/	/	/	/	/	O	O	O	O
Display	Alarm display	/	Yes	/	Yes	/	Yes	/	/	/	Yes	/	/

O : Operable

× : Inoperable

(Op.) : Option

4-2 Conditions of front door operation

To ensure worker's safety, the following conditions are added for opening and closing the front door.

NOTE : Even if the door is closed when the spindle rotates at 10% of command value with the door opened, the spindle continuously rotates at its speed as is.

Stop the spindle once before commanding an optional value.

In the machine with the door interlock, while the machine is automatically operated, the spindle rotates and the axis travels, [Door interlock RELEASE switch] does not operate.

C : CLOSE O : OPEN

Condition	Mode	Memory				Single memory MDI				Manual			
	Door interlock	Valid		Invalid		Valid		Invalid		Valid		Invalid	
	Door status	C	O	C	O	C	O	C	O	C	O	C	O
Command	Automatic operation start	O	O	O	O	O	O	O	O	/	/	/	/
	Spindle start	O	×	O	×	O	×	O	△	O	×	O	△
	C-axis start (op.)	O	O	O	O	O	O	O	O	O	O	O	O
	Rotary tool start (op.)	O	×	O	×	O	×	O	O	O	×	O	O
	Manual turret indexing	/	/	/	/	/	/	/	/	O	O	O	O
	Manual axis feed	/	/	/	/	/	/	/	/	O	O	O	O
Display	Alarm display	/	Yes	/	Yes	/	Yes	/	/	/	Yes	/	/

O : Operable

× : Inoperable

△ : Rotated at 10% of command value.

(Op.) : Option

4-3 Front door interlock switch

< Valid >



When setting [Front door interlock switch] to VALID (right side), the machine operation is impossible with the front door opened.

This switch is equipped with the key, which is removed at the valid side.

< Invalid >



When setting [Front door interlock switch] to INVALID (left side), the machine operation is possible a little with the front door opened.

4-4 OPEN/CLOSE of front door : manual type

WARNING

Do not open the front door during machine operation.

If opened, there is a danger of injury due to the scattered workpiece, chip, splashed coolant, etc.



CAUTION

When closing the front door, take care so that hand is not pinched.

The front door is operated manually.

1. Front door OPEN



When the front door is opened, [Front door close indicating lamp] goes off.



When [Front door lock release switch] (option) is provided, open the front door, pressing the [Front door lock release switch] (option).

2. Front door CLOSE



When the front door is closed, [Front door close indicating lamp] lights.

5 TOOL SLIDE



WARNING

When starting the tool slide, spindle etc., close the front door.

There is a danger of injury due to the scattered workpiece, chip and splashed coolant.



CAUTION

- * Do not place the tool, workpiece, etc., on movable portions such as the tool slide, spindle etc.
- * Check a speed regulation before traveling the tool slide.
- * When traveling the tool slide, take extreme care so that it will not collide with the chuck etc.

5-1 Travel direction

Lateral travel of tool slide: X-axis

Right direction: L-turret: -X

R-turret: +X

Left direction : L-turret: +X

R-turret: -X

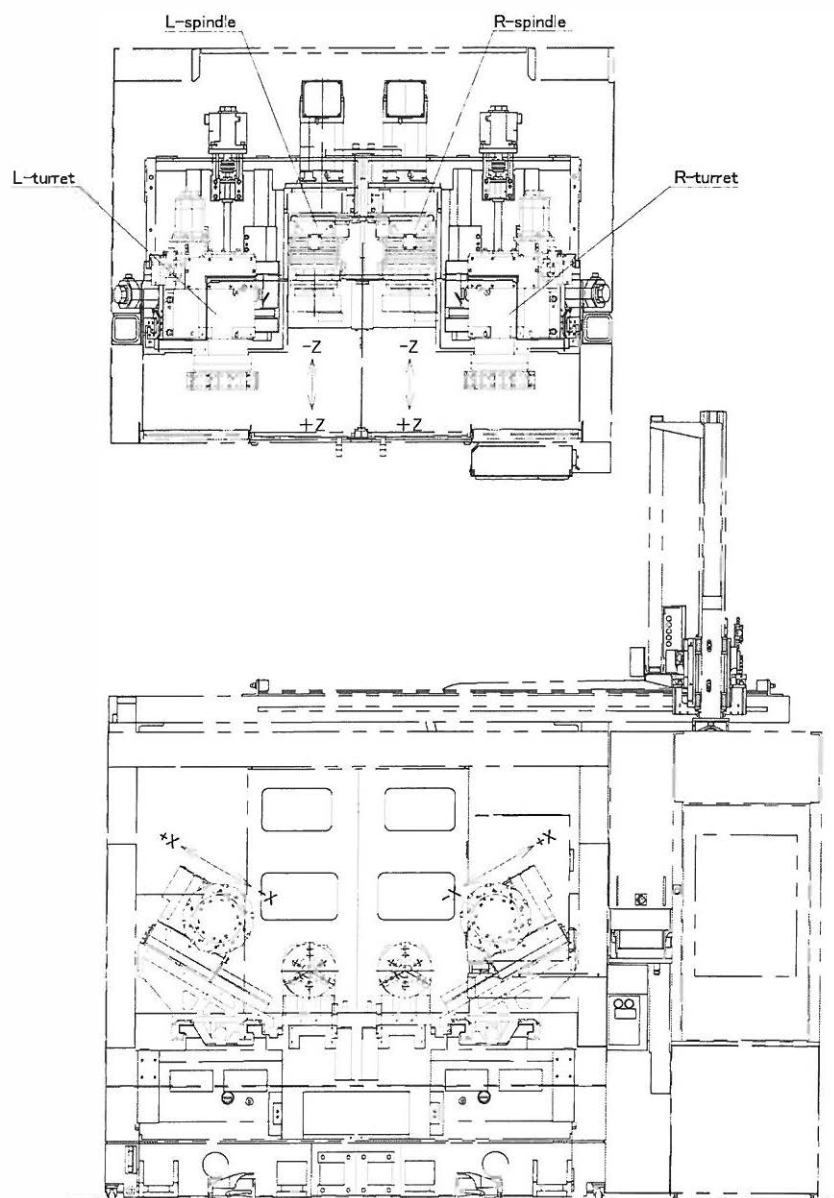
Cross travel of tool slide: Z-axis

Front direction: L-turret: +Z

R-turret: +Z

Rear direction : L-turret: -Z

R-turret: -Z



5-2 Manual reference position return

The reference position differs by the machine specification.

REF.: [TOOLING MANUAL]

Reference position

X-axis: Around stroke end on X-axis (+) side

Z-axis: Around stroke end on Z-axis (+) side

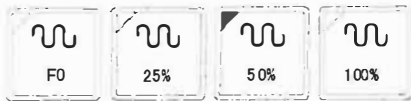
1. Mode selection



When pressing [Manual reference position return mode select switch] of [Mode select switches].

This switch is selected when manually returning the tool slide and C-axis (option) to the reference position.

2. Feedrate selection



Select the speed with [Rapid traverse speed override select switch].

The indicating lamp of selected switch lights.

Each manual operation speed is as follows.

(mm/min)				
Speed Axis	F ₀	25%	50%	100%
X-axis	400	1250	2500	5000
Z-axis	400	1250	2500	5000

CAUTION

Take extreme care when the rapid traverse is selected.

If the unit collides with other equipment, the higher speed increases, the larger damage becomes.

3. Front door close

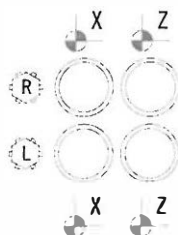


Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

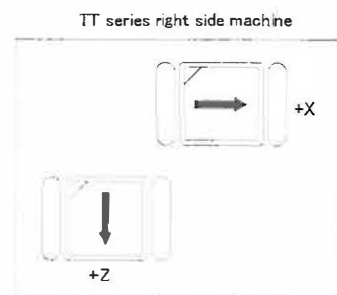
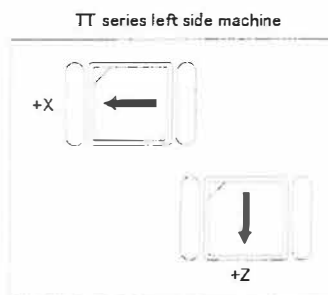
NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

4. Selection of feed direction



Each axis moves at speed set in advance while [Feed direction select switch] is pressed and the axis stops when the switch is released.

Press [+X-axis travel switch] or [+Z-axis travel switch] until the indicating lamp of a switch lights.



5-3 Manual rapid traverse

This mode is used when attempting to travel the tool slide as soon as possible.

1. Mode selection



When pressing [Manual rapid traverse mode select switch] of [Mode select switches].

This switch is selected when the rapid traverse of the tool slide and C-axis (option) are manually performed.

2. Feedrate selection



Select the rapid traverse with [Rapid traverse speed override select switch].

(mm/min)

Speed Axis	F0	25%	50%	100%
X-axis	400	1250	2500	5000
Z-axis	400	1250	2500	5000

CAUTION

Take extreme care when the rapid traverse is selected.
If the unit collides with other equipment, the higher speed increases, the larger damage becomes.

3. Front door close



Close the front door manually.

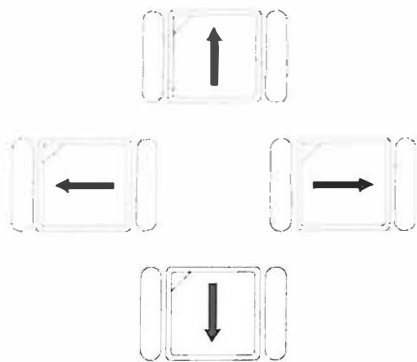


When the front door is closed, [Front door close indicating lamp] lights.



NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

4. Selection of feed direction



When pressing [Feed direction select switch].

NOTE : When keeping [Feed direction select switch] pressed, the tool slide travels to the stroke end and it stops with the hard overtravel alarm.

5-4 Jog feed

This mode is used for forming the chuck jaw for setup or cutting the machining reference plane of the workpiece.

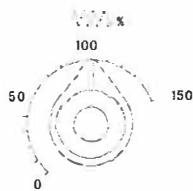
1. Mode selection



When pressing the [Jog feed mode select switch] of [Mode select switches].

This switch is selected when traveling the tool slide and C-axis (option) are manually at jog feed.

2. Feedrate override selection



Select the jog feedrate with [Feedrate override select switch].

The scale is divided into 16 steps and the tool slide stops at scale zero (0).

Jog feedrate is displayed on LCD screen.

Maximum speed: 1260 mm/min, 50 inch/min

The scale of % is used when the automatic operation mode is used.

Since the switch operation is valid for the command value of the program (feed per revolution/feed per min.), set to 100% before starting the machine.

3. Front door close

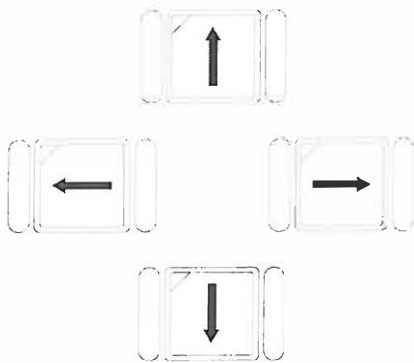


Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

4. Selection of feed direction



When pressing [Feed direction select switch],

NOTE : When keeping [Feed direction select switch] pressed, the tool slide travels to the stroke end and it stops with the hard overtravel alarm.

5-5 Handwheel feed

When manually traveling the tool slide precisely, this mode is used.

Thus, when accurately finishing the chuck jaw for setup or the machining reference plane of the workpiece and correctly positioning the tool slide, the handwheel feed mode is used.

1. Mode selection



Press [Handwheel feed select switch of each axes].

At this time, the indicating lamp of the selected switch lights.

For the C-axis , refer to item 7-5.

2. Movement selection



Select a movement per scale of [Handwheel (manual pulse generator)] with [Handwheel feed magnification switch].

The lamp lights and goes out repeatedly as often as the switch is pressed.

Indicating lamp	Axis	X-axis, Z-axis (mm), C-axis (deg.)	
		Handwheel feed A scale	Handwheel feed A angle
Lamp OFF (x10, x100)		0.001	0.10
Lamp ON (x10)		0.01	1.00
Lamp ON (x100)		0.1	10.00

3. Front door close

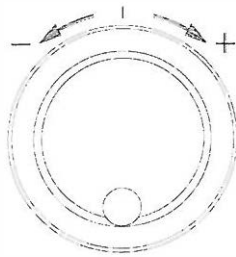


Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

4. Handwheel (manual pulse generator)



When turning the [Handwheel (manual pulse generator)], the tool slide travels to the turned quantity of the handwheel in the selected axis direction and at the selected magnification.

When turning in to the right, the tool slide travels to plus (+) direction. Similarly, when turning in to the left, the minus (-) direction.

At this time, the feedrate is proportional to the handwheel-turning speed.

The handwheel is graduated 100 scales per revolution.

5-6 Recovery of soft overtravel

For the tool slide travel, the soft inhibition areas are provided.

If the tool slide enters this area, it stops because the alarm of the overtravel occurs.

This is the safety equipment to prevent the tool slide from collision.

There are four areas of (+) side, (-) side of X-axis and (+) side, (-) side of Z-axis.

Take care so that the tool slide will not be in overtravel area.

If entered to this area, recover the tool slide by the following procedure.

1. Check of alarm message



Since the alarm message is displayed on the screen, check the alarm content.



At this time, [Alarm indicating lamp] flashing lights.

Alarm message

OT0500 (X)+Overtravel (Soft limit1)

OT0501 (X)-Overtravel (Soft limit1)

OT0500 (Z)+Overtravel (Soft limit1)

OT0501 (Z)-Overtravel (Soft limit1)

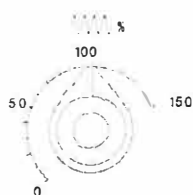
2. Manual operation mode selection



Select any [Manual operation mode].

3. Feedrate selection

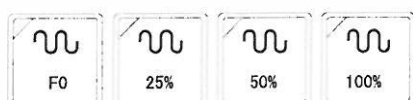
(1) [Jog feed]



Select the feedrate with [Feedrate override select switch].

Select a low speed as much as possible.

(2) [Rapid traverse]



Select rapid traverse with [Rapid traverse speed override select switch].

Select a low speed as much as possible.

(3) [Handwheel feed]



Select the movement with [Handwheel feed magnification switch].

4. Front door close



Close the front door manually.

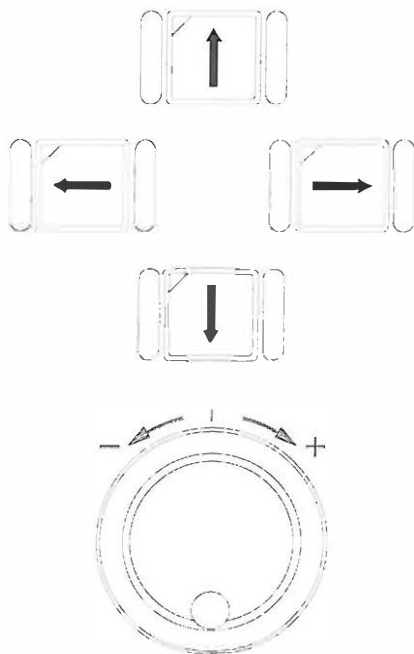
When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

5. Selection of feed direction

CAUTION

Do not mistake the direction of [Feed direction select switches] and direction of (-) or (+) for [Handwheel (manual pulse generator)].
If mistaken, the machine may malfunction.



Return the turret about 10mm in a reverse direction from an over-travel direction.

6. Reset



Press [RESET] key on the MDI panel.

7. Alarm indication



[Alarm indicating lamp] goes off and the machine becomes the normal condition.

5-7 Turret indexing

1. Manual operation mode selection



Select any [Manual operation mode].

2. Front door close



Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

3. Turret indexing



Press [Turret forward select switch] and [Turret indexing switch] simultaneously.

Turret does unclamp, one step forward indexing and clamp.

At the same time, keep the press of [Turret forward select switch], turret does not clamp.

Under this condition, press [Turret indexing switch], turret does forward to the one indexing.

Turret does clamp when [Turret forward select switch] release. (Reverse turn is also same.)

<When turret cannot be indexed>

Check that a main hydraulic pressure is as specified.

<When tool slide with rotary tool cannot be indexed>

- Check that a main hydraulic pressure is as specified.
- Check that the air pressure reaches a specified value.

5-8 Swing of turret by handwheel

The turret can be swung slowly to an optional position with the handwheel. When the turret swings, check that the tool edge will not interfere with the slide cover or workpiece.

1. Set the turret to a handwheel swing mode

Press [Reset key] on MDI panel.

Press [Handwheel feed select switch of each axis].

Press [Turret forward select switch] and [Turret reverse select switch] simultaneously for 1 second.

At this time, the turret is unclamped, and [Turret origin indicating lamp] flickers.

In case of rotary tool type turret

When a rotary tool fixed pin is not locked, the turret cannot be changed to the handwheel swing mode.

When rotating the rotary tool once and pressing the stop switch, the rotary tool fixed pin is locked.

2. When the handwheel is rotated, the turret is also swing

The turret swings 0.1° at 1 pulse of handwheel.

When rotating the handwheel once (100-pulse), the turret swings 10° .

Even if the handwheel magnification switch is pressed, the magnification does not change.

When the turret comes to the indexing position while the turret is swinging with the handwheel, the buzzer sounds and the turret stops temporarily.

[Turret origin indicating lamp] flickers slowly at the indexing position, and it flickers quickly at other positions.

3. Release of turret handwheel swing mode

<Releasing method 1>

Press [Turret indexing switch] at the indexing position.

At this time, the turret is clamped, and the turret handwheel swing mode is released.

[Turret origin indicating lamp] goes out or lights from a flickering status.

<Releasing method 2>

Even if [Emergency stop switch] or [Reset key] is pressed, the turret handwheel swing mode is released.

Although the turret is clamped at the indexing position, it is not clamped at other positions.

In this case, the turret returns to the indexing position by a normal manual indexing operation.

5-9 Rotary tool : Multi-spindle control (option)

The rotary tool rotation is accompanied with various danger conditions.

WARNING

- * Close the front door when rotating the rotary tool.
If this warning is not observed, it will cause accident resulting in injury or death because a part of your body is caught in a rotating part or any tools or chips scatter.
- * Never touch the rotary tool while it rotates.
An accident causing injury or death that becomes entangled in a tool, or be injured by a tool edge will be caused.
- * Check the rotary tool is securely mounted to the holder, the holder is the securely mounted to the turret and workpiece is securely mounted in the rotary tool before rotating the rotary tool.
If these are loosened, an accident causing injury or death, or machine damage will be caused because a tool or workpiece scatters, or a holder drops.

1. Manual operation mode selection



Select any [Manual operation mode].

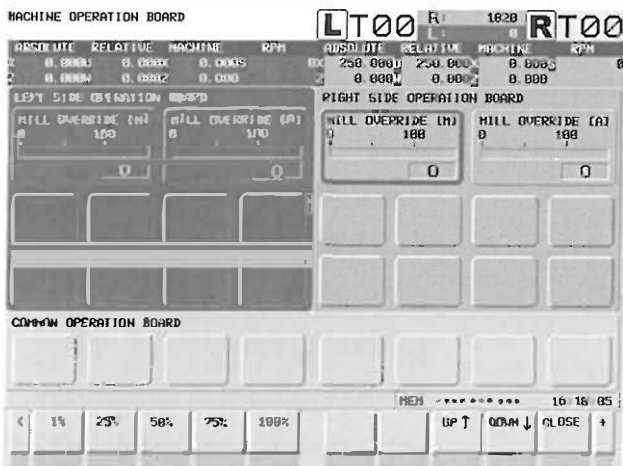
2. Selection of rotary speed

WARNING

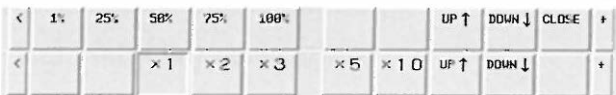
Before starting the rotary tool, make the value of [MILL OVERRIDE [M]] on the machine operation screen small. If the value is large, the rotary tool will start rotating at high speed, which could cause a person to be caught in or the tool flies out, resulting a personal injury or death, or machine damage.

OPERATION

Press  on the operation panel to display the machine operation panel screen. Then, press the page ↓ key to display the [MILLING OVERRIDE [M]].



Move the selected cursor to [MILLING OVERRIDE [M]], and set the override value with the soft key.



If the value is set to 100%, the rotary tool speed will be accelerated to the maximum speed.

Check the rotating speed of the rotary tool of this machine again.

3. Front door close



Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

4. Rotary tool start



When pressing [Rotary tool forward switch], the rotary tool rotates clockwise.

When pressing [Rotary tool reverse switch], the rotary tool rotates counterclockwise.

< Conditions for rotary tool start >

In the following case, the rotary tool does not start:

- (1) Emergency stop
- (2) During reset.
- (3) When chuck is unclamped.
- (4) During program stop and optional stop.
- (5) When the door is not closed under valid condition of front door interlock valid.
REF.: [Chapter B. 4 FRONT DOOR]
- (6) During program check mode (the rotary tool starts when the rotary tool start is set to valid.).

NOTE : When the option specification is added, the conditions may differ from the above.

5. Rotary tool stop



The rotary tool stops when [Rotary tool stop switch] is pressed.

NOTE : When changing the rotary direction of the tool, stop the tool once.

<Fixing rotary tool>

- When stopping the tool by pressing [Rotary tool stop switch], the tool stops at an orientation, and it is locked by the rotary tool fixed pin.

- When the tool is stopped by pressing [Rest key] on MDI panel.

The rotary tool stops in free status.

The rotary tool is not fixed by the fixed pin.

When a turret swing is commanded in this status, the rotary tool stops at the orientation automatically and it is locked by the fixed pin.

After that, the turret swings.

6 SPINDLE

The spindle rotation is accompanied with various danger conditions.

Especially, securely chuck the work before rotating the spindle.

When chucking the workpiece securely, the spindle rotation is available.

REF.: [Chapter C. CHUCKING]

WARNING

- * Close the front door when rotating the spindle.

If this warning is not observed, it will cause accident resulting in injury or death because a part of your body is caught in a rotating part or any tools or chips scatter.

- * Never touch the spindle or workpiece while it rotates.

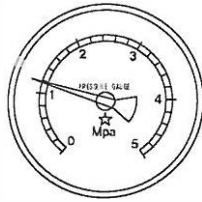
If this warning is not observed, it will cause accident resulting in injury or death because a part of your body is caught in a rotating part.

- * Check the chuck is securely mounted to the spindle and the workpiece is also securely mounted in the chuck before rotating the spindle.

If they are loosened, it will cause accident resulting in injury or death or machine damage because a rotating body scatters.

6-1 Spindle START/STOP

1. Setting of chuck pressure



Check the chuck pressure is regularly supplied to securely clamp the workpiece during spindle rotation.

WARNING

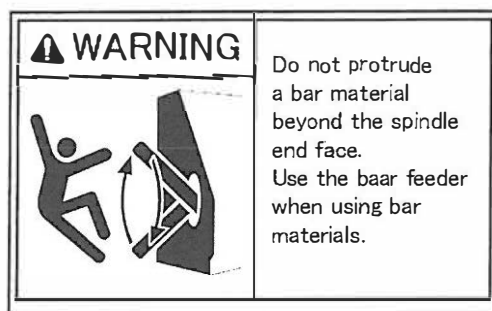
Set the chuck pressure at the lower thrust range after comparing the allowable thrust of chuck with the allowable thrust of the rotary cylinder. If the above is ignored, there is a danger of scattering the workpiece during rotation because of chuck breakdown.

If this warning is not observed, it will cause accident resulting in injury or death, or machine damage because a workpiece or jaws scatters. Workpiece and jaw can be flew out, be related with the fatal accident or machine damage.

2. Workpiece clamp

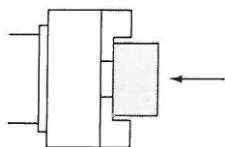
WARNING

When clamping the bar, set it so as not to extrude the bar through the spindle back hole. If the bar must be extruded, support it with the steady rest or the feeder. If this equipment is not provided, it will cause accident resulting in injury or death, or machine damage because the bar is bent when the spindle rotates.



CAUTION

Take extreme care so that fingers won't be pinched in the chuck.



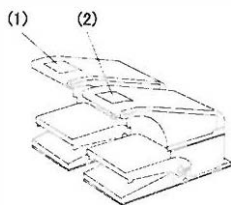
Squeeze the workpiece to the end face of the [Chuck jaw clamp/unclamp foot switch].

< 1-run switch >



When stepping on the foot switch once with the jaw opened, the jaws close. When also stepped, the jaws open.

< 2-run switch >



The 2-run foot switch is equipped with an independent function of chuck clamp/unclamp. Both outer dia./inner dia. clamp functions are as follows.

Left side (1): clamp, Right side (2): unclamp

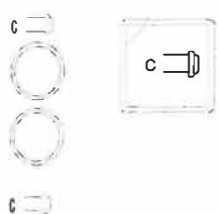
3. Chuck clamp indicating lamp ON



When the workpiece is clamped, [Chuck clamp indicating lamp] lights.

4. Spindle turning mode selection (option)

< Multi-spindle control >



Press [C-axis/Spindle turning mode select switch] and put out the indicating lamp.

5. Manual operation mode selection



Select any [Manual operation mode].

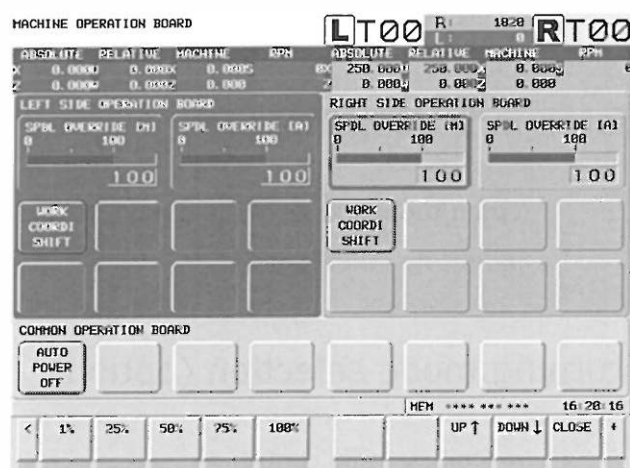
6. Selection of spindle speed

WARNING

Before starting the spindle, make the value of [SPDL OVERRIDE [M]] on the machine operation panel screen small. If the value is set to large, the spindle starts rotating at high speed suddenly, which is very dangerous.

OPERATION

Press  button on the operation panel to display the machine operation panel screen.



Move the selected cursor to [SPDL OVERRIDE [M]], and set the value of the override with the soft key.



A message for confirmation is displayed when setting the manual override to 25% - 100%.

Press [YES] to change.

Press [NO] to cancell.

Check the specification of the spindle rotating speed of this machine again.

NOTE : At power on, the value of [SPDL OVERRIDE [M]] is set to the default of 1%.

Increase or decrease the value of the override is set to x1.

7. Front door close



Close the front door manually.



When the front door is closed, [Front door close indicating lamp] lights.



8. Spindle start



When pressing [Spindle forward switch], the spindle rotates counterclockwise when viewed from the front face of spindle.

When pressing [Spindle reverse switch], the spindle rotates clockwise when viewed from the front face of spindle.

< Conditions for spindle start >

In the following case, the spindle does not start:

- (1) Emergency stop
- (2) During reset.
- (3) When chuck is unclamped.
- (4) During program stop and optional stop.
- (5) When the door is not closed under valid condition of front door interlock valid.
REF.: [Chapter B. 4 FRONT DOOR]
- (6) During program check mode (the spindle starts when the spindle start is set to valid.).

NOTE : When the option specification is added, the conditions may differ from the above.

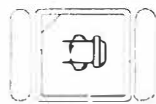
9. Spindle stop



The spindle stops when [Spindle stop switch] is pressed.

NOTE : When changing a rotary direction, stop the spindle once.

10. Spindle jog



When pressing [Spindle jog switch], the spindle rotates forward in a constant speed with the switch still pressed.

When releasing the switch, the spindle stops.

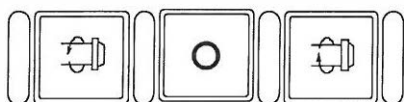
6-2 Chuck CLAMP/UNCLAMP

When the spindle is stopped, the chuck is clamped and unclamped by stepping the [Chuck jaw clamp/unclamp foot switch] on the floor.

CAUTION

During spindle rotation, the operation of chuck clamp/unclamp is impossible.

1. Spindle stop



The spindle stops when [Spindle stop switch] is pressed.

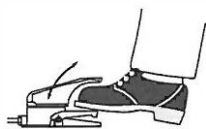
2. Clamp method selection

Selection the chuck clamp method with MDI panel.

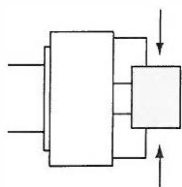
- (1) Outer dia. face clamp method
- (2) Inner dia. face clamp method

REF.: [Chapter C, 3 SELECTION OF CLAMP METHOD]

3. Chuck clamp

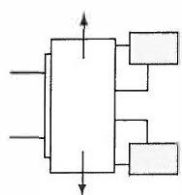


Step [Chuck jaw clamp/unclamp foot switch].



< Outer dia. face clamp method >

Chuck jaws clamp the workpiece inward.



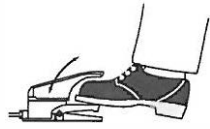
< Inner dia. face clamp method >

Chuck jaws clamp the workpiece outward.

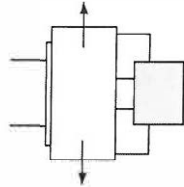


When chuck jaws clamp, [Chuck clamp indicating lamp] lights.

4. Chuck unclamp

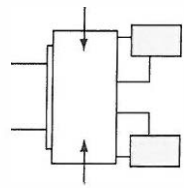


Step [Chuck jaw clamp/unclamp foot switch] again.



< Outer dia. face clamp method >

Chuck jaws unclamp the workpiece outward.



< Inner dia. face clamp method >

Chuck jaws unclamp the workpiece inward.

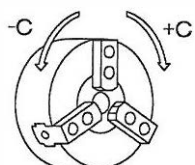


When chuck jaws unclamp, [Chuck clamp indicating lamp] goes out.

7 C-AXIS : Cs-AXIS CONTROL (OPTION)

7-1 Rotary direction by C-axis function

The spindle rotary axis is called the C-axis.



Counterclockwise turn (CCW) ... -C

Clockwise turn (CW) ... +C

WARNING

Close the front door when the tool slide, spindle and headstock etc., are actuated.

There is a danger of injury because workpiece, chips, coolant, etc., may scatter or splash.

CAUTION

- * Do not place the tool, workpiece and headstock etc., on movable portions such as the tool slide, spindle etc.
- * Check a speed regulation before rotating the C-axis.

7-2 C-axis manual reference position return

To establish the coordination of a C-axis, perform the reference position returning of the C-axis once after turning ON power.

After that, it is unnecessary to perform the reference position returning of the C-axis until the power is turned OFF.

1. C-axis mode selection



Press [C-axis/Spindle turning mode select switch].

At this time, the indicating lamp of a switch flickers or lights.



In flickering: The coordinate of the C-axis is not established.

It is necessary to perform the reference position returning to establish the coordinate.

In lighting: The coordinate of the C-axis is established.

It is unnecessary to perform the reference position returning.

In lighting out: This is a spindle turning mode.

2. Mode selection



When pressing [Manual reference position return mode select switch] of [Mode select switches].

3. Front door close



Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

4. Selection of feed direction



Keep pressing [C-axis right turn switch] until the C-axis stops.

The speed becomes 360000 deg./min.

NOTE : Even if [C-axis feed direction select switch] is pressed with the mode set to the spindle turning mode, the spindle does not rotate.

5. Indicating lamp for return completion to reference position

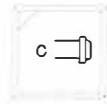


When the reference position returning is completed, the indicating lamp of [C-axis right turn switch] lights.

7-3 Rapid traverse by C-axis function (Cs-axis control)

This mode is used when attempting to turn the C-axis as soon as possible.

1. C-axis mode selection



Press [C-axis/Spindle turning mode select switch].

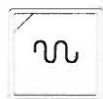
The indicating lamp of a switch lights.



When the indicating lamp of the switch flickers, perform the reference position returning of the C-axis.

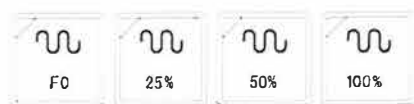


2. Mode selection



When pressing [Manual rapid traverse mode select switch] of [Mode select switches].

3. Feedrate selection



Select the speed with [Rapid traverse speed override select switch].

(deg./min.)

Speed Axis	F0	25%	50%	100%
C-axis	400	2700	5400	10800

CAUTION

Take extreme care when the rapid traverse is selected.

If the unit collides with other equipment, the higher speed increases, the larger damage becomes.

4. Front door close

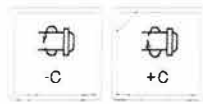


Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

5. Selection of feed direction



When pressing [C-axis left rotary switch] or [C-axis right rotary switch] of [C-axis feed direction select switches], the C-axis turns at the selected speed in the arrow head direction.

When releasing the switch the C-axis stops.

NOTE : Even if [C-axis feed direction select switch] is pressed with the mode set to the spindle turning mode, the spindle does not rotate.

7-4 Jog feed by C-axis function (Cs-axis control)

1. C-axis mode selection



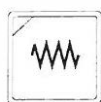
Press [C-axis/Spindle turning mode select switch].

The indicating lamp of a switch lights.

When the indicating lamp of the switch flickers, perform the reference position returning of the C-axis.

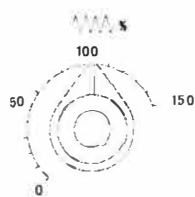


2. Mode selection



When pressing [Jog feed mode select switch] of [Mode select switches].

3. Feedrate selection



Select the jog feed with [Feedrate override select switch].

Maximum speed: 1260deg./min

4. Front door close



Close the front door manually.

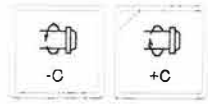


When the front door is closed, [Front door close indicating lamp] lights.



NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

5. Selection of feed direction



When pressing [C-axis left turn switch] or [C-axis right turn switch] of [C-axis feed direction select switches], the C-axis turns at the selected speed in the arrow head direction.

When releasing the switch the C-axis stops.

NOTE : Even if [C-axis feed direction select switch] is pressed with the mode set to the spindle turning mode, the spindle does not rotate.

7-5 Handwheel feed by C-axis function (Cs-axis control)

Use this mode to manually rotate the spindle correctly by using C-axis function (option.)

1. C-axis mode selection



Press [C-axis/Spindle turning mode select switch]. The indicating lamp of a switch lights.

When the indicating lamp of the switch flickers, perform the reference position returning of the C-axis.

2. Mode selection



When pressing the [Handwheel feed select switch of C-axis].

3. Handwheel feed magnification selection



Select a movement per scale of [Handwheel (manual pulse generator)] with [Handwheel feed magnification switch].

Indicating lamp	Axis	C-axis (deg.)	
		Handlewheel feed A scale	Handlewheel feed A angle
Lamp OFF (×10, ×100)		0.001	0.10
Lamp ON (×10)		0.01	1.00
Lamp ON (×100)		0.10	10.00

4. Front door close

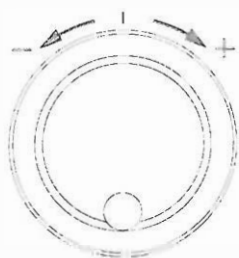


Close the front door manually.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

5. Handwheel (manual pulse generator)



When turning the [Handwheel (manual pulse generator)], the C-axis rotates travels to the turned quantity of the handwheel at the selected magnification.

At this time, the feedrate is in proportion to the handwheel-turning speed.

NOTE : Even if [Handle (Manual pulse generator)] is turned with the mode set to the spindle turning mode, the spindle does not rotate.

8 COOLANT SYSTEM

CAUTION

When discharging the coolant, close the front door.

1. Front door close



Close the front door manually.

In case the loader is provided, press [Shutter close switch] to close the shutter.

When the front door is closed, [Front door close indicating lamp] lights.

NOTE : If [Front door lock release switch] (option) is provided, refer to item 4-3.

2. Coolant ON



When pressing [Coolant 1 ON/OFF switch], the switch lights and coolant discharges from the turret holder.

NOTE : The discharge position may vary according to the option specification.

3. Coolant OFF



When pressing [Coolant 1 ON/OFF switch] once more, the switch lamp goes out and coolant stops.

9 CHIP CONVEYOR (OPTION)

CAUTION

- * Do not touch the chip conveyor during transfer.

There is a danger of pinching in the chip conveyor and being injured with chip.

- * When starting the chip conveyor, close the front door.

9-1 Manual operation mode

The following procedure is recommended for operating the chip conveyor.

1. Chip conveyor forward



When pressing [Chip conveyor forward switch], the indicating lamp lights and the conveyor is continuously operated forward.

The chip in the machine is unloaded.

2. Chip conveyor stop switch



When pressing [Chip conveyor stop switch], the chip conveyor stops.

3. Chip conveyor reverse switch



While pressing [Chip conveyor reverse switch], the chip conveyor reversibly transfers.

When releasing the switch, the conveyor stops.

If chip is caught in the conveyor, use this mode.

The conveyor may not run depending on the type of the chip conveyor.

9-2 Automatic operation mode

The following procedure is recommended for start and stop the chip conveyor during the automatic operation.

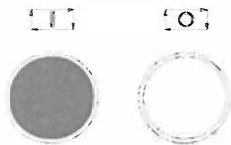
1. Start preparation of chip conveyor



When pressing [Chip conveyor automatic switch] before the automatic operation, the indicating lamp lights.

However, the conveyor does not start.

2. Start of chip conveyor



When pressing [Cycle start switch], the chip conveyor starts simultaneously with the program controlled mode and it continuously transfers forward.

3. Stop of chip conveyor



When pressing [Chip conveyor stop switch], the chip conveyor stops.

At this time, the indicating lamp goes off.



When operating the conveyor again, press [Chip conveyor automatic switch] switch.



When pressing [Feed hold switch], the chip conveyor stops simultaneously with the program controlled mode.

10 AUTOMATIC REFERENCE POSITION RETURN

In order to realize interlocked operation of this machine and the loader, both the tool slide and loader are automatically returned to the reference position.

For TT-2600, the tool slide must be moved as close to the 2nd reference position as the loader interlocking condition.

This function is to automatically move the tool slide as close to the 2nd reference position by pressing the switch.

In addition, the loader is returned to the reference position simultaneously with the automatic reference position return of this machine.

Tool slide 2nd reference position

X-axis: Same as X-axis reference position

Z-axis: Around - OT

Loader reference position

XG-axis : Same as XG-axis reference position

YG-axis : Same as YG-axis reference position

ZG-axis : Same as ZG-axis reference position

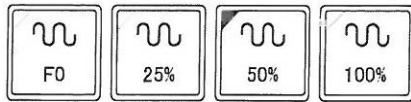
1. Mode selection



(1) Press [Automatic reference position return switch].

This switch is used to return the tool slide to the 2nd reference position.

2. Feedrate selection



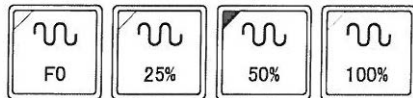
In case of tool slide, select the rapid traverse speed by operating [Rapid traverse speed override select switch] on the operation panel.

The indicating lamp of selected switch lights.

Each manual operation speed is as follows.

(mm/min)

Speed Axis	F0	25%	50%	100%
X-axis	400	1250	2500	5000
Z-axis	400	1250	2500	5000



In case of loader, select the rapid traverse speed by operating [Rapid traverse speed override select switch] on the loader pendant.

The indicating lamp of selected switch lights.

Each manual operation speed is as follows.

(mm/min)

Speed Axis	F0	25%	50%	100%
XG-axis	1000	2500	5000	10000
YG-axis	1000	2500	5000	10000
ZG-axis	1000	2500	5000	10000

3. Operation

- (1) When pressing [Automatic reference position return switch], it is switched to the manual reference position return mode, the message [2004 STARTING AUTOMATIC REFERENCE RETURN. PRESS AUTOMATIC REFERENCE RETURN BUTTON AGAIN] (A, B, C type), [1103 STARTING AUTOMATIC REFERENCE RETURN. PRESS AUTOMATIC REFERENCE RETURN BUTTON AGAIN] (D type: R side), [1303 STARTING AUTOMATIC REFERENCE RETURN. PRESS AUTOMATIC REFERENCE RETURN BUTTON AGAIN] (D type: L side) is displayed.
- (2) When pressing [Automatic reference position return switch] with the message 2004 (A, B, C type) (1103 (D type: R side), 1303 (D type: L side)) displayed in the manual reference position return mode, the 2nd reference position return is started.
- (3) Z-axis is returned to the reference position. If X-axis is being returned to the reference position, this operation is not performed but the step (5) is performed.
When the Z-axis of loader is returned to the reference position, the Y-axis of loader followed by the X-axis of loader is returned to the reference position.
- (4) After Z-axis is returned to the reference position, X-axis is returned to the reference position.

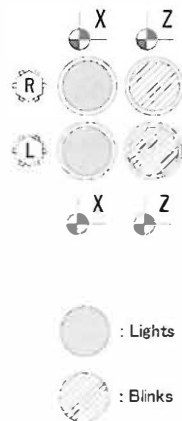
(5) After X-axis is returned to the reference position, it is automatically switched to the manual rapid traverse mode, Z-axis is moved to the minus (-) direction. When the Z-axis machine coordinate value becomes on the minus side of the value set by CNC parameter 1241#Z, Z-axis is stopped.

* CNC parameter 1241#Z :

Default is -240.000 (Do not change this value unnecessarily. If inappropriate value is set, the loader could collide.) When the Z-axis machine coordinate is on the minus side of this value, it is considered that Z-axis is already returned to the 2nd reference position.

Unit: mm

(6) When the 2nd reference position return is completed, the X-axis reference position return completion lamp lights and the Z-axis reference position return completion lamp blinks.



(7) When the loader Z-axis is not returned to the reference position, it is returned to the reference position, and then, the loader Y-axis followed by the loader X-axis is returned to the reference position.

4. Operation stop

In the following conditions, the auto reference position return is not performed or is stopped.

The loader side operation and conditions are further included for the loader auto reference position return.

- Mode select switch or axis travel switch is pressed during operation.
- Current value is the 2nd reference position.
- Door is open.
- During automatic operation
- During feed hold
- In interlocking mode
- Loader is at the interference position.
- During NC reset

In case that Message 2004 (A, B, C type) (1103 (D type: R side), 1303 (D type: L side)) is displayed, pressing [Automatic reference position return switch] again after stopping the operation will restart the operation. To erase the Message 2004 (A, B, C type) (1103 (D type: R side), 1303 (D type: L side)) after stopping the operation, press [Alarm reset switch].

C. CHUCKING

This chapter explains about the set-up to chuck the workpiece.

The chucking work is a very important on lathe operation.

The chuck features the safety and correct chucking by integrated functions.

Since there is a danger of causing the trouble if the part of function fails.

Correctly understand the chuck mechanism before proceeding the work.

CONTENTS

1 PRECAUTIONS FOR CHUCKING	C3
2 SETTING OF CHUCKING FORCE	C6
3 SELECTION OF CLAMP METHOD	C8
4 FORMING OF CHUCK JAWS	C11
4-1 Outer dia. face clamp	C11
4-2 Inner dia. face clamp.....	C17

1 PRECAUTIONS FOR CHUCKING

Completely understand precautions and observe them strictly.

If not strictly observed, there is a danger of injury due to scattered workpiece during the spindle rotation because of damage for the chuck or rotary cylinder.

WARNING

- * Set the cylinder pressure for chuck to the low thrust range after comparing the allowable thrust of the chuck with the allowable thrust of the cylinder.

If this warning is not observed, it will cause accident resulting in injury or death, or machine damage because a chuck and cylinder may damage, and a workpiece or any jaw scatters.

- * Determine the cylinder pressure for chuck after carefully considering the workpiece shape, size, spindle speed, cutting force, etc., because the cutting force may exceed the chucking force when the deformed workpiece, protruded pouring gate and workpiece with burr are machine. If a workpiece is machined with a gripping force reduced, it will cause accident resulting in injury or death or machine damage because a workpiece scatters.

- * If the distance from the chuck end face to the chucking point of the jaw is longer than the standard soft jaw height, there is the danger of damaging jaws or bolts due to the remarkable force involved. If any bolt will damage during chuck rotation, it will cause accident resulting in injury or death, or machine damage because a workpiece or any jaw scatters.

WARNING

- * Carefully consider the setting of the cylinder pressure for chuck because acting centrifugal force according to the increase of the spindle speed reduces the chucking force.

If a workpiece is machined with a gripping force reduced, it will cause accident resulting in injury or death or machine damage because a workpiece scatters.

- * Determine a lower allowable rotating speed in comparison with allowable rotating speeds of the chuck and the cylinder, and also, determine it in consideration of jaw and workpiece form.

If the rotating speed exceeds the allowable range, it will cause accident resulting in injury or death or machine damage because the workpiece scatters while the spindle is rotating.

- * When machining the bar, don't extrude the bar through the spindle back hole.

In an unavoidable case, support it with the steady rest or the bar feeder.

- * When machining the bar with it far extruded from the chuck front, support it with the tailstock spindle of the steady rest because there is danger in removing the due to bar bending.

If the free edge of a workpiece is not supported, it will cause accident resulting in injury or death or machine damage because the workpiece is bent or swung.

- * Do not perform the operation of chuck CLAMP/UNCLAMP during spindle rotation.

Be sure to stop the spindle before mounting the workpiece.

It will cause accident resulting in injury or death or machine damage because the workpiece scatters and fall down.

CAUTION

- * When chucking the workpiece, take care so that hands are not pinched in the chuck.
- * Do not use the jaw, which is weightier than the standard soft jaw because the chucking force is reduced by the excess centrifugal force.
- * Occasionally reform the chucking face of the soft jaw because the chucking force of the workpiece is reduced by the wear of the chucking force on the soft jaw.
- * Daily lubricate the chuck. If lubrication insufficiently, wearing proceeds and the chucking force is reduced.
- * Do not strike the chuck or workpiece with a hammer, etc.
The service life of the chuck is shortened and problems will arise.

NOTE : (1) Carefully clean the mounting face of the soft jaw before mounting it so as not to cause a machining accuracy failure.

(2) Make the forming plug with the material equivalent to the workpiece.

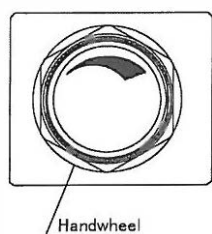
2 SETTING OF CHUCKING FORCE

The chucking force is adjusted by a chuck pressure.

Since the chucking force is reduced in accordance with the acceleration of the spindle speed, sufficiently consider its chucking force.

REF.: [MACHINE INSTRUCTION MANUAL Chapter D, 7 CHUCK SYSTEM]

1. Pressure adjustment of chuck



Remove the cover if the cover is set to the reducing valve handwheel.

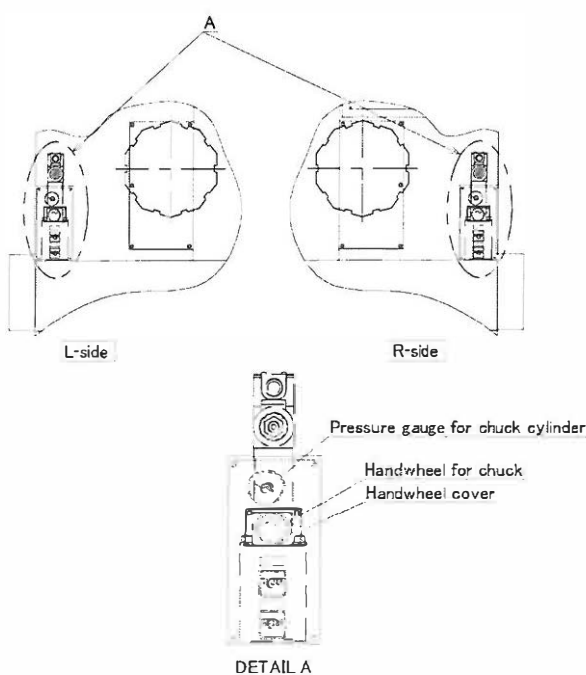
Loosen the lock nut of [Pressure reducing valve] counterclockwise and turn the handle to adjust the pressure, watching the pressure gauge.

Clockwise: Pressure increase

Counterclockwise: Pressure decrease

Set: 0.8 to 2.5 MPa

Understand the chuck system before setting the adequately pressure for the chuck.

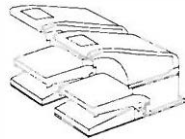


2. Operation check of chuck jaws



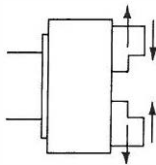
< 1-run switch >

Repeat the clamp/unclamp operations of chuck jaws several times by stepping on the foot switch to check chuck jaws are correctly operated.

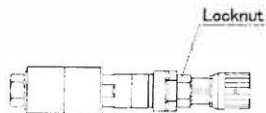


< 2-run switch >

Alternately step the left foot switch (clamp) and the right foot switch (unclamp) to check the clamp/unclamp operations of chuck jaws.



3. Lock of reducing valve



Fix the lock nut of the [Reducing valve] by turning to clockwise.

Mount the cover when the cover is provided to the reducing valve handle.

3 SELECTION OF CLAMP METHOD

The following explains about steps selecting the clamp method of outer diameter or inner diameter of workpiece.

CAUTION

Chucking method cannot be changed during spindle rotation.

1. MDI mode selection



When pressing [MDI mode select switch] of [Mode select switches].

This switch is selected when writing a simple program on LCD with MDI panel and automatically operating the machine.

This switch is used when a test operation is performed.

After executing the program, it is erased.

2. LCD display



Press [PROG] key of the function keys and then, press [MDI] of the soft key.



3. MDI program



Program the operation with [Address/Numeric keys].

Press the function key [EOB] at each block end.

Semicolon (;) is attached to the block end.

The clamp method is selected by assigning M-function during the program.

Outer dia. face clamp method: M88;

Inner dia. face clamp method: M89;

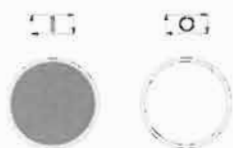


After programming, press [INSERT] key to store the clamp method.

WARNING

If this warning is not observed, in the memory operation, never operate the program with M88 and M89 stored together it will cause accident resulting in injury or death or machine damage because the workpiece scatters when the chuck jaws loosen.

4. Execution of program



When pressing [Cycle start switch], the indicating lamp lights and the program is executed.

In automatic operation mode (memory operation, MDI operation), this press switch is for starting the automatic operation.

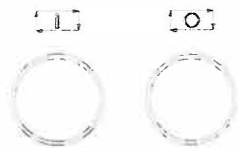
When pressing this switch, the indicating lamp lights.

With the switch pressed, the program can execute the automatic operation.

5. Reset



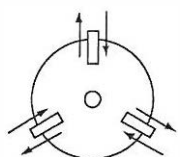
When pressing [RESET] key, [Cycle start switch] goes out.



6. Clamp/unclamp check of chuck jaws



Step [Chuck jaw clamp/unclamp foot switch] to check the outer dia. face clamp/inner dia. face clamp of chuck jaws.



< Outer dia. face clamp method >

Jaws travel inside and [Chuck clamp indicating lamp] lights.

When jaws travel outside, the lamp goes off.



< Inner dia. face clamp method >

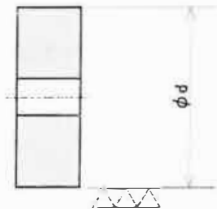
Jaws travel outside and [Chuck clamp indicating lamp] lights.

When jaws travel inside, the lamp goes off.

4 FORMING OF CHUCK JAWS

4-1 Outer dia. face clamp

1. Forming plug



Prepare the forming plug.

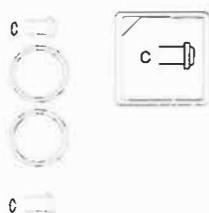
Finish the plug at 6.3S or less of surface roughness.

2. Selection of inner diameter clamping system of workpiece (M89)

First, machine the part clamping the plug for forming. Since it is machined with the chuck jaws unclamped, select the inner diameter clamping system.

Refer to the clamping system described on a previous item.

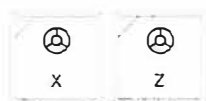
3. Spindle turning mode selection (option)



<Multi-spindle control>

Press [C-axis/Spindle turning mode select switch] and put out the indicating lamp.

4. Handwheel feed mode selection

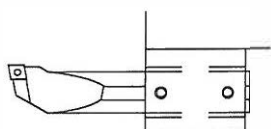


When pressing [Handwheel feed select switch of each axes] of [Mode select switches].

5. Indexing of boring tool



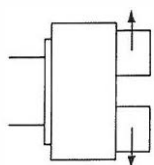
Press [Turret indexing switch] to index the boring tool or mount the boring tool to the turret.



6. Unclamp of chuck jaws



Step [Chuck jaw clamp/unclamp foot switch] to unclamp chuck jaws.



7. Front door close

Close the front door.

8. Movement selection



Select a movement amount with [Handwheel feed magnification switch].

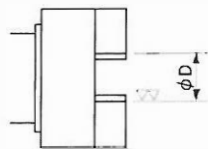
9. Spindle start



Select a spindle speed on the machine operation panel screen.

Press [Spindle forward switch] to rotate the spindle.

10. Forming of plug dia.



The handwheel feeds the tool slide to form the jaw.
Set dia. D mm dimension to grip around the middle of the maximum jaw stroke.

Plug dia.: dia. d

$$\text{dia. D} = \text{dia. d} + (\text{Max. jaw stroke}) / 2$$

11. Spindle stop



Press [Spindle stop switch] to stop the spindle.

12. Front door open

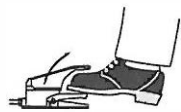
Open the front door.

13. Selection of outer diameter clamping system of workpiece (M88)

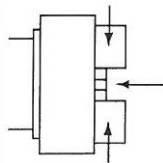
Next, machine the part clamping the workpiece for forming. Since it is machined with the chuck jaws unclamped, select the outer diameter clamping system.

Refer to the clamping system described on a previous item.

14. Plug clamp



Push the plug to the front face of chuck and step [Chuck jaw clamp/unclamp foot switch] to clamp the plug so that it will not be inclined in the chuck jaws.



15. Front door close

Close the front door.

16. Jaw forming



Form the jaw, operating spindle rotation and [Handwheel (manual pulse generator)] feed. At this time, machine the jaw at the workpiece chucking dia. and 6.3S or less of surface roughness.

17. Spindle stop

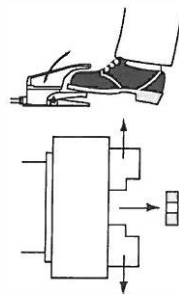


Press [Spindle stop switch] to stop the spindle.

18. Front door open

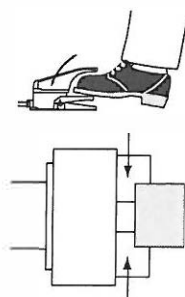
Open the front door.

19. Removing of plug



Step [Chuck jaw clamp/undamp foot switch] to unclamp the chuck and remove the plug.

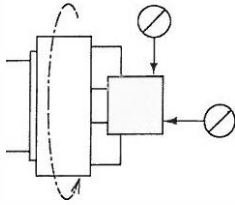
20. Workpiece clamp



Step [Chuck jaw clamp/undamp foot switch] to clamp the workpiece in the chuck.

At this time, repeat unclamp/clamp operation and check the jaw stroke and workpiece chucking condition.

21. Workpiece runout check



Mount the dial gauge to the turret and touch dial gauges to the workpiece outer diameter and the end face.

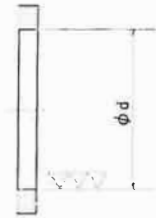


Select a spindle speed (low speed) on the machine operation panel screen.

Rotating the spindle at a slow speed, check the run out of a workpiece.

4-2 Inner dia. face clamp

1. Forming ring



Prepare the forming ring.

Finish the ring at 6.3S or less of surface roughness.

2. Selection of inner diameter clamping system of workpiece (M88)

First, machine the part clamping the ring for forming.

Since it is machined with the chuck jaws unclamped, select the outer diameter clamping system.

Refer to the clamping system described on a previous item.

3. Spindle turning mode selection (option)



<Multi-spindle control>

Press [C-axis/Spindle turning mode select switch]

and put out the indicating lamp.

4. Handwheel feed mode selection

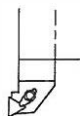


When pressing [Handwheel feed select switch of each axes] of [Mode select switch].

5. Indexing of outline cutting tool



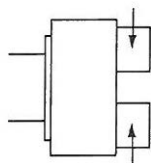
Press [Turret indexing switch] to index the outline cutting tool or mount the outline cutting tool to the turret.



6. Unclamp of chuck jaws



Step [Chuck jaw clamp/unclamp foot switch] to close (inside) chuck jaws.



7. Front door close

Close the front door.

8. Movement selection



Select a movement amount with [Handwheel feed magnification switch].

9. Spindle start



Select a spindle speed on the machine operation panel screen.

Press [Spindle forward switch] to rotate the spindle.

10. Forming of ring dia.



The handwheel feeds the tool slide to form the jaw.
Set dia. D mm dimension to grip around the middle of the maximum jaw stroke.

Plug dia.: dia. d

$$\text{dia. D} = \text{dia. d} - (\text{Max. jaw stroke}) / 2$$

11. Spindle stop



Press [Spindle stop switch] to stop the spindle.

12. Front door open

Open the front door.

13. Selection of inner diameter clamping system of workpiece (M89)

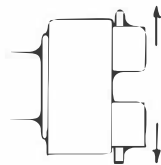
Next, machine the part clamping the workpiece for forming. Since it is machined with the chuck jaws unclamped, select the inner diameter clamping system.

Refer to the clamping system described on a previous item.

14. Ring clamp



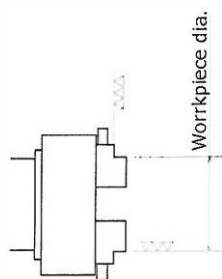
Push the ring to the front face of chuck and step [Chuck jaw clamp/unclamp foot switch] to clamp the ring so that it will not be inclined in the chuck jaws.



15. Front door close

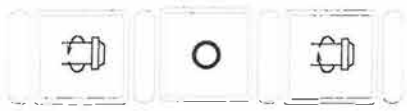
Close the front door.

16. Jaw forming



Form the jaw, operating spindle rotation and [Handwheel (manual pulse generator)] feed. At this time, machine the jaw at the workpiece chucking dia. and 6.3S or less of surface roughness.

17. Spindle stop



Press [Spindle stop switch] to stop the spindle.

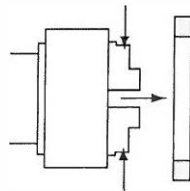
18. Front door open

Open the front door.

19. Removing of ring



Step [Chuck jaw clamp/unclamp foot switch] to unclamp the chuck and remove the ring.

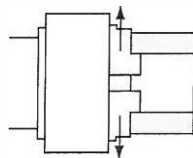


20. Workpiece clamp

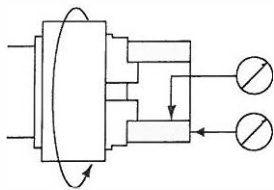


Step [Chuck jaw clamp/unclamp foot switch] to clamp the workpiece in the chuck.

At this time, repeat unclamp/clamp operation and check the jaw stroke and workpiece chucking condition.



21. Workpiece runout check



Mount the dial gauge to the turret and touch dial gauges to the workpiece inner diameter and the end face.



Select a spindle speed (low speed) on the machine operation panel screen.

Rotating the spindle at a slow speed, check the run out of a workpiece.

D. AUTOMATIC OPERATION

This chapter explains about the automatic operation after the daily inspection, programming, chucking, tooling, etc., has already been prepared.

In the automatic operation, the machine is not correctly operated unless all conditions such as the programming, chucking and tooling are satisfied.

Carefully perform individual works so as not to cause miss-operation.

WARNING

- * Carefully check conditions such as the programming, chucking, tooling equipment before operation.

There is a danger of injury by one miss-operation.

- * Close the front door before operation.

If this warning item is not observed, it will cause accident resulting in injury or death because the workpiece or any chip scatters.

Moreover, coolant splashes and floor gets wet, thus resulting in dangerous status.

- * Confirm check the position of [Emergency stop switch] so that the switch can be pressed rapidly even if any unusual situation occurs.

If the switch is not pressed rapidly, damage is increased at the worst.

CAUTION

Perform [DAILY CHECK] before automatic operation.

CONTENTS

1	PROGRAM EDIT	D3
2	CHECK BEFORE AUTOMATIC OPERATION.....	D4
3	TEST OPERATION OF PROGRAM	D6
3-1	Method by program check switch	D7
3-2	Method by single block switch.....	D10
4	MEMORY OPERATION.....	D11
5	MDI OPERATION	D14
6	SWITCHES USED DURING AUTOMATIC OPERATION	D16
7	MANUAL OPERATION INTERRUPTION DURING AUTOMATIC OPERATION.....	D24

1 PROGRAM EDIT

For the program edit, refer to [PROGRAMMING MANUAL] and the Instruction Manual of NC manufacturer.

1. Edit switch valid (memory edit possible)



When setting [Edit switch] to right point, the program can be edited.

2. Edit mode selection



When pressing [Edit mode select switch] of [Mode select switches].

This switch is selected when writing a new program into the memory and editing the program stored in the memory of NC unit.

3. Program edit

The program can be edited with MDI panel.

4. Edit protect switch invalid (memory edit impossible)



When setting [Edit switch] to left point, the program cannot be edited.

A manager shall save the key, to protect the program, pull out the key to save it.

2 CHECK BEFORE AUTOMATIC OPERATION

Check the following items before starting the automatic operation.

1. Check of interlock

- (1) Front door
- (2) Enclosure door

2. Check of tools

- (1) Tool tip
- (2) Tool shank
- (3) Tool holder
- (4) Chuck jaw
- (5) Workpiece

3. Pressure check

- (1) Chuck pressure
- (2) C-axis brake pressure (option)

4. Speed check

- (1) Rapid traverse speed override select switch
- (2) Feedrate override select switch
- (3) Spindle speed override select switch
- (4) Spindle speed override select (machine operation panel screen)
- (5) Rotary tool speed override select switch (option)
- (6) Rotary tool speed override select (machine operation panel screen) (option)

5. Function switch check

- (1) Single block mode select switch
- (2) Optional block skip mode select switch
- (3) Optional program stop mode select switch
- (4) Program check mode select switch
- (5) Chip conveyor automatic switch

6. Indicating lamp check

- (1) Front door close indicating lamp
- (2) Chuck clamp indicating lamp
- (3) Reference position indicating lamp

7. Offset data check

- (1) Tool shape compensation
- (2) Tool wears compensation
- (3) Workpiece coordinate system shift

8. Program

- (1) Program No.

3 TEST OPERATION OF PROGRAM

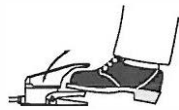
When the program of the memory operation is completely prepared, perform the test operation with air cut (no workpiece operation) to check the program.

There are the following methods for testing the program by conditions of tool slide travel, indexing and spindle (rotary tool) stop or actuation.

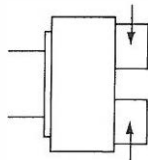
3-1 Method by program check switch

- * Tool slide travel: Actuation
- * Tool slide indexing: Actuation
- * Spindle revolution: Stop (For rigid tap, the spindle is rotated.)
- * Rotary tool (option): Stop (For rigid tap, the rotary tool is rotated.)
- * Spindle revolution by C-axis function (option): Actuation

1. Clamp of chuck jaw



Step [Chuck jaw clamp/unclamp foot switch] to clamp the chuck jaws.



[Chuck clamp indicating lamp] lights.
At this time, don't clamp the workpiece.



NOTE : When the proximity switch checks the workpiece clamp, [Chuck clamp indicating lamp] does not light.

In this case, move the proximity switch so that it can check at chuck clamped end.

2. Program check switch ON



In the automatic operation mode, press [Program check mode select switch] before starting.

At this time, this indicating lamp lights.

This switch is used for checking the program under the automatic operation mode.

However, when the workpiece is actually machined, this switch cannot be used.

With the indicating lamp lights by pressing [Program check mode select switch], the tool slide axis travel and index are executed with the spindle stopped.

At this time, the feedrate is applied at the speed selected with [Feedrate override select switch].

When the indicating lamp goes off, the unit is operated at the program command value.

Even if this switch is pressed during the automatic operation, the program does not actuate.

3. Front door close



Close the front door.

When the front door is closed, [Front door close indicating lamp] lights.